Market review of cement sector

JSW Cement

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1 Indian economy review and outlook

1.1 Review and outlook of GDP growth in India

India's real gross domestic product (GDP) growth stood at 8.2% on-year for fiscal 2024, higher than the 7.0% in fiscal 2023.

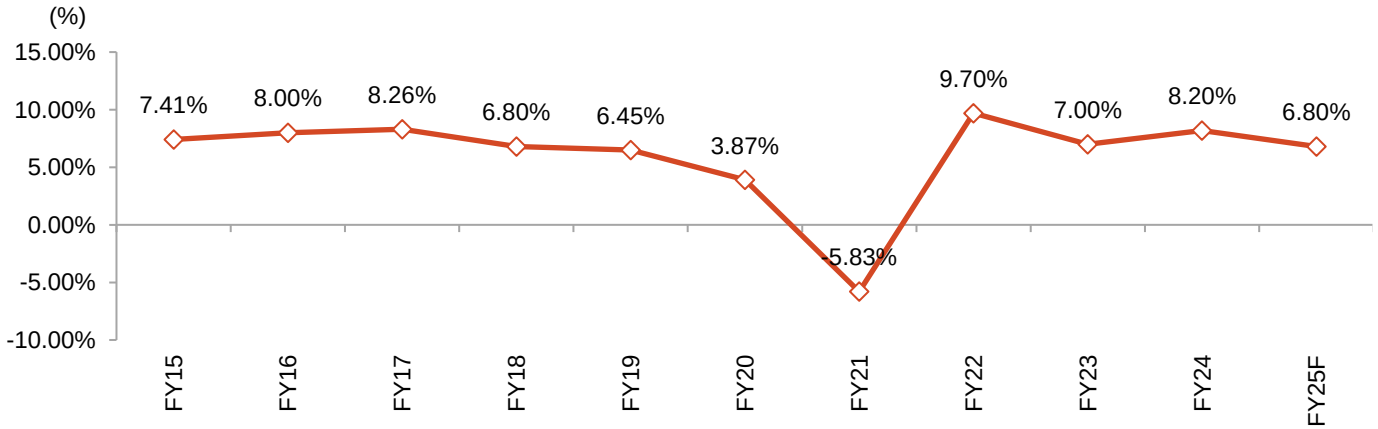
Despite weak agricultural growth (1.4% in fiscal 2024 vs 4.7% in fiscal 2023), overall GDP growth is seen as robust, indicating that the surge in non-agriculture sectors has more than offset the agricultural slowdown. Construction, the most labour-intensive sector, saw strong growth in fiscal 2024 at 9.9% vs average 4.9% growth witnessed in pre-pandemic decade. This is attributable to infrastructure spending of the government and revival of housing. Manufacturing too picked up (9.9% vs -2.2%), supported by lower input prices. Utilities posted a healthy growth at 7.5% (vs 9.4%) propelled by a surge in electricity production.

The government has also released details on saving, investment, and consumption trends in the economy until fiscal 2023. Fiscal 2023 — the first normal year post the pandemic — saw gross domestic savings fall to 30.2% of GDP compared with 31.2% previous year. This was also below the pre-pandemic decadal average (fiscal 2011-fiscal 2020) of 32.6%

Household saving reduced to 18.4% of GDP in fiscal 2023 from 20.1% previous year, as their consumption normalised. While their financial savings fell, saving in physical assets rose. Private corporate savings remains stable at ~11.2% of GDP.

Encouragingly, foreign funding increased last fiscal, accounting for 6.1% of gross capital formation compared with 3.7% previous year, and higher than pre-pandemic decadal average (fiscal 2011-fiscal 2020) of 5.7%.

Historical GDP growth and outlook



E: Estimate, F: Forecast
Source: RBI, NSO, CRISIL MI&A Research

GDP and macroeconomic outlook

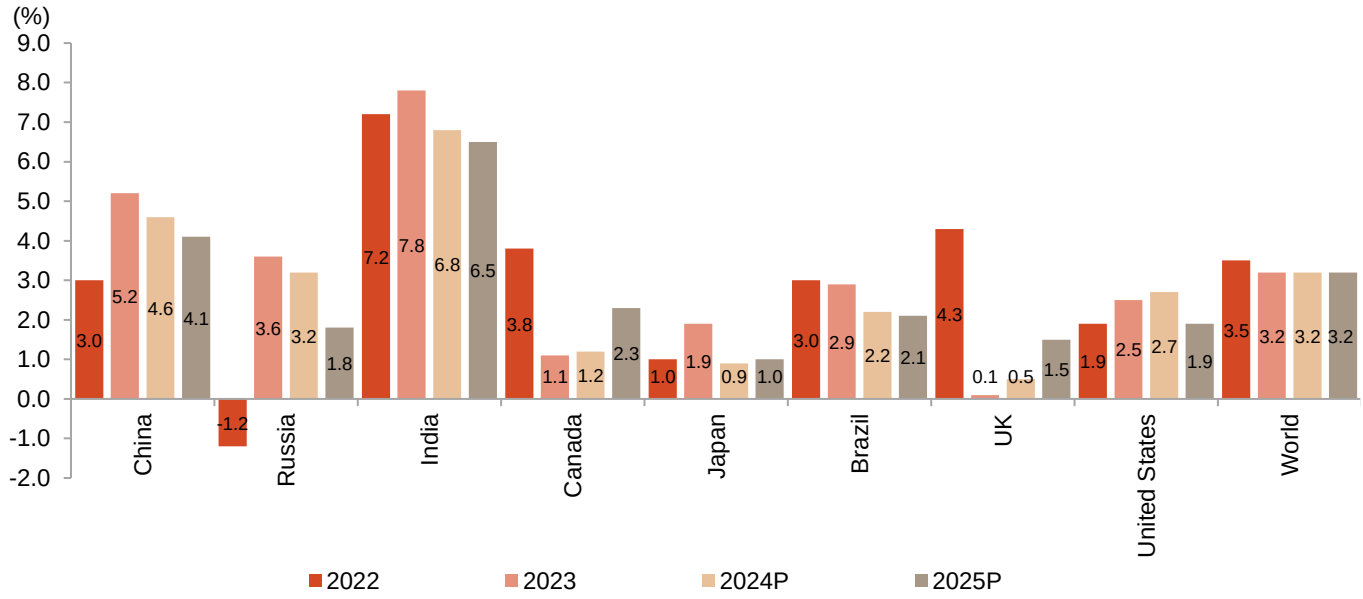
Macro variable	FY22	FY23	FY24	FY25P	Rationale for outlook
Real GDP (%, y-o-y)	9.69	6.99	8.15	6.80	High interest rates and lower fiscal impulse will temper domestic demand. Net indirect tax impact on GDP is expected to normalise in fiscal 2025. Uneven growth in key trade will restrict healthy export recovery. But budgetary support to capex and rural farm incomes will support growth
Consumer price index (CPI)-based inflation (%, y-o-y)	5.51	6.65	5.36	4.50	Range-bound crude oil prices, high-base effect, especially in food inflation, and cooling domestic demand will help moderate inflation. A non-inflationary budget that focusses on asset-creation rather than direct cash support bodes well for core inflation
Current account balance/GDP (%)	-1.2	-2.0	-0.7	-1.0	Support from remittances and healthy services exports will help keep current account deficit (CAD) in check
Rs/$ (March)	76.24	82.28	82.99	84.0	Low current account deficit, and healthy foreign portfolio debt inflows, amid favourable domestic macro environment will support the rupee

*E: Estimate, F: Forecast, *NSO Second Advance Estimates*
Source: RBI, NSO, CRISIL MI&A Research

India among fastest-growing economies

India is one of the fastest-growing economies globally. With the subsiding of the pandemic, India's macroeconomic situation has started improving gradually. The twin deficits (current account and fiscal) are narrowing, and the growth-inflation mix is improving, and durably so. Also, the government has adopted an inflation-targeting framework to provide an institutional mechanism for controlling inflation, while modernising the banking system.

GDP growth outlook for key economies



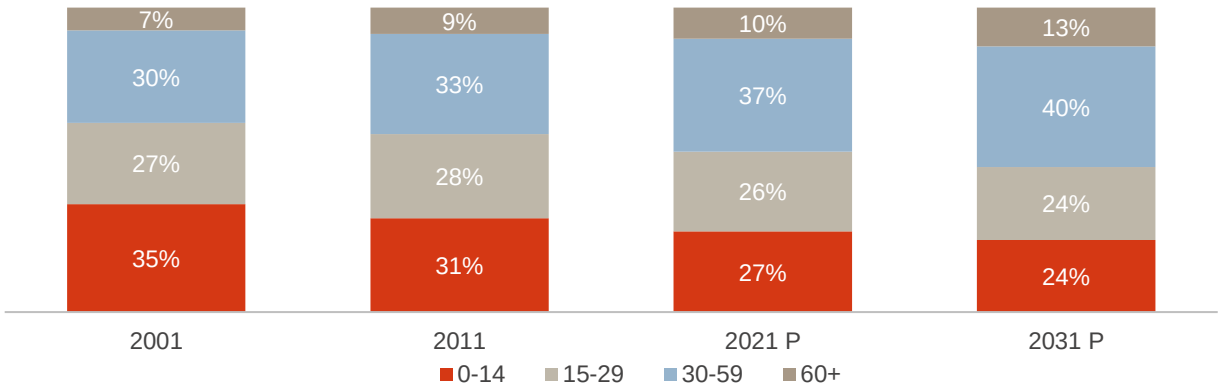
P: Projected
**Forecast for calendar year, while for India, it is fiscal year, i.e., 2021 = fiscal 2022, 2022 = fiscal 2023*
Note: All forecasts refer to International Monetary Fund forecasts
Source: International Monetary Fund (April 2024 outlook), CRISIL MI&A Research

1.2 Demographics overview

Favourable demographics

As of 2020, India has one of the largest young populations in the world, with a median age of 28 years. About 85-90% of Indians would still be below the age of 60 years by end-2031, of which, CRISIL Research estimates, 64% of them would be between 15 and 59 years. In comparison, the US, China, and Brazil had 74%, 62% and 78%, respectively, of their population below the age of 60.

India's demographic dividend



Note: 2021 census yet to be conducted
Source: United Nations Department of Economic and Social affairs, CRISIL MI&A Research

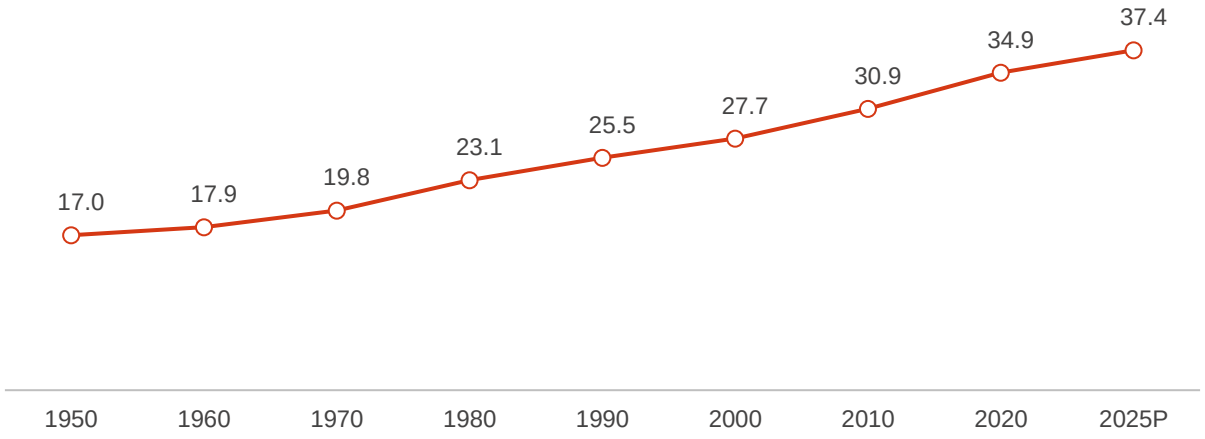
Urbanisation

Urbanisation provides an impetus to housing demand in urban areas as migrants from rural areas require dwelling units. The share of urban population in total population has been consistently rising over the years and stood at about 35% in 2020. This trend in urbanisation has pushed the demand for houses in urban areas and, consequently, urban housing cement demand.

Nearly 40-42% of the country's population is expected to live in urban locations by 2030, which will drive the demand for housing in these areas.

Urbanisation is one of India's most important economic growth drivers, as it will drive substantial investments in infrastructure development, which, in turn, is expected to lead to job creation, development of modern consumer services and increased ability to mobilise savings. This is expected to reach ~37% by 2025.

Urban population (% of total population)



Note: P - projected
Source: Census 2011, World Urbanization Prospects 2021: The 2018 Revision (UN)

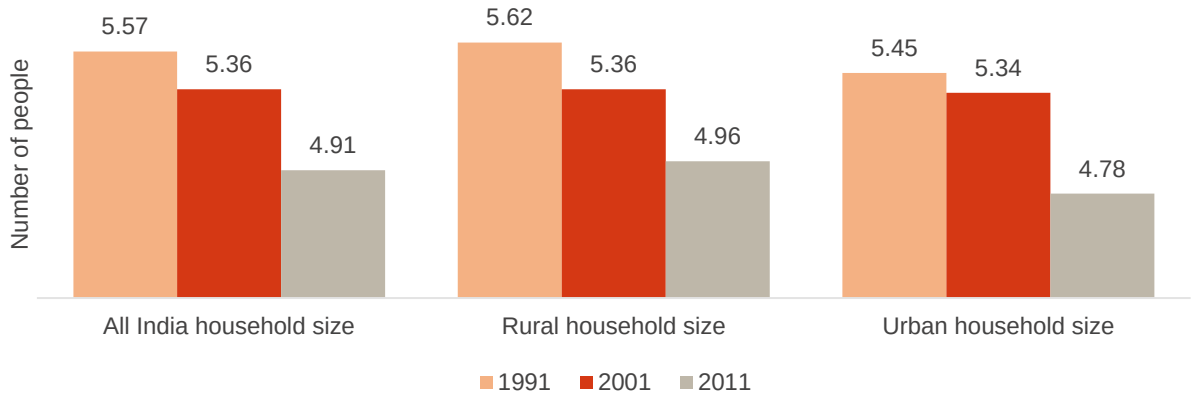
Factors, such as urbanisation and favourable demographics, are likely to manifest in higher growth in per-capita income and increased propensity to spend on discretionary items, including household appliances, mobiles & personal computers.

Increasing nuclearisation

Nuclearisation refers to formation of multiple single families from one large joint family; each of these families lives in separate houses while the ancestral house may be retained or partitioned to buy new houses.

The average household size of the country has come down to 4.9 in 2011, from 5.6 in 1991.

Decline in size of households to drive overall growth in consumption



Source: Census 2011, CRISIL MI&A Research

Increasing per-capita Income

Per-capita income (per-capita net national income) is estimated to have grown by 9.3% in fiscal 2022 and further 5.7% in fiscal 2023, compared with -8.9% in fiscal 2021. However, per-capita income is forecast to improve in line with GDP growth. This will be an enabler for domestic consumption. According to IMF estimates, India's per-capita income (at constant prices) is expected to increase at a 5.8% CAGR over calendar years 2022-27. Increasing disposable income, typically, has a positive correlation with demand for housing units as it increases affordability and, eventually, housing cement demand.

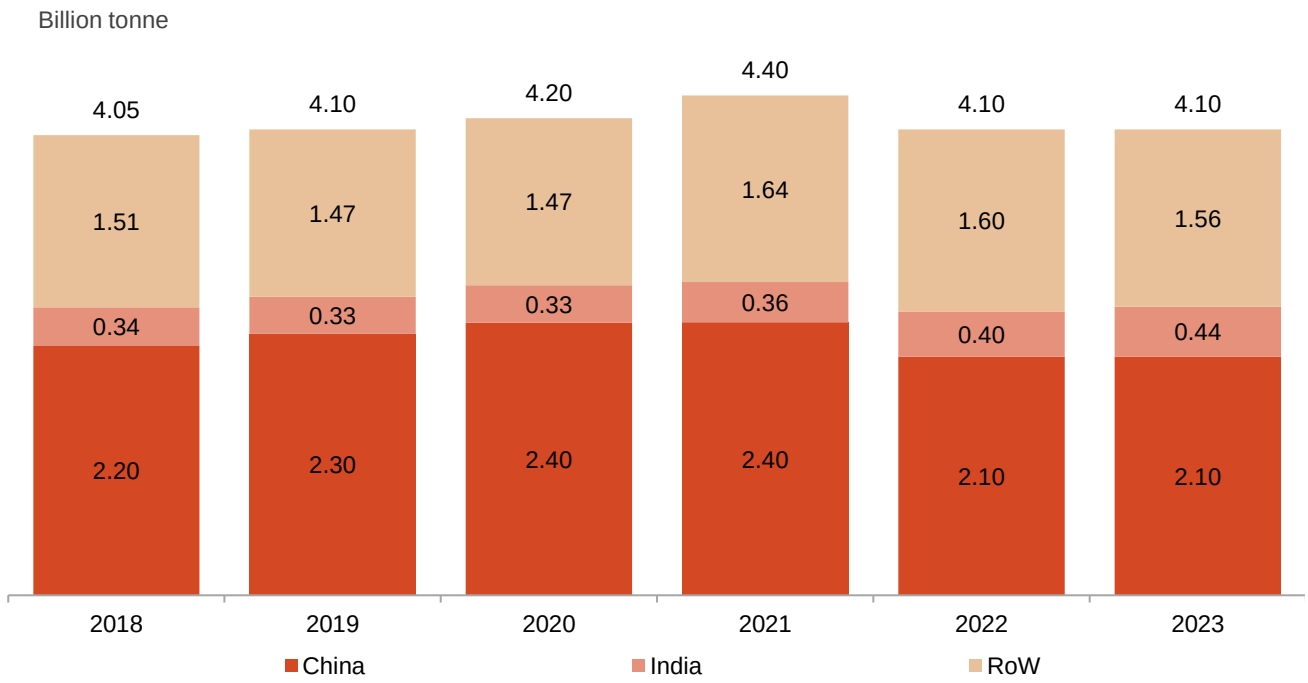
Per-capita income	Level in FY24 (Rs '000)		Growth at constant prices (%)									
	Current prices	Constant prices	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23	FY24
	184.21	106.74	6.17	6.67	6.88	5.52	5.19	2.48	-8.88	9.32	5.69	7.38

Source: MoSPI, IMF, CRISIL Research

2 Global cement industry overview

Global cement production in 2023 stood at ~4.1 billion metric tonne. The production growth had remained steady almost over the previous six years, with the highest production of 4.4 billion metric tonne recorded in 2021.

Cement production comparison — India vs China and rest of the world (RoW)



Note: India's production data are on fiscal year (Apr-Mar) basis and that of others on calendar year basis; Data above bars represent total cement production by world for that particular year
Source: United States Geological Survey – Mineral Commodity Summaries, CRISIL MI&A Research

China is the largest producer of cement globally, accounting for more than half of the overall cement production. A major portion of the cement produced in the country is consumed domestically. India comes a distant second, accounting for 7-11% of world's production.

During 2018-2023, developing nations such as India and Vietnam have been some of the fastest growing economies in terms of cement produced. During the period, cement production in India logged the highest compound annual growth rate (CAGR) of 5.6% among the top seven cement producing countries. In 2023, China remained the largest producer, accounting for 51% of the overall volume. The country's production remained in a range of 2.1-2.5 billion tonne over 2018-2023.

Share of top seven cement producing countries in global production

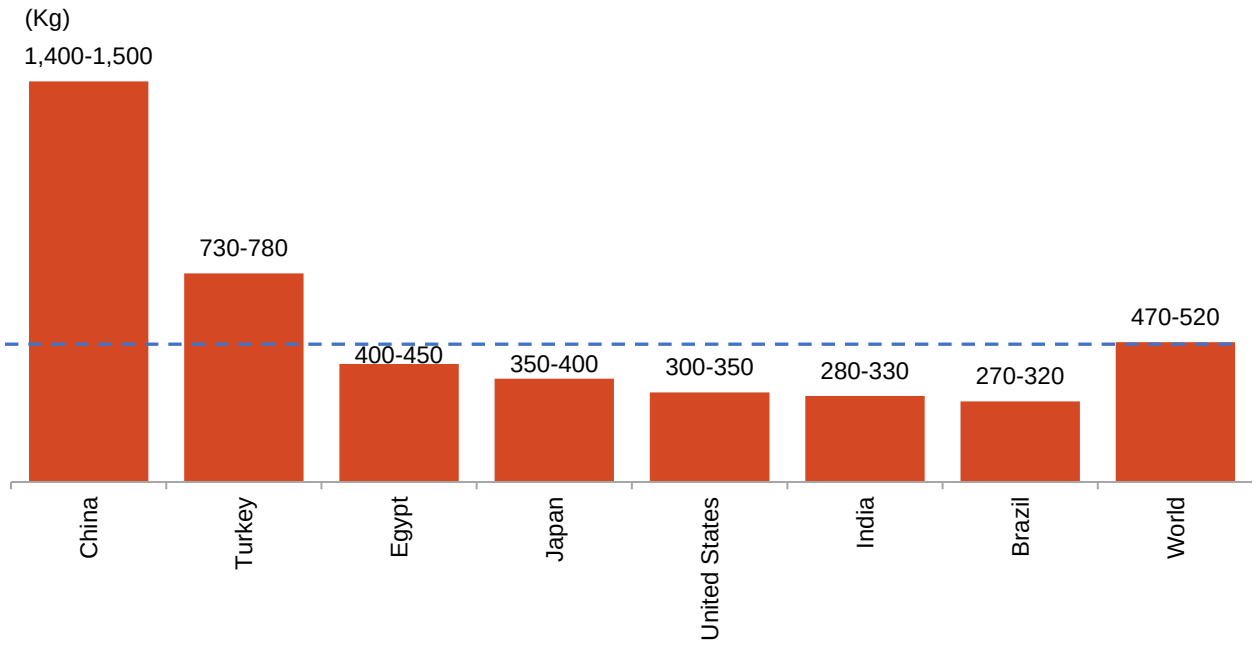
Country	Production in CY18 (million tonne)	Share (%)	Production in CY23 (million tonne)	Share (%)	CAGR 2018-23 (%)
China	2,200	53.80%	2,100	50.30%	-0.90%
India	335	8.20%	441	10.60%	5.60%
Vietnam	90	2.20%	110	2.60%	4.00%
United States	87	2.10%	91	2.20%	0.90%
Turkey	73	1.80%	79	1.90%	1.70%
Iran	58	1.40%	65	1.60%	2.30%
Brazil	53	1.30%	63	1.50%	3.50%
Others	1,193	29.30%	1,227	29.20%	0.50%
Total (rounded)	4,050		4,100		0.40%

Notes: India's production data are on fiscal year (Apr-Mar) basis and that of others on calendar year basis
US includes Puerto Rico
Others include Indonesia, Russia, Saudi Arabia, Egypt, Japan, Korea, Mexico and the remaining countries of the world
Source: United States Geological Survey-Mineral commodity summary, CRISIL MI&A Research

2.1 Per capita cement consumption in leading cement producing countries vis-à-vis India

India's per capita cement consumption stands at 280-330 kg, way below the world average of 470-520 Kg. China has the highest — 1,400-1,500 Kg. Per capita cement consumption of some of the leading cement producing countries is as follows:

Per capita cement consumption of leading cement producing countries (2023)



Note: The figures are CRISIL estimates, arrived at by assessing various data points from sources such as United Nations Comtrade database (for trade data of cement), US Geological survey and world population estimates published by The World Bank
India's production data are on fiscal year (Apr-Mar) basis and that of others on calendar year basis
The US includes Puerto Rico
Source: United States Geological Survey-Mineral commodity summary, United Nations Comtrade database, The World Bank, CRISIL MI&A Research

There is significant potential for the Indian cement industry to grow because of the country's low per capita consumption. Also, despite a low per capita cement consumption, the country is the second largest cement consumer in the world.

3 Indian cement industry overview

3.1 Budget allocation and capital outlay across major segments

Infrastructure segment

While the overall gross budgetary capex support increased 17% in FY25BE over FY24RE to Rs 11.11 lakh crore, the budgetary support for 10 core infrastructure ministries increased only 4% to Rs 5.6 lakh crore. A large share of the deviation is on account of higher allocation to the Ministry of Finance, under which the Department of Economic Affairs has been allocated Rs 66,197 crore for disbursement towards central schemes, the details of which are yet to be announced.

While growth has moderated, it is on a high base and the overall quantum of capex allocation is still high. The moderation implies the central government's capex is on a glide path to stabilisation. The foot is still on the pedal after a phase of robust growth where infrastructure capex was used to pump prime the economy during the Covid-19 years, thereby setting the stage for the private sector to step in and continue the healthy pace of capex for the infra build-out.

Roads & Railways

The overall gross budgetary outlay for the Ministry of Road Transport and Highways doubled from Rs 1.28 lakh crore in fiscal 2019 to Rs 2.64 lakh crore in fiscal 2024RE (Revised estimates of fiscal 2024). Against this backdrop, the roads and highways capex for the fiscal 2025 has witnessed a sharp moderation in growth rate and is only higher by 3% vis-à-vis fiscal 2024RE. Similar to the previous fiscal, the entire allocation of Rs 2.73 lakh crore would be via GBS as the IEBR limit has been completely eliminated in order to reduce the National Highways Authority of India's (NHAI) dependence on market borrowings. On the other hand, the asset monetisation target has increased from Rs 10,000 crore in fiscal 2024RE to Rs 15,000 crore in fiscal 2025BE (Budgeted estimates of fiscal 2025). To be sure, in 9M fiscal 2024, NHAI has been able to monetise ~16,000 crore, which bodes well for the divestment target set out for fiscal 2025. This assumes greater significance as roads account for close to 30% of the National Monetisation Plan (NMP) targets and healthy progress in monetisation of road assets is imperative for the achievement of overall NMP targets.

The budgetary allocation of Rs 1.68 lakh crore towards the NHAI for fiscal 2025 has remained flattish vis-à-vis fiscal 2024RE. The elimination of IEBR and minimal contribution of cess implies that a significantly large portion of NHAI funding would be met through GBS.

Furthermore, the NHAI has been aiming to modify the build-operate-transfer (BOT) model with fast-tracked clearances to award more projects, as the share of this model has dipped to negligible levels in recent years. Large developers are also likely to be interested in BOT projects amidst dipping profitability in the hybrid annuity model owing to competitive bidding. Notably, if successful, the shift towards the BOT model could reduce funding burden on the ministry since 100% of the construction cost is borne by the developer in this model.

Railway capital expenditure budgeted at Rs 2.65 lakh crore is 2% higher than fiscal 2024RE, while the GBS (Gross budgetary support) at Rs 2.52 lakh crore increased 5% over fiscal 2024RE. Under the

railway ministry, three key economic railway corridors have been announced under the PM Gati Shakti initiative: (i) energy, mineral and cement corridors, (ii) port connectivity corridors, and (iii) high-traffic density corridors. These projects are aimed at facilitating multi-modal connectivity, thereby enhancing logistics efficiency and reducing operational costs. Development of the three new rail corridors along with the completion and full operationalisation of the dedicated freight corridor will improve the logistical efficiency and aid the government in achieving its target of reducing the overall logistics cost, which currently stands at 14% of the GDP.

Additionally, 40,000 normal rail bogies would be upgraded to Vande Bharat standards to enhance safety, convenience and comfort of passengers.

Budgeted allocation for Roads and Railways

	Budgeted outlay FY25 (Rs crore)	Revised estimates FY24 (Rs crore)	Increase/(Decrease) %
Ministry of Road Transport and Highways	280,976	273,332	3%
Ministry of Railways	265,000	260,000	2%

Source: Budget documents

Metro and MRTS and Smart City Mission

The government intends to expand metro rail and Namo Bharat to more cities with focus on rapid urbanisation. For this, central government has allocated Rs. 24932 crore for FY25BE against Rs. 23104 crore in FY24RE (7.9% higher). As of February 2024, 874 km of metro rail is operational in the country while another 986 km is under construction.

The Government of India launched SCM (Smart City Mission) on June 25, 2015 to improve living conditions in 100 cities across India. At least one city from every state/union territory was selected under the SCM to implement the concept of a 'smart city'. The goal was to be accomplished by improving infrastructure and services such as water, sanitation, energy, mobility, education and health.

To further push infrastructure spending, the government has approved a budget of Rs 10,400 crore in FY25BE for the development of over 100 smart cities. The focus is on adequate and clean water supply, sanitation, solid waste management, efficient transportation, affordable housing for the poor, power supply, robust IT connectivity, e-governance, safety and security of citizens, health and education. As of Dec'23, a total of 6271 projects worth ~Rs. 116,300 crore have been completed and further ~1688 projects are still under development.

	Budgeted outlay FY25 (Rs crore)	Revised estimates FY24 (Rs crore)	Increase/(Decrease) %
Metro & MRTS	24932	23104	7.91%
AMRUT and Smart Cities mission	10400	13200	(21.21)%

Source: Budget documents

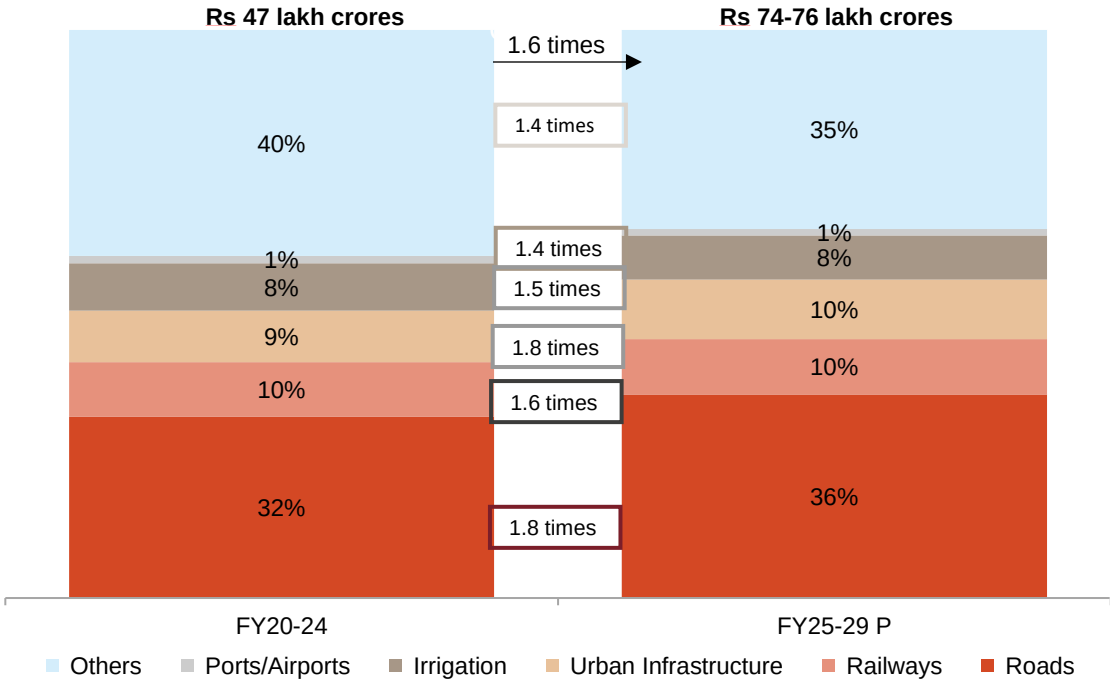
Sagarmala

As a part of the Sagarmala programme, more than 800 projects at an estimated cost of ~Rs 5.48 lakh crore have been identified for implementation. This programme includes logistics projects from various categories such as modernisation of existing ports and terminals, new ports and terminals and tourism

jetties, enhancement of port connectivity, inland waterways, lighthouse tourism, industrialisation around ports, skill development, technology centres.

At an overall level, as of Feb 2024, 241 projects worth Rs 1.22 lakh crore have been completed out of 839 identified projects worth Rs. 5.79 lakh crore under the scheme; 598 projects worth Rs 4.57 lakh crore are under implementation and various stages of development. Projects under Sagarmala include the Special Economic Zone at the Jawaharlal Nehru Port Trust, Smart Industrial Port City at Deendayal Port and Paradip Port, and the Coastal Employment Unit at the V O Chidambaranar Port.

Investments across key infrastructure sectors:



Source: CRISIL MI&A Research

Based on an analysis of key infra sectors, CRISIL Research estimates construction investment in the infrastructure segment at Rs 74-76 lakh crore between fiscals 2025 and 2029, rising 1.6 times over spends seen in fiscals 2020 to 2024. The rise in investments is mainly driven by ~1.8x rise in investments across urban infrastructure with more than 100% growth compared to previous five years followed by higher growth in capex of roads and railways. The rise is in line with Government's focus on infrastructure as visible in rising central and state budget allocations in order to meet the infra build out outlined in the National Infrastructure Pipeline.

Housing segment

PMAY was introduced in 2015 to provide affordable housing for all by the end of 2022. Owing to delay in completion, the timeline was revised to fiscals 2024 and 2025 for PMAY-G and PMAY-Urban (U), respectively. The Budget 2025 announcement to bring three crore additional houses under the ambit of PMAY over the next five years is a positive. For one, it will reduce housing shortage in urban and rural

areas. The incremental target will support cement and building construction segments, too, as it will lead to incremental cement demand. It will also support other allied building and construction activities.

Under the Pradhan Mantri Awas Yojana-Urban 2.0 housing, 1 crore additional houses, or ~81%, from the previous target of ~1.2 crore houses with planned allocation of Rs 2.2 lakh crore over the next five fiscals has been announced in Budget 2025. Within the PMAY-U 2.0, the Credit-Linked Subsidy Scheme (CLSS) has been revived, with an allocation of Rs 3,000 crore towards CLSS–I, covering the economically weaker section (EWS) and lower-income group (LIG) categories, and an allocation of Rs 1,000 crore under CLSS–II for the middle-income group (MIG) category. This is likely to revive interest in affordable housing, which has lately seen a decline in construction activity, with developers increasingly shifting focus towards the premium and luxury segments in metros, Tier I and II cities, etc.

Increase in the PMAY–Rural target by 2 crore houses, or ~68%, from the previous target of ~3 crore houses is also a positive. Execution under the PMAY-Gramin scheme has been encouraging so far. Of the targeted 2.95 crore houses, 2.62 crore have been completed as of May 2024, with as much as 70% of these having women as either sole or joint owners.

While PMAY focussed on affordable housing, thereby catering to the low-income group, the announcement of a enabling policies and regulations for efficient and transparent rental housing markets with enhanced availability would benefit eligible middle-class households who live in rented houses, slums, chawls and other unauthorised colonies.

The government's continued focus on housing is expected to provide an impetus to the real estate sector as well as its stakeholders, such as developers, engineering, procurement and construction contractors, and allied industries such as steel, cement, etc.

Allocations to PMAY

Sr no	Parameters	FY23A (Rs crore)	FY24BE (Rs crore)	FY24RE (Rs crore)	FY25BE (Rs crore)	Growth in FY25BE over FY24RE (%)
1	PMAY Urban	28,653	25,103	22,103	30,171	36%
2	PMAY Grameen	44,962	50,487	32,000	54,500	70%

Note: PMAY (G) figures include just the programme component

Source: Budget documents

Industrial segment

During the last four years, higher focus for capex was laid on household segment and infrastructural development by the central and state governments of the country. In the future, industrial sectors* are expected to accelerate, and investments will move to both traditional and developing sectors. At the same time, investment in infrastructure segment is expected to maintain its momentum.

Overall industrial capex grew ~9% on average between fiscals 2019 and 2023, with fiscal 2022 and fiscal 2023 outperforming. In absolute terms, industrial capex averaged Rs 3.9 lakh crore per annum in the period. It will likely rise to ~Rs 6.5 lakh crore on average between fiscals 2024 and 2028, marking an increase of ~1.7x on an annual basis. Growth would be facilitated by a higher utilization rate of production

capacities, strong investment prospects with new sectors and the introduction of the PLI system over the next 3-4 fiscal years.

CRISIL estimates Rs 30-35 lakh crore of debt will be needed to fund capex by the private sector alone. While the infrastructure and corporate sectors are expected to be financed primarily by the banking and corporate bond markets, investments in emerging sectors, dominated by multinational and large Indian companies, will be financed by the domestic and international corporate bond markets.

Rs lakh crore	FY24E	FY25P	FY19-23 (A)	FY24-28P (B)	B/A
Emerging (I)	0.5	70-80%	0.4	6	14.5
Semiconductors and electronics	0.3	35-40%	0.4	3	8.5
EV capex	0.2	1.2x-1.3x	0	2	NM
Battery manufacturing	0	14-16x	0	0.4	NM
Solar modules	0	30-35%	0	0.2	5.2
PLI (II)	0.5	45-50%	0.6	2	3.8
Conventional (III)	4.4	5-7%	18.6	24	1.3
Industrial total (I+II+III)	5.4	17-19%	19.6	31-33	1.7

*Note: *Includes Emerging, PLI and conventional sectors from the above table*
NM - not meaningful; Conventional sectors include oil and gas, steel, cement, auto (internal combustion engines) and others; E - estimates, P - projections
Source: CRISIL MI&A Research

Total budget allocation

Figures in Rs. crore	FY24RE	FY25BE	% Change(25BE/24RE)
Total Infrastructure	884,010	958,292	8%
Roads	273,332	280,976	3%
Railways	260,000	265,000	2%
Metro & MRTS	23,104	24,932	8%
AMRUT & Smart city mission	13,200	10,400	-21%
PMAY-Urban	22,103	30,171	36%
PMAY-Grameen	32,000	54,500	70%

Source: Budget documents

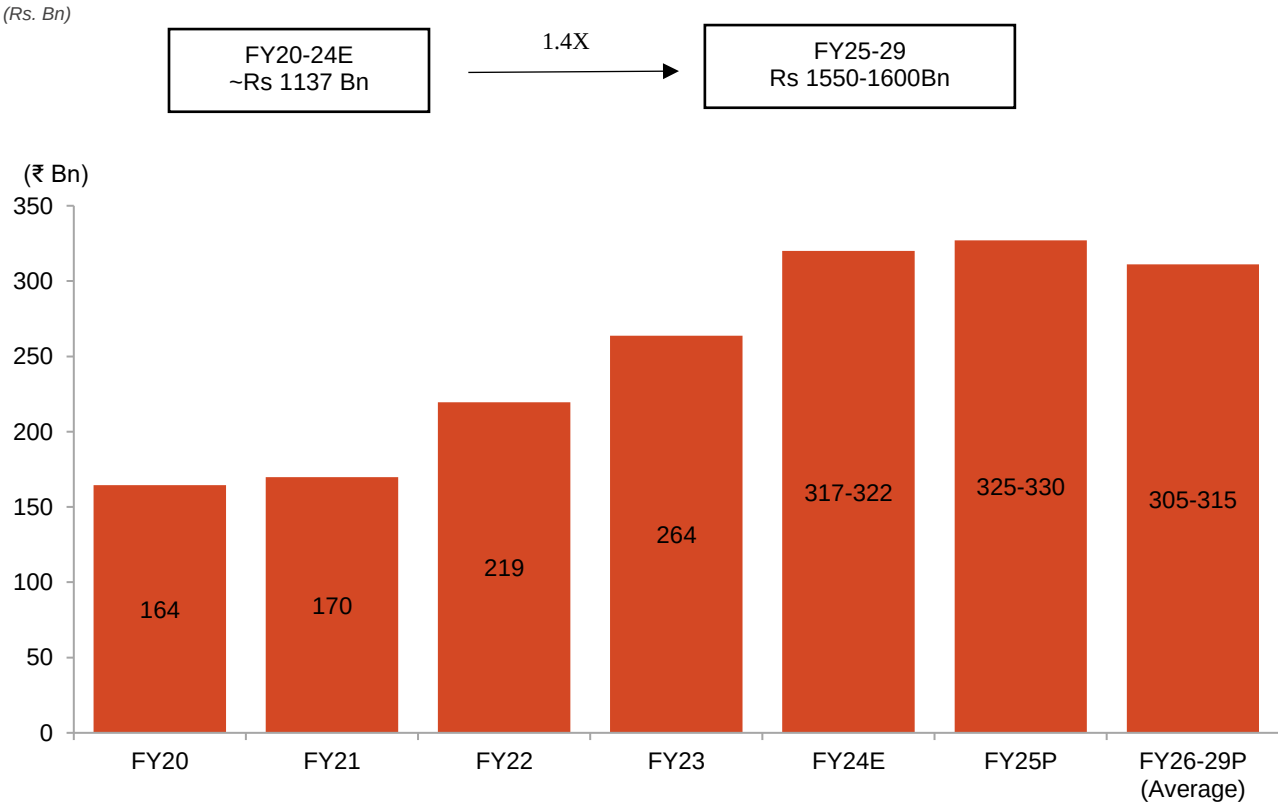
3.2 Anticipated Capital expenditure in Cement sector over medium term

Cement Industry in India witnessed an investment of ~Rs. 1137 bn in past five years (FY20-24E) with regards to adding new capacities, brownfield expansions, debottlenecking and maintenance of existing plants. With demand recovering in the past three fiscals and increased competitive intensity, the players especially the large ones are implementing sizeable capex over the next five years with the aim to capture the market share. Robust demand has also bolstered the balance sheets of large players and some mid-sized players with strong market presence, prompting them to expand capacity on the back of healthy cash accrual and credit profile.

Hence,210-220 Mtpa grinding capacities are expected to be onboarded in next five years (FY25-29) with investment quantum to be around 1.4x of capital expenditure of previous five years. Industry is expected to infuse Rs. 1550-1600 billion during FY25 to FY29. Most of this capex would be incurred by the large players. Given their strong balance sheets and high liquidity, a large part of this capex is expected to be funded from internal accruals.

Estimated investment in cement Industry in India

(Rs. Bn)

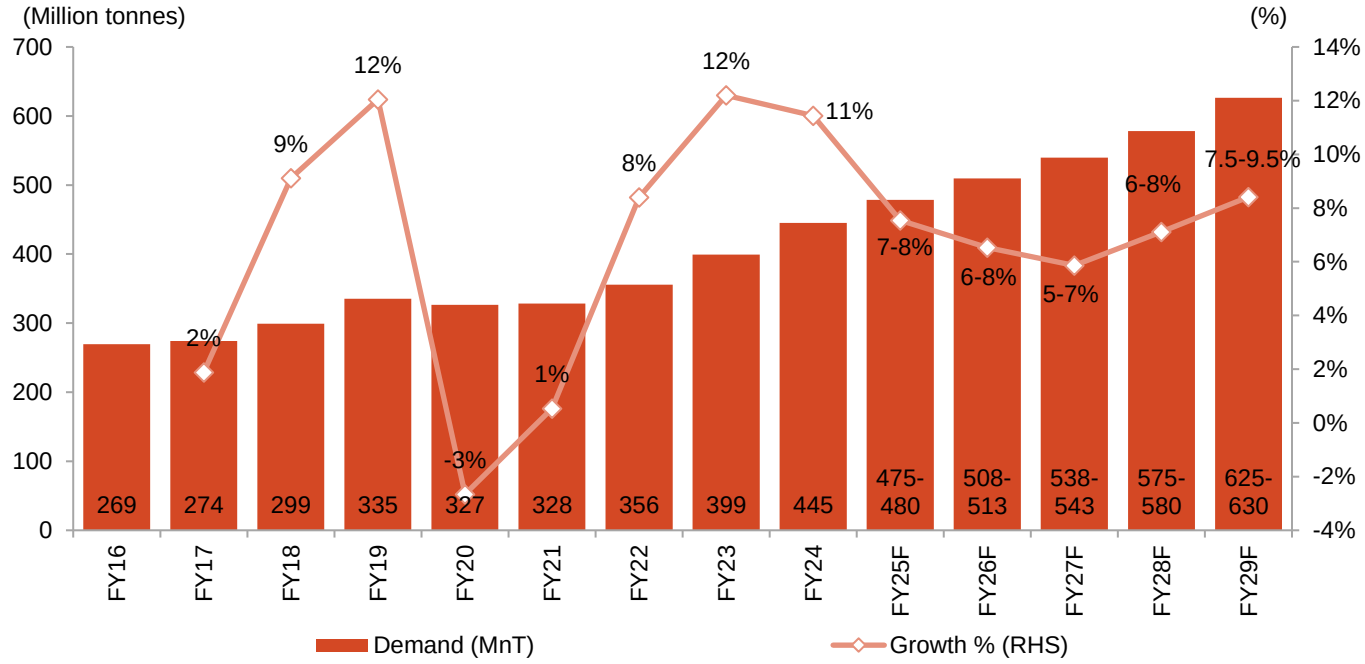


Source: CRISIL MI&A Research

4 Cement Demand Analysis – Pan India

4.1 Pan-India cement demand review and outlook

Cement demand review and outlook



E: Estimated F: Forecasted
Source: CRISIL MI&A Research, industry

Domestic cement demand grew at a healthy ~6% CAGR over fiscal 2019 to 2024, despite pandemic-induced slowdown, majorly led by sustained government thrust on infrastructure and affordable housing. In fact, a large part of the growth was due to pre-election spending between fiscals 2018 and 2019 and a healthy uptick in fiscals 2022 and 2023, while in fiscals 2020 and 2021, demand was weak because of pandemic-induced lockdowns. On a low base, pan-India cement demand recovered by 8% in fiscal 2022 and accelerated further by ~12% in fiscal 2023, supported by strong demand for rural housing and infrastructure. A pre-election boost and healthy traction from infrastructure segment led to further 11% on-year growth in fiscal 2024.

Fiscal 2022: Cement demand in the first half of the fiscal was impacted by the second wave of Covid-19, which slowed the growth momentum, though pent-up demand from the first quarter helped stabilise demand in the second quarter despite the onset of monsoon. In the third quarter, demand took an unexpected hit because of unseasonal rains, labour unavailability due to the wedding season, sand availability issues in some states, and onset of the festive season, translating into a decline of ~4% on-year. Demand recovered at a snail's pace in the fourth quarter, on a sequential basis, due to high construction cost of building materials. Inflation hit commodities such as steel, aluminium and cement because of geopolitical tensions following the Russia-Ukraine conflict, leading to supply constraints and higher prices of crude oil-derived commodities. This sharply increased prices of building materials such as

steel, cement and aggregates, discouraging construction. Thus, after growing in double digits in the first half of the year on a low base, demand was limited to only 8% on an annualised basis in the fiscal.

Fiscal 2023: Demand rose ~12% on-year. In the first quarter, demand logged a robust growth of ~18% on-year on a low base, on a pick–up in infrastructure activities as well as strong recovery in individual housing – both rural and urban. The second quarter witnessed some moderation sequentially on the back of seasonal weakness, but still grew ~9% on-year. Further, with the monsoon receding, inflationary pressures easing, real estate and affordable housing gaining traction, as well as pick-up in infrastructure project execution ahead of the general elections in 2024, demand grew a healthy ~10% on-year in the third quarter. The last quarter registered ~12% on-year growth, driven by continued traction from infra and housing projects ahead of the general elections. In fact, high construction costs, which impacted demand in the early months, cooled off somewhat in the second half of the fiscal. Volume was also supported by tailwinds from strong demand for rural housing and infrastructure. The individual housing segment, especially rural, which was expected to bear the brunt of inflation in the early months of the fiscal, fared well in the second half amid cooling construction costs, higher rural income owing to healthy yields, and increase in crop prices, indirectly supporting demand growth from the rural housing segment. Infrastructure continued its strong growth momentum, led by government spending, primarily across its flagship schemes such as PM Gati Shakti and the National Infrastructure Pipeline.

In **Fiscal 2024**, the infrastructure segment had been the major demand driver, led by central government's higher spending on key infra sectors ahead of elections. In FY24, central government's capital expenditure had been ~28% higher for road ministry and ~52% higher for railways compared to previous fiscal. Capacity expansion plans of large players in capital-intensive sectors (steel and cement), implementation of the production-linked incentive (PLI) scheme, rising warehousing spaces and return to office/hybrid model drove demand from the industrial and commercial segments. On a high base of last fiscal, rural housing witnessed moderate growth momentum in FY24 due to impact of El Nino condition on agri profitability; although the rise in demand was supported by a higher shortage of houses and the government's push to attain a central scheme (PMAY-G) targets before elections. Growth from urban housing was supported by traction from real estate although growth was at a slower pace due to elevated interest rates and capital values. Also, the construction pace under PMAY-U slowed down as the scheme nears closure and the sanctions have already surpassed targeted levels. At an overall level, the pre-election boost to infra and housing and growth from I&C segment led to an overall rise of 11% in fiscal 2024 despite high base of previous fiscal.

Fiscal 2025: On two consecutive healthy bases, demand growth is expected to moderate to 7-8% in fiscal 2025. While the infrastructure segment is expected to remain the key demand driver, a marginal rise of 4% in capex for core infrastructure ministries for fiscal 2025BE over fiscal 2024RE is expected to slow down demand growth of the segment to 9-10% in fiscal 2025. That said, the moderation is on a high base and the overall quantum of capex allocation is still high. The government's focus on developing dedicated rail corridors for energy, mineral, and cement sectors, higher budget allocation for metro (~7.57% higher allocation in 2025BE over 2024RE), UDAN scheme for airports, expansion of metro rail and Namo Bharat to more cities, ongoing NHAI and Bharatmala road projects should continue to support infrastructure demand. Demand from the housing segment is expected to moderate to 6-7% but to be driven by the rural housing segment owing to the expectation of healthy crop profitability on the back of above-normal monsoon predictions. Government focus on rural housing schemes in the upcoming budget remains a

key monitorable. Elevated but steady interest rates to support urban housing growth from the real estate segment. However, lower execution under PMAY-U (Pradhan Mantri Awas Yojana – Urban) to restrict growth in fiscal 2025. Hence, demand growth for housing is likely to moderate. Further, on three consecutive healthy bases, growth from the Industrial and commercial (I&C) belt is expected to slow down, however, production-linked incentive (PLI) scheme, traction in commercial real estate and rise in private investments to continue to support traction from the segment. As a result, at an overall level demand growth is expected to moderate to a 7-8% rate in fiscal 2025.

Over the next five years, i.e., fiscals 2025 to 2029, CRISIL MI&A Research expects cement demand to clock a healthy 6.5-7.5% CAGR, moderately higher than ~6% CAGR in the previous five years. Growth will be driven by a raft of infrastructure investments and healthy momentum from housing segment. Initiatives undertaken by the Government of India, such as the Bharatmala Pariyojna, Sagar Mala, the Pradhan Mantri Awaas Yojana - Gramin, Atmanirbhar Bharat Abhiyan, Product Linked Incentive Scheme, Swachh Bharat Mission, UDAN for airports and metro projects along with the thrust on infrastructure will drive demand growth in the medium term for the cement industry in India. This presents a major opportunity for growth in the cement industry in India.

Player-wise sales volume (top 10 players)

MTPA	FY14	FY19	FY23	FY24	FY14-24 CAGR	FY14-19 CAGR	FY19-24 CAGR
UltraTech Cement	40.4	79.3	100.1	112.8	10.82%	14.46%	7.29%
Ambuja Cement	45.0	52.7	68.0	58.0	2.57%	3.20%	1.95%
Shree Cement	14.3	25.9	31.8	35.5	9.56%	12.66%	6.54%
Dalmia Bharat	10.1	18.7	25.7	28.8	11.05%	13.09%	9.04%
Nuvoco Vistas	7.2	11.4	18.8	18.8	10.14%	9.81%	10.47%
The Ramco Cement	8.6	11.1	15.0	18.4	7.91%	5.29%	10.59%
JK Cement (India - grey cement)	5.4	8.4	13.2	16.8	12.08%	9.30%	14.94%
JSW Cement	2.2	7.4	9.6	12.5	19.06%	27.40%	11.26%
Birla Corporation	7.4	13.8	15.8	17.8	9.22%	13.39%	5.21%
JK Lakshmi	5.6	9.7	11.4	12.0	7.91%	11.50%	4.44%
Industry	244.5	335.4	399.2	444.9	6.17%	6.53%	5.81%

Source: Company annual reports and publications

Note: Only domestic operations have been considered for UltraTech Cement. Ambuja Cements had changed its financial year end from December 31 to March 31 in FY 2022-23. Therefore, the figure for FY 2022-23 is for 15 months and not comparable with the figures for the 12 months year ended March 31, 2024. Ambuja Cements sales volume includes sales volumes of ACC Ltd for FY14, FY19 and FY23 while includes ACC Ltd and Sanghi Industries for FY24.

4.2 Product wise demand segmentation

The major types of cement products are:

- Ordinary Portland cement (OPC)

- Portland Pozzolana cement (PPC)
- Portland slag cement (PSC)
- Composite

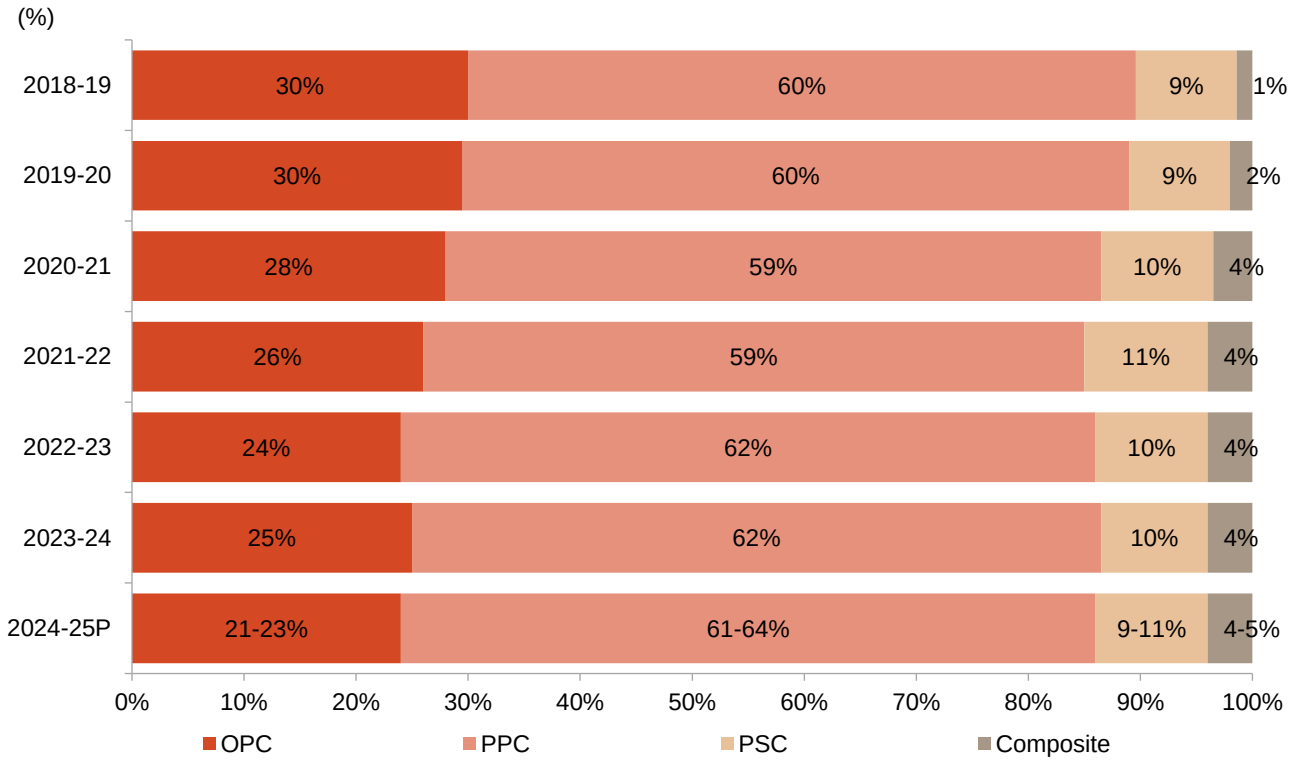
1. **OPC:** One of the most used cements globally, OPC is a hydraulic cement which becomes water-resistant once curing is done with water. Mostly used as construction material for building houses (structures like beam, slabs, columns, footing, etc), bridges, pavements, and so on, it is also used for varied purposes including the making of concrete, mortars, etc. OPC is manufactured by inter-grinding gypsum and clinker. The key characteristics of OPC are its quick setting properties and ability to reach optimal strength quickly, thereby increasing the speed of construction. OPC can also be blended with other mineral admixtures to form blended cement such as PSC.
2. **PPC:** It is a type of Portland cement characterised by the presence of Pozzolana particles such as fly ash and volcanic ash which is added to OPC in the ratio of 15% to 35% as specified by the Bureau of Indian Standards (BIS). Due to the presence of Pozzolana particles, it becomes a cement which uses less OPC but has greater durability and strength. Since it uses a lesser concentration of clinker, it is less expensive and more environmentally friendly than OPC. PPC is used in the construction of marine structures, masonry mortars, hydraulic structures, dykes, sewage pipes, dams, etc.
3. **PSC**: It is a blended cement created with a combination of 35-70% blast furnace slag, 25-65% clinker, and 3-5% gypsum as specified by the BIS. Slag is, essentially, a non-metallic product comprising more than 90% glass with silicates and alumino-silicates of lime. Due to its low heat of hydration, it is considered as the best cement to be used for mass construction. It is used in the construction of all types of residential, commercial and industrial projects, dams and other mass concrete works, water-retaining structures, concrete roads and flyovers, etc.
4. **Composite**: Composite cement is a mixture of high-quality clinker, fly ash, granulated slag, and gypsum. The typical range of these components is clinker (35% to 65%), fly ash (15% to 35%), granulated slag (20% to 30%), and gypsum (3% to 5%). For composite cement, the BIS allows slag and fly ash to comprise 40-65% of cement mass. It reduces the carbon footprint by utilizing industrial by-products, enhances resistance to chemical attacks and cracking, and provides better workability and long-term performance. The use of composite cement enhances the overall quality of concrete structures, making them more resilient and cost-effective. High strength cement, enhanced durability and sustainability, reduction of concrete bleeding and segregation, increased safety of structures, etc are few benefits of composite cement.

Cement-to-clinker ratio for various types of cement

Type of cement	Minimum clinker requirement	Cement-to-clinker ratio
OPC	95%	1.05
PPC	60%	1.67
PSC	25%	4.00
Composite	35%	2.86

Source: CRISIL MI&A Research
Note: Proportion of clinker is for the best-case scenario. For example, OPC cement must contain at least 95% clinker as per BIS norms

Demand review and outlook by product type:



Source: Industry, CRISIL MI&A Research

The proportion of blended cement has been rising, with the share of PPC being the highest. By blending low-cost additive fly ash or slag in the substitution of natural resources such as limestone with OPC, cement producers can lower power, fuel and raw material costs, thereby improving their overall profitability. These cements are also less carbon- and energy-intensive and thus help lowering cost components.

The production of slag cement (PBFSC/PSC) is concentrated in the eastern and southern regions. This is on account of a greater number of steel plants in the region, leading to higher availability of slag since proximity to steel plant is important for the supply of slag. The western and northern regions have a higher share of PPC compared to east and central regions.

The blending ratio for the cement industry is estimated to have risen to 1.48 in fiscal 2024 (based on a sample covering ~70% of industry's production) from 1.40-1.41 in fiscal 2019, owing to rising usage of PPC, PSC and Composite cement, where proportion of blending material is higher. The decline in share of OPC (~1%) has been comparatively lower in fiscal 2024 compared to decline in fiscal 2023 and fiscal 2022 (~2% each) majorly due to infrastructure boost received during the year which led to higher usage of OPC cement, given it’s nature of durability and strength.

The blending ratio is expected to improve even further with players shifting to more profitable composite cement. Since the proportion of blending material allowed in composite cement is 65% as per BIS norms, it allows a higher share of fly-ash and slag usage as against 35% fly ash currently used in PPC cement.

While availability of slag will be limited by production of steel through the blast furnace route, fly ash is available in abundance.

The blending ratio has risen due to higher acceptance and applications of blended cement, such as PPC, PSC and composite cement. Besides faster growth in the east, permission to use PPC in works of state PWDs (earlier only OPC was permitted) have been driving the increase in the blending ratio.

Along with a rise in demand for PPC cement, demand for composite cement is gaining momentum, leading players converting to composite cement production. However, slag and composite cement will be confined to regions where steel plants are located. Being a low-cost commodity, it becomes unviable to transport it over longer distances. With efforts by cement companies to educate customers about the advantages of slag cement in the south, its share would gradually increase in the region.

We expect the share of blended cement to rise further in fiscal 2025 as power and fuel costs have increased compared to pre Russia-Ukraine crisis leading to increase in production costs compared to FY22 levels. Thus, players have started using differential pricing for blended and OPC cement. Further with higher focus on environmental aspects, players will continue to push blended cement to meet emission norms targets and cut production costs. Thus, in the long run, CRISIL Research estimates blending ratio to improve, led by a shift towards PPC, PSC and composite cement.

4.3 Demand segmentation by end user industry

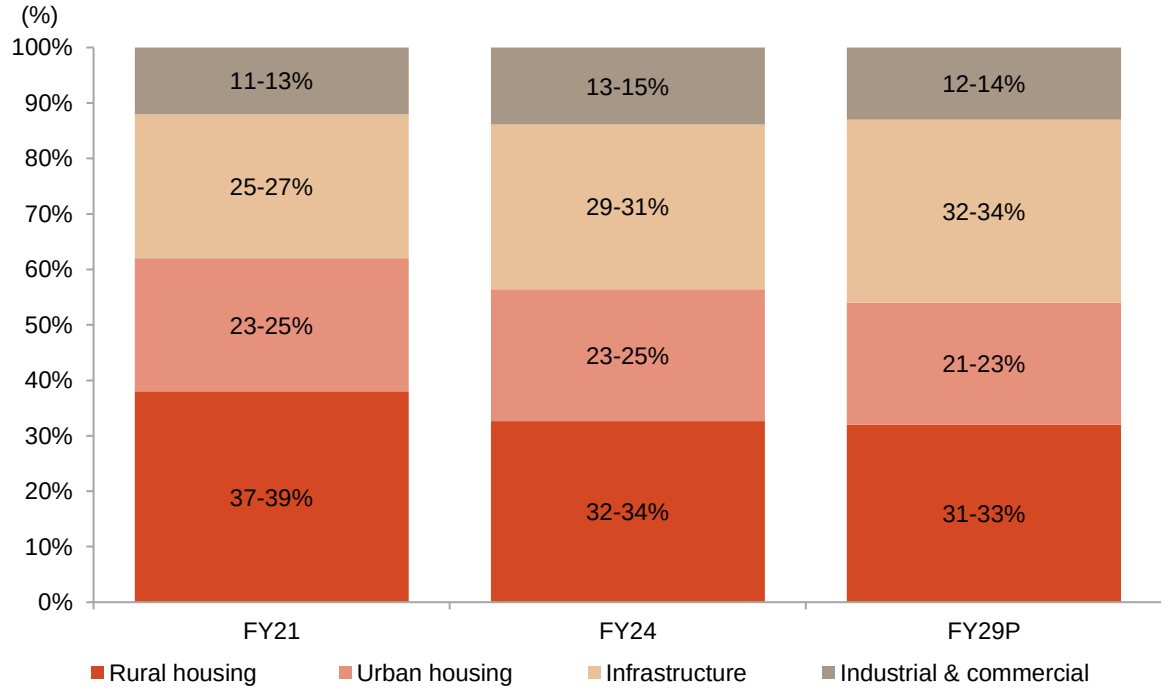
As of fiscal 2024, the end-user sector mix in cement demand share mainly comprised housing (56-58%), infrastructure (29-31%), and industrial/commercial (13-15%).

Over the past five years, though, the share of housing and industrial/commercial in overall cement demand declined, while the share of infrastructure increased. The decline in the share of the housing sector in the cement demand pie was because of the sector buffeted by slow economic growth, weak demand, buyer unaffordability and high inventory.

However, following the pandemic, demand for real estate, especially urban housing, rose sharply in fiscal 2021, as work-from-home mandate boosted demand for increased floor space, incomes stabilised, customer preference shifted to home ownership from rental, and the cost of buying declined. Lower concretisation, rising wages, and continued traction in rural housing demand through PMAY, especially during peak of Covid-19, led to higher share of cement demand from rural housing (32-34%) in total cement consumption as well. Hence, overall housing share in cement demand stood at 56-58%.

The share of the infrastructure segment in cement demand has been rising over the past decade as well, because of a surge in the Central government’s capex towards the sector. In fact, the sector’s share in overall cement demand more than doubled to 29-31% in fiscal 2024 from 11-13% in fiscal 2013.

Sectoral mix

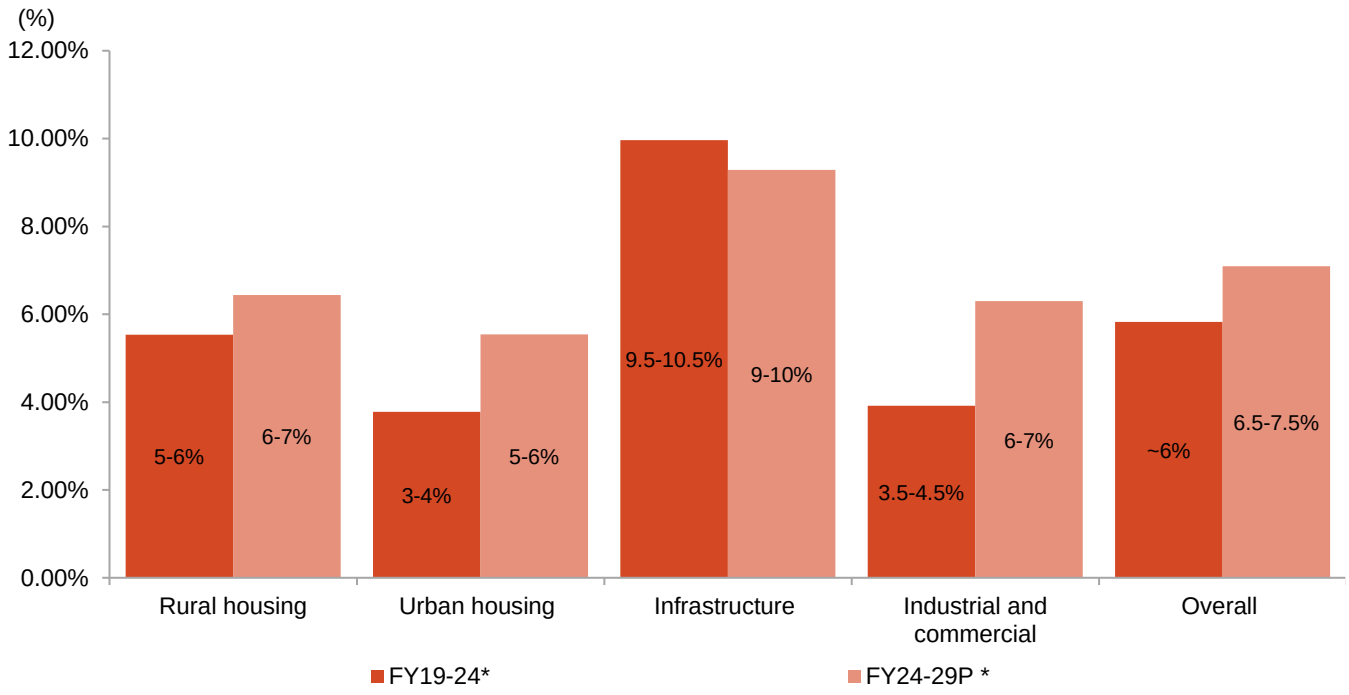


Source: CRISIL MI&A Research, industry

While share of housing segment is expected to marginally contract over the next five years (fiscals 2025 to 2029), it will continue to remain a key contributor, backed by a lower concretisation rate in the country (which means high potential for cement demand growth). Even as housing will be the key volume contributor, infrastructure will expand its share, with the government focusing on infrastructure spending through its flagship schemes, such as PM Gati Shakti, and rising investments in roads, railways, metros, airports, and irrigation. The segment's share is expected to increase to 32-34% in fiscal 2029. The Central government's focus on roads, railways, urban infrastructure, and irrigation will boost infrastructure investments.

On the other hand, the share of the industrial and commercial segment is expected to remain almost at par with marginal decline to 12-14% in fiscal 2029. Recent government initiatives, such as the PLI scheme and Atmanirbhar Bharat, focus on multimodal logistics, warehousing, hybrid model of working and rising capex owing to a long-term positive demand outlook are expected to support demand from the industrial segment.

Segment-wise demand growth outlook



*Note: *CAGR*
Source: CRISIL MI&A Research

Segmental growth	**FY24**	**FY25F**
Rural housing	7-8%	6.5-7.5%
Urban housing	8-9%	5.5-6.5%
Infrastructure	18-19%	9-10%
Industrial and commercial	11-12%	7-8%
Overall	**11%**	**7-8%**

Thus, in the longer run, cement demand will be driven by the infrastructure segment, which has been key driver in the past as well. Growth in the industrial and commercial segment is expected to be supported by government initiatives, such as the PLI scheme and Atmanirbhar Bharat, focus on multimodal logistics, warehousing, hybrid model of working and rising capex.

The housing segment would continue its healthy growth trajectory, with rural housing outpacing the urban segment on the back of a lower development base and a continued rise in the concretization of kuccha houses.

Hence, CRISIL MI&A Research expects cement demand to log a CAGR of 6.5-7.5% over the next five years, moderately higher than the ~6% CAGR during the past five years driven by a raft of infrastructure investments and healthy momentum from industrial and commercial segment.

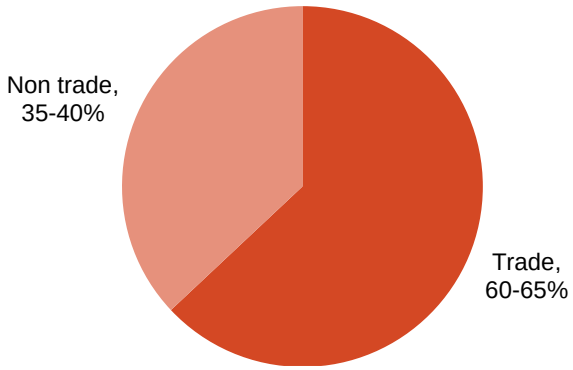
4.4 Segmentation by modes of sales

Cement is marketed under two mechanisms: trade and non-trade.

Trade: The manufacturer directly sells cement to dealers and retailers, who sell to the end consumers. It is a more common and stable method of vending cement since the manufacturer does not have to take the liability for making sales pitch to the consumer directly. Also, it increases the manufacturers' reach. The dealer gets incentives to sell the product. Segments that fall under this mode are individual housing, PMAY-G and parts of infrastructure, industrial-commercial as well as other housing segments.

Non-trade: Under this mechanism, the manufacturer directly sells to the consumer like a construction company for use in a project. Here, the dealer is not involved.

Break-up of cement sales by mode of sales (As per FY24 estimates)



Source: CRISIL MI&A Research, industry

Higher profitability in trade segment makes it more attractive

Trade is preferred by manufacturers as it fetches higher realisations. While the manufacturer has to invest in a distribution channel, the returns are relatively higher. The difference between trade and non-trade price varies from Rs 30 to Rs 60 per bag for a manufacturer. The difference in prices is based on factors such as:

- Region: difference between trade and non-trade is highest in the southern region
- Volume: Higher the volume, higher the difference. For large-scale projects, buyers negotiate to get better prices
- Project type: For infra projects, prices are often fixed on an ex-FOR (freight on road) basis. Often there is a pricing differential between trade and non-trade FOR prices to the tune of Rs 50-100 per bag
- Relationship: The relationship between the construction company and the cement manufacturer plays a key role in determining the quantum of discount

In fiscal 2024, first half witnessed healthy traction from housing segment which resulted in higher trade sales. However, with a focus to speed up execution of infra projects during second half of the fiscal (ahead of Lok Sabha elections in April/May'24), the share of non-trade segment increased sharply at an overall level. While non-trade cement is sold at a discount, it comes with several cost advantages as well, the key being:

- A large part of the non-trade cement is transported in the form of bulk cement, which helps in cutting freight as well as packaging cost
- Since the dealer is not involved, the company does not have to pay dealer commissions.
- Further, the company has to spend less in setting up a dealer network

Despite the cost advantages, the trade segment is more attractive due to higher prices and consistency in the business. Additionally, the scale and distribution of trade segment well offsets the margins paid to dealers. Thus, it often leads to higher profitability. The difference in profitability in trade and non-trade segments varies from 100 bps to 300 bps. However, regional dynamics as well as difference in prices and volumes can lower the profitability gap and in some regions make non-trade segment more profitable than trade segment.

Realisations for cement players vary depending on a wide range of factors, including channel (share of trade/ non-trade), brand positioning and geographical market mix. Owing to high taxes on cement (the commodity is in the highest slab of GST) and high freight costs, there is a wide difference between the maximum retail price and ex-freight realisation for the industry.

Trade and non-trade prices

Price/cost	Rs per bag (trade)	Rs per bag (non-trade)
Average realisation	220-225	213-218
Packaging cost	7-10	0
Freight	55-60	40-45
Average realisation including freight	284-289	255-260
GST @ 28%	78-83	70-75
Wholesaler margin	7	0
Dealer margin	9	0
MRP	383-388	328-333

Note: The prices exhibit regional as well as seasonal variations. The prices mentioned above indicate pan-India average price for fiscal 2024 for category A players.
Source: CRISIL MI&A Research, industry

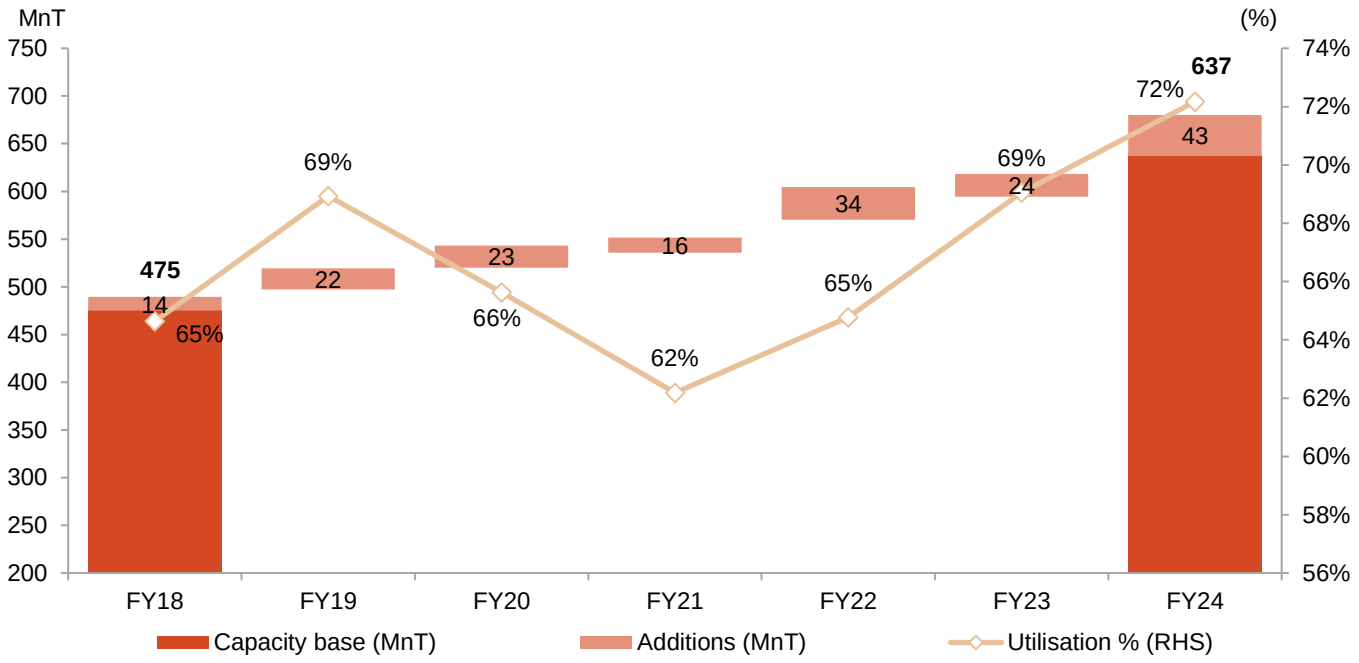
Cement bags are sold through either trade or non-trade channels (largely dependent on the customer segment — individual housing, infrastructure, commercial and industrial) and the prices vary accordingly. Owing to orders of higher quantity, non-trade customers are usually able to get discounts of Rs 30-60 per bag on trade prices. The realisations from government orders are typically even lower since procurement is undertaken via bidding. For large-scale government projects, the prices are usually calculated on a FOR basis and are often Rs 60-80 lower per bag than trade prices.

In trade channel, dealer and wholesaler margins are the highest — at Rs 8-10 per bag — in the eastern region due to heightened competition. In other regions, they are typically Rs 6-8 per bag. Moreover, when new players set up capacities or enter new markets, they increase dealer margins to Rs 10-15 per bag to penetrate the market quickly and gain market share. Dealer discounts, freight cost reduction and bidding values determine the difference between trade and non-trade prices. These vary significantly across players and regions.

5 Cement Supply Analysis – Pan India

5.1 Pan-India supply review

Historical capacity additions and capacity utilisation trend



Source: CRISIL MI&A Research

Player-wise capacity growth

The Indian cement industry is highly fragmented and competitive, with the presence of a few large players and several medium and small players.

Large and mid-sized players have used both organic and inorganic routes to grow. While UltraTech Cement has undertaken the maximum capacity additions in absolute terms, other large players such as Dalmia Bharat and Shree Cement have added capacity aggressively as well.

Among the mid-sized players, JK Cement, JK Lakshmi, JSW Cement and Ramco Cements have undertaken healthy capacity growth, led by organic expansion to newer regions. JSW cement has achieved highest CAGR growth amongst the top 10 players in terms of installed capacity in the past 10 years spanning from fiscal 2014 to fiscal 2024.

Player-wise installed grinding capacity (top 10 players)

MTPA	FY14	FY19	FY23	FY24	FY14-24 CAGR	FY14-19 CAGR	FY19-24 CAGR
UltraTech Cement	54.0	109.4	127.0	140.8	10.06%	15.17%	5.18%

Ambuja Cement	58.5	63.1	67.5	78.9	3.04%	1.53%	4.57%
Shree Cement	17.5	37.9	46.4	53.4	11.80%	16.71%	7.10%
Dalmia Bharat	22.8	26.5	38.6	44.6	6.94%	3.05%	10.97%
Nuvoco Vistas	11.0	11.8	23.6	25.0	8.56%	1.41%	16.20%
The Ramco Cement	15.5	16.7	22.0	22.9	3.98%	1.50%	6.52%
JK Cement (India - grey cement)	7.5	10.5	20.7	22.3	11.46%	6.96%	16.15%
JSW Cement	5.5	12.8	16.6	20.6	14.14%	18.40%	9.98%
Birla Corporation	8.5	15.4	19.3	20.0	8.93%	12.62%	5.37%
JK Lakshmi	7.7	12.5	14.0	16.5	7.92%	10.18%	5.71%
Industry	395.0	497.0	594.0	637.0	4.89%	4.70%	5.09%

Source: Company annual reports and publications

Note: Only domestic operations have been considered for UltraTech Cement and Shree Cement. The company-wise installed base is mentioned and includes capacity additions through expansion, de-bottlenecking and reclassification. FY24 Capacity of Ultratech excludes cement capacity of Kesoram Industries. Ambuja Cements capacity includes cement capacity of ACC Ltd and Sanghi Industries.

Year of commissioning of upcoming additions is as per CRISIL MI&A Research estimates

Trend in share of top 5 players

Capacity in MnT	**FY14**	**FY19**	**FY23**	**FY24**
Ultratech cement	54.0	109.4	127	140.8
Ambuja Cement	28.0	29.7	31.5	78.9*
ACC Ltd	30.5	33.4	36.1	
Shree cement	17.5	37.9	46.4	53.4
Dalmia Bharat Ltd.	22.8	26.5	38.6	44.6
Nuvoco Vistas	-	-	-	25.0
Share of Top 5 Players	**39%**	**45%**	**47%**	**54%**

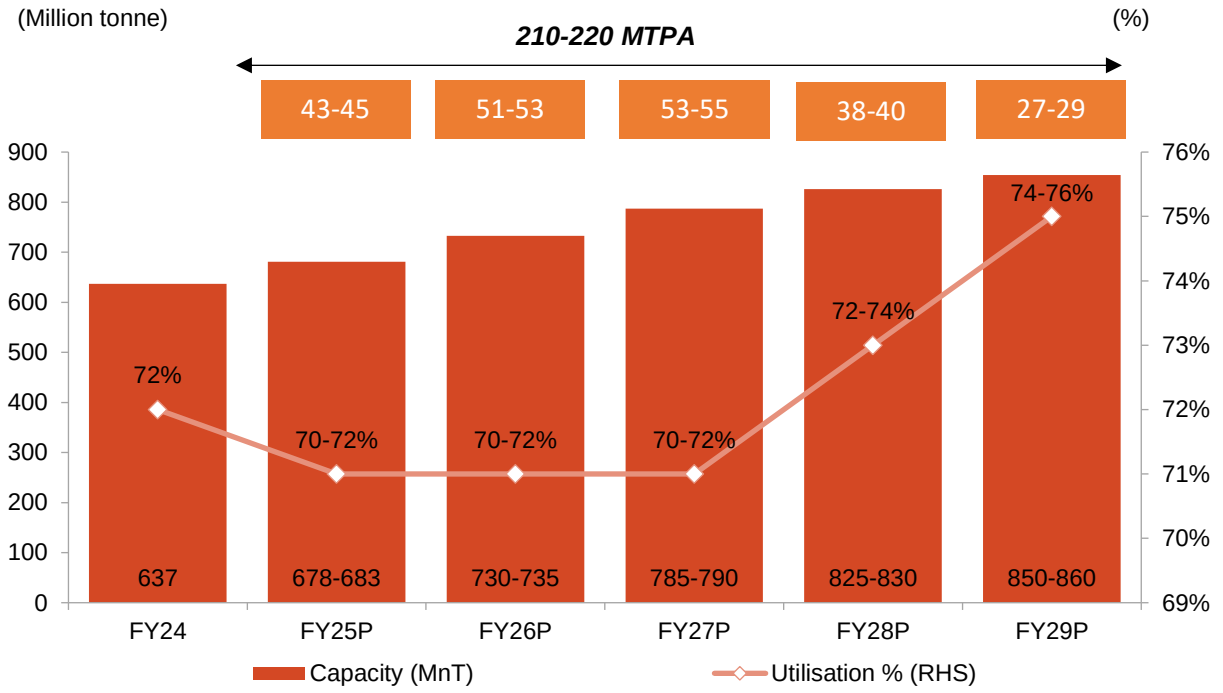
Source: Company annual reports and publications

Note: Only Domestic operations have been considered for UltraTech Cement and Shree Cement. Prior to FY24, ACC ltd, Ambuja cements, Ultratech Cement, Dalmia Bharat Ltd. and Shree Cement considered in top 5 players; Top 5 players share of 47% till FY23 does not include Nuvoco Vistas. In FY24, Nuvoco vistas included in top 5.

**In FY24, Ambuja Cements and ACC Ltd capacity of 78.9 MTPA includes cement capacity of Sanghi Industries.*

5.2 Pan-India supply outlook

Installed capacity and utilisation rates outlook



Note: Capacities include announcements of capacity addition plans during fiscals 2024-2028
Source: CRISIL MI&A Research, company reports

CRISIL MI&A Research projects the cement industry to add 210-220 MTPA of grinding capacities between fiscals 2025 and 2029. The industry added ~34 MT of grinding capacity in fiscal 2022. However, higher input costs in the form of elevated power and fuel prices in early fiscal 2023 dented profitability, leading to lower cash flows and capex slowdown. Hence, relatively lower capacity of ~24 MT was added in fiscal 2023. With rebound in profitability and higher cash accruals in fiscal 2024, players further added ~43 MT during the year.

In fiscal 2025, CRISIL MI&A Research expects the operating rates of cement players to marginally lower to 70-72%, after having risen to ~72% in fiscal 2024. Utilisation levels improved in fiscal 2024 from ~69% in fiscal 2023 and ~65% in fiscal 2022, amidst a healthy demand uptick. Utilisation levels breached 70% mark for the first time in past decade. Higher utilisation levels were supported by strong tailwind of higher demand from housing and infra segment despite capacity additions of ~43 MT during FY24. However, with expected moderation in demand growth on account of post election slowdown coupled with 43-45 MT of capacity additions in fiscal 2025, operating rates are expected to slightly lower but still remain healthy at 70-72% level.

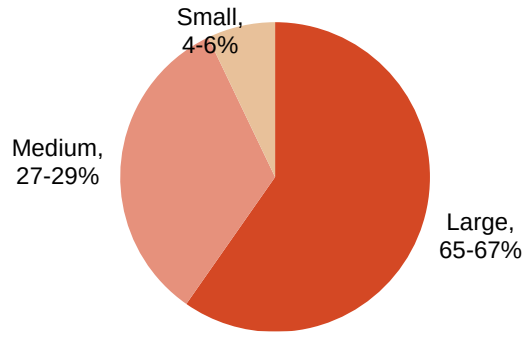
That said, improving demand expectations in the medium term and efforts to gain higher market share has triggered a wave of new-capacity announcements, especially by large players. Despite higher supply, rising demand to support operating rates and elevate to 74-76% in the coming five fiscals.

In fiscal 2024, the installed capacity totalled ~637 MTPA. Assuming 210-220 MT of capacity additions, the total installed capacity is projected at 850-860 MTPA by fiscal 2028.

Capacity addition breakup by size of players

CRISIL Research expects bulk of the capacities (~95%) up to fiscal 2029 to be added by large and mid-size players. We believe large companies will be able to fund capex through internal accruals. Also, their comfortable gearing levels give them the financial flexibility to raise debt, if required.

Large players to account for around 65-67% of total capacity addition in the next five years



Note: Large (capacity ≥ 25 MTPA); medium (capacity: 8-24 MTPA); small (capacity: <8 MTPA)
Source: CRISIL MI&A Research

Consolidation trend in Industry

Over the past five years, the sector has witnessed an unparalleled surge in mergers and acquisitions, resulting in the transfer of 106-108 MTPA of capacity, of which 95-97 MTPA have been acquired by large players[1]. On the other hand, large players have installed only 51-53 MTPA of capacities via organic route. Companies have been preferring inorganic way of expansion rather than organic route due to the lengthy gestation period involved in setting up new plants, which can take three to four years. Additionally, it makes it simple to enter an established market, expanding their geographic reach. Inorganic approach to expansion eliminates the entire hassle of finding the site, purchasing land, and delays in regulatory approvals. The top five players have been gaining market share over the last five years through various

5.3 Limestone mine auctions and bidding trend

The growth of the cement industry is contingent on the availability of limestone — the key raw material, accounting for almost 85% of the total raw material cost. It is also used in iron and steel, chemical, sugar, glass, fertiliser and paper industries. About 97% of the limestone produced in India is cement-grade, ~2% chemical, and ~1% iron, steel and other grades.

The Indian mining sector is governed by the Mines and Minerals (Development and Regulation) Act, 1957, (MMDR Act). It specifies the process and requirements for obtaining and granting mining leases for mining operations. After an amendment to the MMDR Act in 2015, limestone mining costs surged since

[1] *Note: Large (capacity ≥ 25 MTPA); medium (capacity: 8-24 MTPA); small (capacity: <8 MTPA)*

auctions were made compulsory for allocation of new blocks. This made mining costs higher on the back of premiums and incremental royalty (royalty increased from Rs 72 per tonne to Rs 90 per tonne). Another amendment in 2016 stated transfer of the mining lease of captive mines from the transferor to transferee would require an additional transfer fee to be paid to the state government above the royalty amount. Transfer charges payable by the transferee are to be an amount equal to 80% of the royalty paid. The additional transfer fees were considered one of the major hurdles in the merger and acquisition process. This amendment pushed up limestone prices ~7% in fiscal 2016 to above Rs 500 per ton.

Of the various amendments to the MMDR Act, removal of the fee in the transfer of mining leases was a key positive for the cement industry. MMDR Amendment Bill, 2021, revoked the additional transfer fee to make the transfer simpler. It aimed to enable the transfer of mining leases with bad assets to a new lessee. The existing acquisitions also benefitted from the amendment as they do not have to pay the incremental transfer charges for mining limestone from acquired mines. The amendment helped limit the rise in raw material cost to ~10% in fiscal 2022, after it declined ~3% in fiscal 2021, due to higher premiums, incremental royalties and higher mining costs.

5.4 Distribution of limestone reserves

India has huge reserves of cement grade limestone estimated at about 227 billion tonnes as per Indian Minerals Yearbook 2021 . Of this, around 19 billion tonnes is of "proved" grade and 208 billion tonnes of "possible" grade. Cement grade limestone reserves are found in 24 states and 3 union territories (UT) but its distribution is not uniform. About ~93% of the total proven reserves are concentrated in 10 states - Andhra Pradesh and Telangana, Rajasthan, Karnataka, Himachal Pradesh, Gujarat, Meghalaya, Chhattisgarh, Madhya Pradesh and Maharashtra. Rajasthan is the leading producing State accounting for (22%) of the total production of limestone, followed by Madhya Pradesh & Andhra Pradesh (13% each), Chhattisgarh (11%), Karnataka (10%), Telangana (7%), Gujarat (6%), Tamil Nadu (5%) and the remaining 13% was contributed by Himachal Pradesh, Maharashtra, Meghalaya, Odisha and Uttar Pradesh. Environmental rules and regulations restrict the exploitation of resources.

The total reserves of cement grade limestone are not fully utilised to manufacture cement due to constraints such as inaccessibility of some deposits in hilly terrain, environmental regulations, etc.

Availability of limestone reserves for future requirements is a concern as 30% of reserves fall under forests and other regulated areas unavailable for cement manufacture. Another 7.5% of limestone bearing area falls in the Coastal Regulation Zone.

5.5 Capacity overview of top players

Player name	Grinding capacity (MTPA)			Clinker capacity (MTPA)
	FY22	FY23	FY24	FY23
UltraTech Cement Ltd	114.5	126.5	140.8	NA
Shree Cement Ltd	46.4	46.4	53.4	29.6
Dalmia Bharat group	35.86	38.6	44.6	21.7

ACC Ltd	36.11	36.1	38.9	NA
Ambuja Cements Ltd	31.45	31.5	37.5	NA
Nuvoco Vistas	23.63	23.6	25	NA
The Ramco Cements Ltd	19.4	20.9	22.9	15
J K Cement Ltd	14.7	20.7	22.2	NA

Note – Clinker Capacity for fiscal 2023 is not available (NA) for the companies: Ultra Tech Cement Ltd., ACC Ltd., Ambuja Cements Ltd., Nuvoco Vistas and JK Cement Ltd.
Source: Industry, CRISIL MI&A Research

Both organic and inorganic growth paths have been used by large and midsized companies. In absolute terms, other large players such as Dalmia Bharat and Shree Cement have also added capacity significantly over the period of fiscal 2022 to fiscal 2024, while UltraTech Cement has increased its capacity to the highest when compared to its competition. Mid-sized players such as JK Cement and Ramco Cement have undergone healthy capacity growth, led by organic expansion to new regions.

Region-wise capacity

Region	Installed capacity (In million tonnes), FY23	Installed capacity (million tonnes), FY28P
North	112	143-148
Northeast	14	17-22
East	114	178-180
West	81	105-110
South	191	234-239
Central	83	117-122
Total	**595**	**800-810**

Note – P: Projected
Source: CRISIL MI&A Research

In terms of total installed capacity in fiscal 2023, the southern region topped with a share of 32%, followed by the northern and eastern regions with a share of 18-20% each and the western and central regions with 13-14% each.

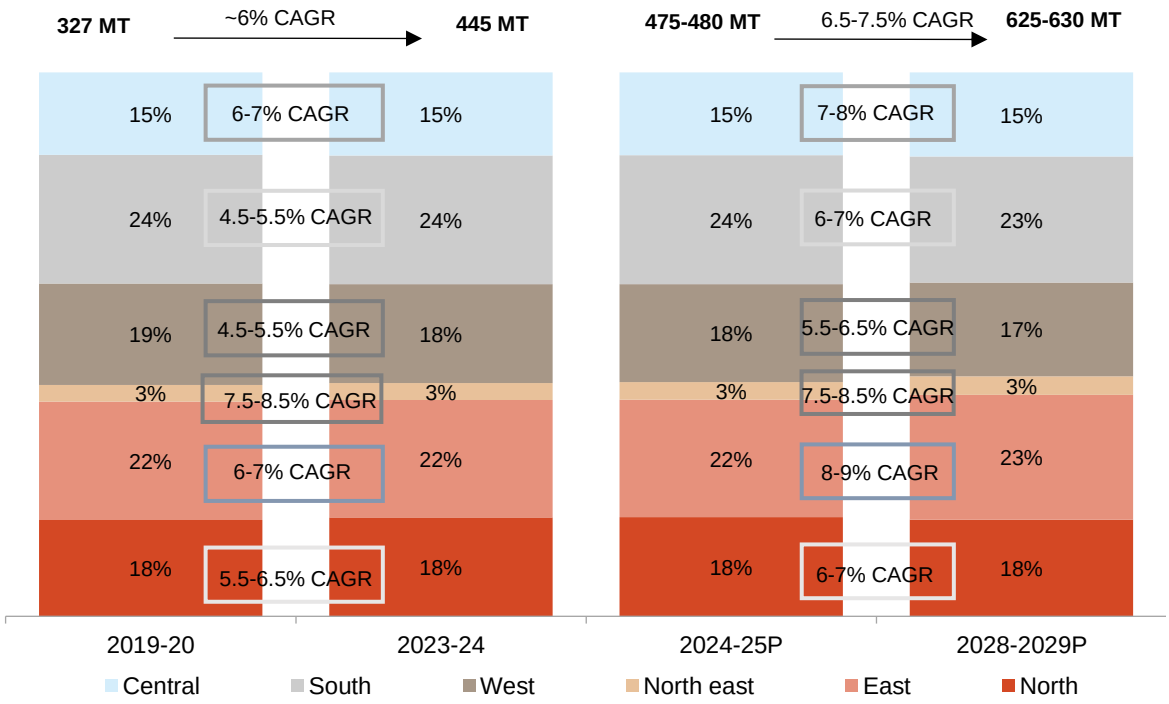
6 Regional demand, supply and utilisation

6.1 Region-wise cement demand review and outlook

Over the past five years (fiscals 2020-2024), the eastern region (Odisha, Bihar and West Bengal), followed by the central region (Uttar Pradesh and Madhya Pradesh) saw strong demand growth, led by a surge in infrastructure construction and rural housing. Moreover, the eastern region witnessed the highest growth since it was less affected by Covid-19-led demand disruptions as it is a rural concentrated region.

Overall, cement demand logged a healthy CAGR of ~6% over the five-year period, mainly dragged down by the economic slowdown in fiscal 2020 and Covid-19 disruptions in fiscal 2021.

Regional cement demand trend



Source: CRISIL MI&A Research

CRISIL MI&A Research expects cement demand to increase at a healthy 6.5-7.5% CAGR between fiscals 2025 and 2029.

During this period, the eastern and central regions, which have a higher housing shortage and a lower base in terms of per capita cement consumption, are expected to exhibit robust growth, followed by the north and south. Demand in the southern region will be supported by real estate and urban housing projects, and road and irrigation infrastructure projects. Central vistas project, metro projects in Delhi and Gurgaon will continue to support demand in the north. The western region is expected to witness moderate growth but likely to grow at a faster rate compared with the previous five fiscals. This region has high-budget infrastructure projects under execution (Mumbai-Ahmedabad bullet train, multiple

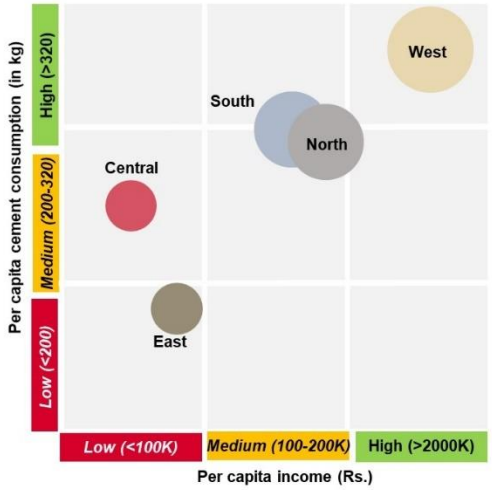
expressways and metro projects in Mumbai) but already has the highest per capita cement consumption, which will limit the demand growth potential.

Eastern (including north-east) and central regions to outperform others in the long term

Continuing the past decade's trend, the eastern and central regions will continue to drive cement demand in India in the medium term, led by the government's thrust on infrastructure and housing, coupled with a low base of development. Per capita income and per capita cement consumption in these two regions are well-below pan-India numbers, thereby providing significant potential upside. Though the northern, western and southern regions comprise the more industrialised states, demand growth has been relatively low in the past; they are expected to continue lagging the other two regions in the future as well.

Further, the eastern and central regions account for over a third of the rural housing shortage, according to the 2011 census. Although the shortage has lessened over the years on the back of central and state government schemes such as PMAY-G and Biju Pucca Ghar Yojana in Odisha, it remains high.

Region-wise per capita income vs per capita cement consumption



Source: CRISIL MI&A Research, Ministry of Statistics and Programme Implementation (MoSPI), 2011 Census

North: Demand outlook to marginally improve in longer term

Review (fiscal 2020-2024): Infrastructure projects and affordable housing helped cement demand log 5.5-6.5% CAGR in the northern region over fiscals 2020-2024. Demand from metro projects in and around the National Capital Region (NCR) and construction by the National Highways Authority of India (NHAI) and border roads in Rajasthan continued to support demand during the period. The projects included the dedicated freight corridor (DFC) in Haryana; metro projects in Delhi and Gurgaon; smart-city-related development in Delhi, Rajasthan and Haryana; and several road and highway projects. In addition, affordable housing continued to support demand growth.

Outlook (fiscal 2025-2029): CRISIL Research estimates growth to moderate in fiscal 25 to 7-8% on two consecutive high base. Also, impact of heat wave during the first quarter to limit demand growth. Various infrastructure projects -- roads, metros, DFC, etc. will support growth in the region in this fiscal along with traction from real estate. Over fiscals 2025-2029, CRISIL Research expects cement demand in the

region to log a 6-7% CAGR growth. Key infrastructure projects in the region such as metro projects in Delhi, Gurugram (Gurugram-Alwar metro); smart-city-related development in Delhi, Rajasthan (Jaipur and Udaipur) and Faridabad (Haryana); several road and highway projects, etc., will drive cement demand in the region. Real estate development in key existing and emerging pockets will gradually support demand as well. However, demand for housing in the region is expected to remain moderate on account of low levels of housing shortage and higher levels of pucca/ concrete houses.

Region	Housing	Infrastructure	Commercial/industrial	FY20-24	FY24	FY25P	FY25-29P
North				5.5-6.5%	12%	7-8%	6-7%

Source: CRISIL MI&A Research, industry

West: Infrastructure and real estate to support demand growth

Review: Cement demand growth witnessed a modest CAGR of 4.5-5.5% over the past five years, owing to swaying demand and the pandemic's impact in fiscal 2021. After a healthy uptick in fiscal 19, the growth declined in fiscal 20 owing to the high base and floods that affected rural areas and infrastructure construction, reducing demand in Maharashtra and Gujarat. In fiscal 2021, demand declined a further 1-3% since the region was the hardest hit by the first wave of Covid-19. In fiscal 22 and 23, the region witnessed recovery on a low base of two consecutive years and due to a pickup in real estate after a reduction in stamp duty, low interest rates, customer preference for individual homes, and pickup in infrastructure projects. In fiscal 24, demand grew further by ~12% even after rebounding sharply in the two previous fiscal years largely led by urban housing and real estate pickup.

Outlook: Demand growth to moderate in fiscal 2025 to 6.5-7.5% in anticipation of temporary slow-down in funding for infra projects post Lok Sabha elections. However, healthy traction expected from infra and housing projects in Maharashtra ahead of state elections in Dec 2024. In the longer run, CRISIL Research expects cement demand in the west to log a 5.5-6.5% CAGR over the forecast period, higher than the growth seen in the previous five years. Development of infrastructure, such as urban infrastructure projects (metros, expressways, national highways), state roads in Gujarat, the Mumbai-Ahmedabad bullet train, multiple expressways and healthy traction in demand for real estate and urban affordable housing to support demand in the region.

Region	Housing	Infrastructure	Commercial/industrial	FY20-24	FY24	FY25P	FY25-29P
West				4.5-5.5%	13%	6.5-7.5%	5.5-6.5%

Source: CRISIL MI&A Research, industry

East: Social infrastructure and housing development to boost demand

Review: With 6-7% CAGR during fiscals 2020-2024, cement demand in the eastern region (along with central region) outpaced that in most other regions. State governments' focus on development in the region and the low-base effect (east is one of the lowest cement-consuming regions in the country) drove the growth. The demand picked up during the period, driven by healthy growth in affordable housing under the PMAY-G, strong rural demand, smart city-related construction, and IHB. However, some slowdown was witnessed in fiscal 20 and 21 on the back of demand destruction in Odisha due to cyclone Fani and a slowdown in construction in Bihar and Jharkhand due to an acute water shortage. After

continued slowdown during fiscal 22 as well, demand rebounded sharply in fiscal 23 largely propelled by traction under rural housing, specially under PMAY-G. Rural housing remains the key demand driver in the region amid a higher housing shortage. Although, fiscal 24 witnessed relatively lower demand growth owing to sand and aggregate availability issue as well as funding issue in West Bengal and Bihar during second half of the fiscal.

Outlook: In fiscal 2025, growth is expected to moderate but still remain higher than other regions at 7.5-8.5% in line with post-election moderation in demand. Also, moderate slowdown expected post assembly elections in Odisha during Q1FY25 which will limit further demand uptick. In the longer run, rural housing (IHB and PMAY-G) and infrastructure (roads and railways) development should propel healthy cement demand during fiscals 2025-2029. Demand in this region is expected to log 8-9% CAGR during the period. With the lowest per capita cement consumption in the country and a 30-35 million housing shortage identified in the region, CRISIL MI&A Research expects demand for cement to remain healthy in the long term. Further, an uptick in infrastructure investments is also expected via key projects, such as metro development in Kolkata, Patna and Ranchi, smart-city-related development in Odisha (Bhubaneswar), West Bengal (Newtown Kolkata), Jharkhand (Ranchi), Bihar (Bhagalpur), and Chhattisgarh (Raipur); and several other road and highway projects. Industrial demand is also expected to be healthy on the back of investments by the government and private players in the railways, power, cement and steel sectors.

Region	Housing	Infrastructure	Commercial/industrial	FY20-24	FY24	FY25P	FY25-29P
East	↑	↑	↑	6-7%	9%	7.5-8.5%	8-9%

Source: CRISIL MI&A Research, industry

North-east: Weak infrastructural base to pave way for healthy demand growth

Review: In previous five years, cement demand in the region grew at a healthy 7.5-8.5% CAGR, marginally higher than eastern region. Demand growth accelerated in fiscal 2018 and fiscal 2019, driven by the central government's greater focus on infrastructure development. Although, growth moderated in fiscal 2020 and 2021, impacted by the pandemic as well as weak government spending. However, on a low base, demand picked up in fiscal 2022, driven by traction from infrastructure projects and rural housing. Further, a pre-election boost spurred healthy growth in fiscal 2023, with higher demand from the infrastructure segment followed by housing. Completion of several road and rail connectivity projects (Bogibeel with linking lines between Dibrugarh, North and South Bank line, Agartala – Sabroom, New Maynaguri – Jogighopa line) in the past years have supported demand growth in the region. Demand further grew by ~10.5% in fiscal 2024, driven by a healthy pace in first half of the fiscal ahead of state elections in Mizoram, AP and Sikkim.

Outlook: CRISIL MI&A Research estimates demand momentum to slow in fiscal 2025 on two consecutive healthy base. In the long run, CRISIL MI&A Research expects demand growth to remain healthy with similar momentum at 7.5-8.5% CAGR on a high base with various infrastructure projects under construction (new greenfield airport projects in Arunachal Pradesh, Dibrugarh, Guwahati, road projects of Dimapur-Kohima Road in Nagaland, four-laning of Nagaon bypass to Holongi in Arunachal Pradesh, two-lane highway from Bagrakote to Pakyong in Sikkim, etc). Also, rising need of concretisation will support growth from the rural housing segment in the medium to long term.

Region	Housing	Infrastructure	Commercial/industrial	FY20-24	FY24	FY25P	FY24-28P
North east				7.5-8.5%	10.5%	7-8%	7.5-8.5%

Source: CRISIL MI&A Research, industry

Central: Housing and infrastructure development to drive healthy growth

Review: Over the five-year period, cement demand logged a strong 6-7% CAGR in the region. Demand growth remained healthy in fiscal 19, however, the region witnessed a slowdown during fiscal 20 and 21 on account of previous two healthy base, water scarcity in Bundelkhand and flooding in MP. Although, in fiscal 22 and 23 pre-election spending in Uttar Pradesh with a slew of infrastructure projects under execution, majorly roads, airports, and metro, supported the demand revival in the region and grew at a healthy rate. In fiscal 24 demand witnessed another year of healthy growth owing to infrastructure construction, a pick-up in urban housing development in Uttar Pradesh and healthy rural housing demand in Madhya Pradesh.

Outlook: On two consecutive healthy bases, demand growth is expected to moderate to 6.5-7.5% in fiscal 2025. Expected fund diversion during elections will cause temporary slowdown of infra projects in the next fiscal leading to moderation. Also, lower budgeted state spending for the year in MP will limit growth. During fiscals 2025-2029, cement demand in the region is expected to log healthy 7-8% CAGR, moderately higher than growth seen in the previous five years. Key infrastructure projects in the region, such as metro projects in Bhopal, Meerut, Agra and Indore; smart-city-related development in Madhya Pradesh (Bhopal, Indore and Jabalpur) and Uttar Pradesh (Lucknow); road and highway projects; irrigation projects and the waterway project across Varanasi-Haldia will back cement demand. Further, housing demand in the new emerging pockets of Meerut (after metro linkage to the NCR) and Aligarh, and development in the key centres of Indore, Bhopal and Noida will continue to boost demand.

Region	Housing	Infrastructure	Commercial/industrial	FY20-24	FY24	FY25P	FY25-29P
Central				6-7%	12%	6.5-7.5%	7-8%

Source: CRISIL MI&A Research, industry

South: Demand to grow led by infrastructure projects

Review: The southern region clocked in CAGR of 4.5-5.5% during the past 5 years. The region was most severely impacted during fiscal 20 and 21 amidst disruptions in demand due to general and assembly elections, the cancellation of several awarded projects, the stalling of construction work in Amaravati and stricter lockdowns and related labour and supply-chain disruptions due to Covid-19 leading to a sharp decline. Going forward, demand recovery was faster in Andhra Pradesh and Telangana led by government spending on housing and infrastructure projects. In fiscal 22 and 23, the demand rose sharply on a low base, driven by a pickup in infrastructure execution and housing projects across southern states. In fiscal 24, growth momentum continued its healthy pace led by traction from infrastructure project executions, primarily roads, expressways, metros, etc.

Outlook: In fiscal 2025, growth is expected to moderate to 7-8% on two consecutive healthy base. Over fiscals 2025-2029, the demand in the region is expected to log a 6-7% CAGR. States with poor growth in

the past, such as Tamil Nadu and Karnataka, are expected to witness an upward bias on the back of growth in the state infrastructure segment. Expressways, such as Chennai-Tiruchirapalli expressway, Namma Metro construction in Bengaluru, Kochi metro, irrigation projects, etc, would drive incremental cement demand during the next five years.

Region	Housing	Infrastructure	Commercial/industrial	FY20-24	FY24	FY25P	FY25-29P
South				4.5-5.5%	12.5%	7-8%	6-7%

Source: CRISIL MI&A Research, industry

6.2 Growth drivers of high potential states

Cement demand: Review and outlook

States	Demand, FY24	Demand, FY29P	CAGR FY24-29P	Growth potential
Andhra Pradesh & Telangana	41-43	56.2-61.7	6-8%	Medium
Tamil Nadu	27-29	38.4-42.1	6.5-8.5%	Medium-High
Karnataka	23-25	31.4-34.5	5.5-7.5%	Medium
Kerala	10-12	12.8-14	3-5%	Low
West Bengal	26-28	37.9-41.5	7-9%	High
Odisha	18-20	26.6-29.2	7-9%	High
Goa	0.5-2.5	1.9-2.1	4.5-6.5%	Medium
Maharashtra	47-49	64.2-70.5	6-8%	Medium

Note: Growth classification – high >7%, medium 5-7%, and low <5%; P: projected
Source: CRISIL MI&A Research

In fiscal 2024, demand was the highest from Maharashtra, followed by Andra Pradesh and Telangana. In Maharashtra, the Mumbai Metropolitan Region (MMR) accounted for 9-10 million tonne of demand. By fiscal 2029, the key states, as mentioned in the above table, are likely to contribute to major domestic cement demand include West Bengal and Odisha; demand from the key states is expected to clock a CAGR of 7-9%.

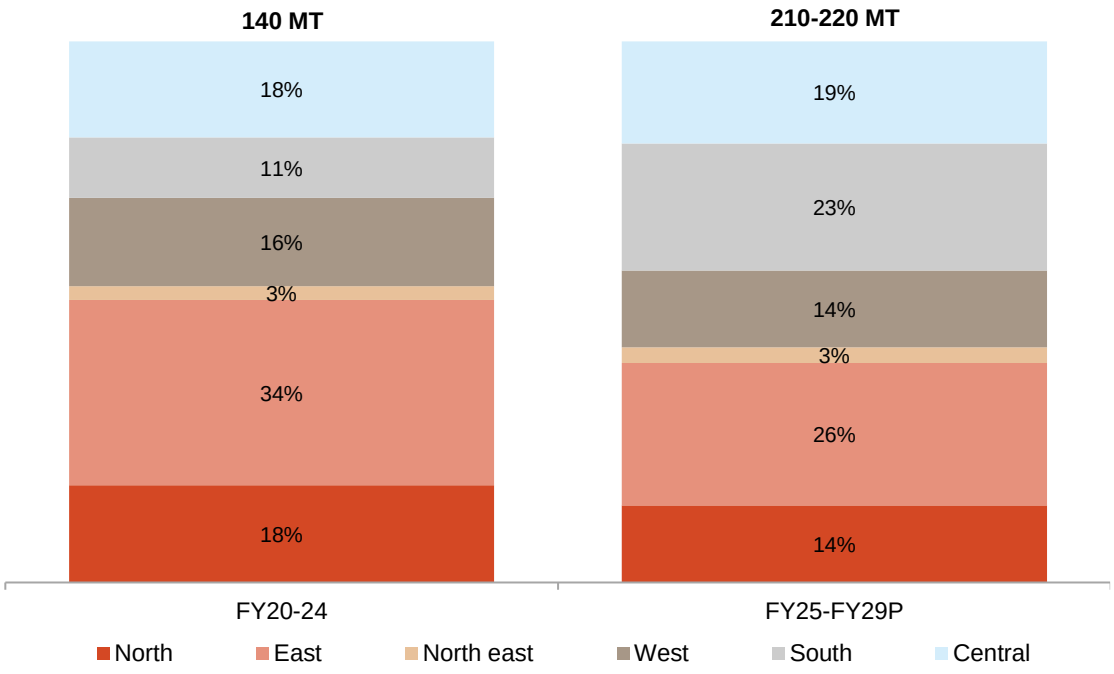
6.3 Region-wise cement supply and utilisation review and outlook

Over fiscals 2020-2024, the northern, eastern and central regions collectively comprised ~70% of overall capacity additions. The eastern region has seen the largest share of capacity additions in recent years, led by the rapid expansion by Nu Vista Ltd (formerly Emami Cement, now a wholly owned subsidiary of Nuvoco), Dalmia Cement, JSW Cements, Ramco Cements and Shree Cement, which helped these companies gain share in a fast-growing market.

Over fiscals 2025-2029, the east and south are expected to drive capacity additions, followed by the central region, and the north, west and north-east.

Improving demand outlook over the medium term and the push to gain market share have triggered a wave of capacity addition announcements from cement manufactures, especially large players. Over fiscals 2025-2029, CRISIL MI&A Research expects the industry to add 210-220 MTPA of grinding capacities, taking the country's total installed capacity to 850-860 MTPA.

Regional break-up of capacity additions

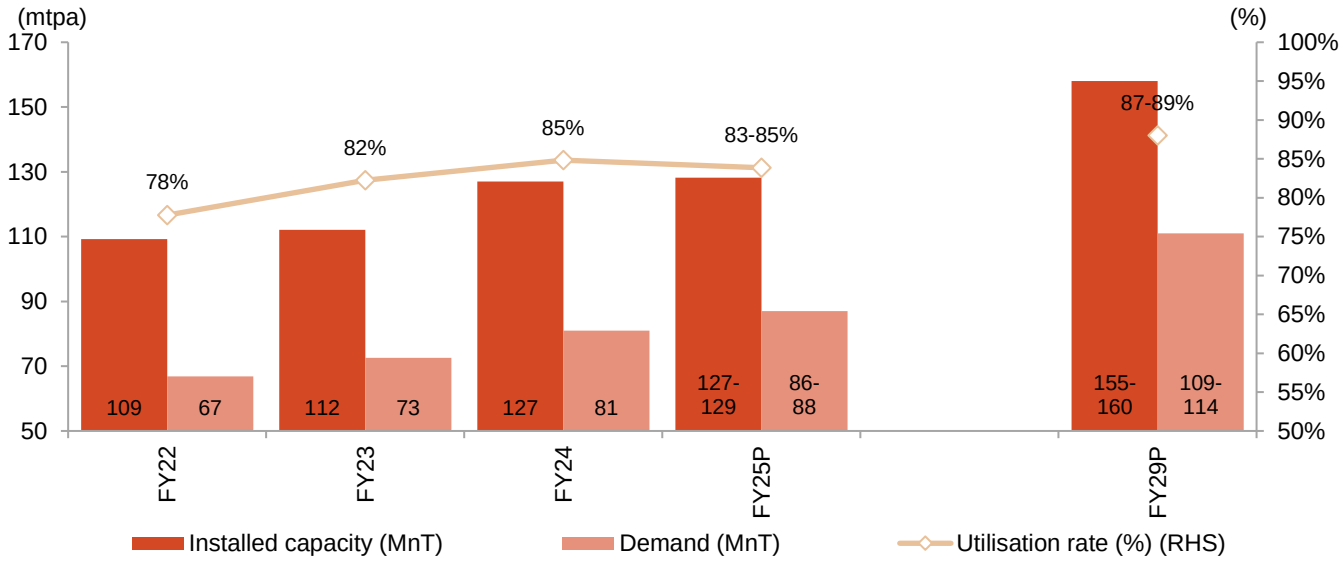


Source: CRISIL MI&A Research, industry

Capacity, demand-supply balance and utilisation in the north

In fiscal 2021, utilisation was stable, despite the pandemic-caused lockdowns as demand recovered in the second half of the fiscal. However, utilisation improved in fiscal 2022, with few capacity additions and robust demand revival on the back of government spending and pick-up in construction, leading to ~78% utilisation levels in the region. In fiscal 2023, utilisation levels picked up pace and reached ~82% amid lower capacity addition. In fiscal 2024, utilisation further improved, despite the rise in capacity additions, majorly due to healthy demand growth. In fiscal 2025, operating rates are expected to inch down marginally with moderation in demand growth. These levels are expected to remain elevated compared to other regions in the coming 5 years amid a positive demand outlook and lower capacity additions.

Demand–supply and utilisation rates

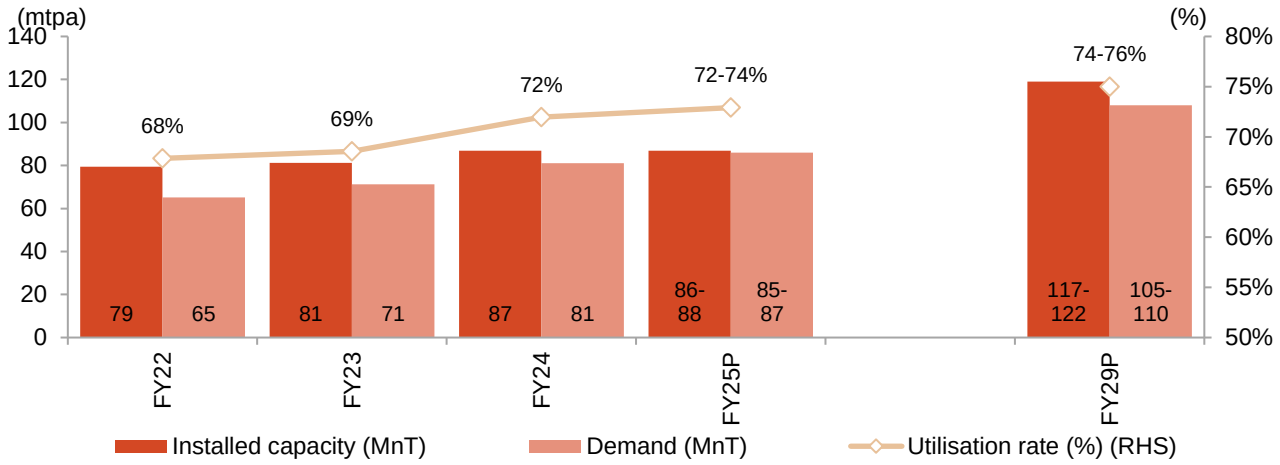


Source: CRISIL MI&A Research, industry
Note: Capacity utilisation is calculated on effective capacity – based on the date of commissioning of the plant; capacity utilisation is calculated as production in the region divided by effective capacity and does not take into consideration inter-regional movement

Capacity, demand-supply balance and utilisation in the west

The west was the most impacted region in fiscal 2021, due to stringent lockdowns leading to production shutdowns. As a result, utilisation rate declined to ~65% from a high of ~72% in fiscal 2020. However, in fiscal 2022, ~10 MT capacity was installed in the west, which limited the rise in utilisation levels, despite healthy demand, leading to ~68% utilisation rate. Utilisation levels remained almost stable in fiscal 2023 and improved in fiscal 2024 due to healthy demand growth. Further, in fiscal 2025, utilisation levels are expected to marginally improve with moderate capacity additions and lower inbound cement movement from the south (Karnataka) and north, leading to lower cement supply amidst a steady demand outlook. Also, going forward, these levels are expected to hover at 74-76% on account of the slower pace of capacity additions over the next five years and healthy growth in demand.

Demand–supply and utilisation

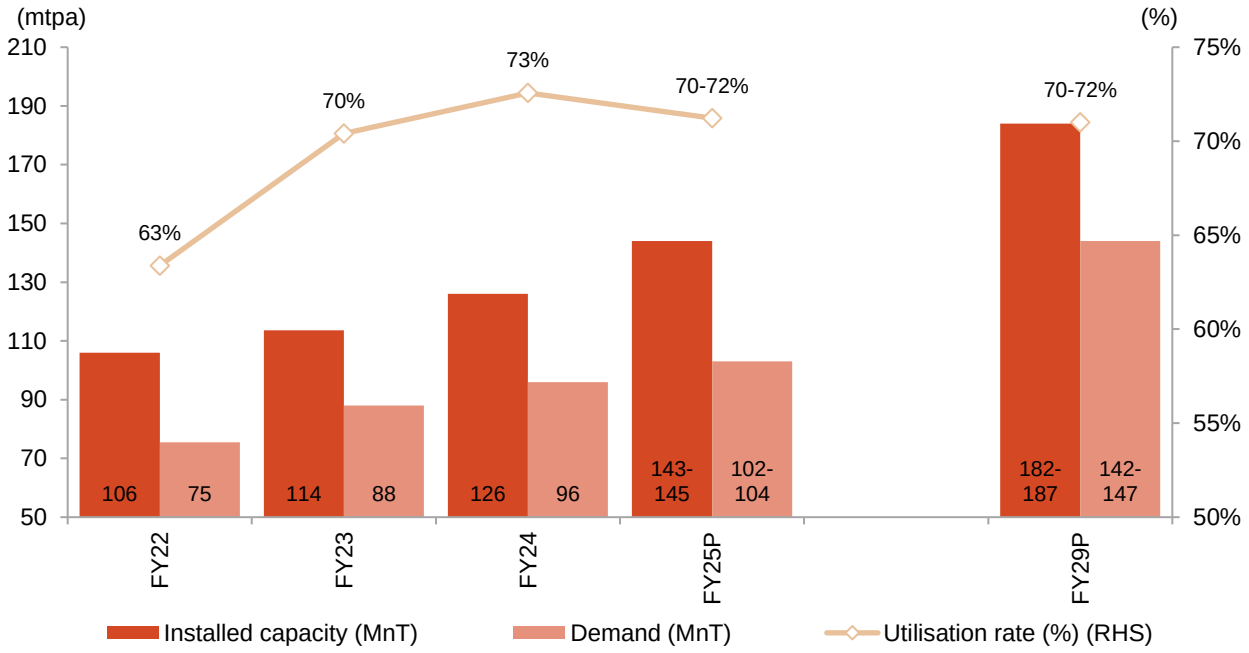


Source: CRISIL MI&A Research, industry
Note: Capacity utilisation is calculated on effective capacity – based on the date of commissioning of the plant; capacity utilisation is calculated as production in the region divided by effective capacity and does not take into consideration inter-regional movement

Capacity, demand-supply balance and utilisation in the east

The eastern region was able to better tackle the pandemic owing to a large share of rural areas and lesser congested urban settlements. Demand support from rural housing and government-led infrastructure projects led to healthy production. Hence, utilisation rate declined to ~70% in fiscal 2021. However, with positive demand outlook amid low per capita cement consumption and healthy government spending, many players announced capacity addition plans in fiscal 2021. This put pressure on utilisation levels, which dropped to ~63% in fiscal 2022 amid higher capacity additions and weak demand due to sand issues and untimely rainfall. However, in fiscal 2023, utilisation rebounded to 70% on the back of robust demand growth on a low base, supported by the traction in rural housing, infra push, lower per capita consumption and higher housing shortage. In fiscal 2024, the operating rate improved to 73%, although limited by slow demand momentum during the second half of the fiscal. In fiscal 2025, it is expected to inch down to 70-72% amidst higher capacity addition in pipeline.

Demand–supply and utilisation

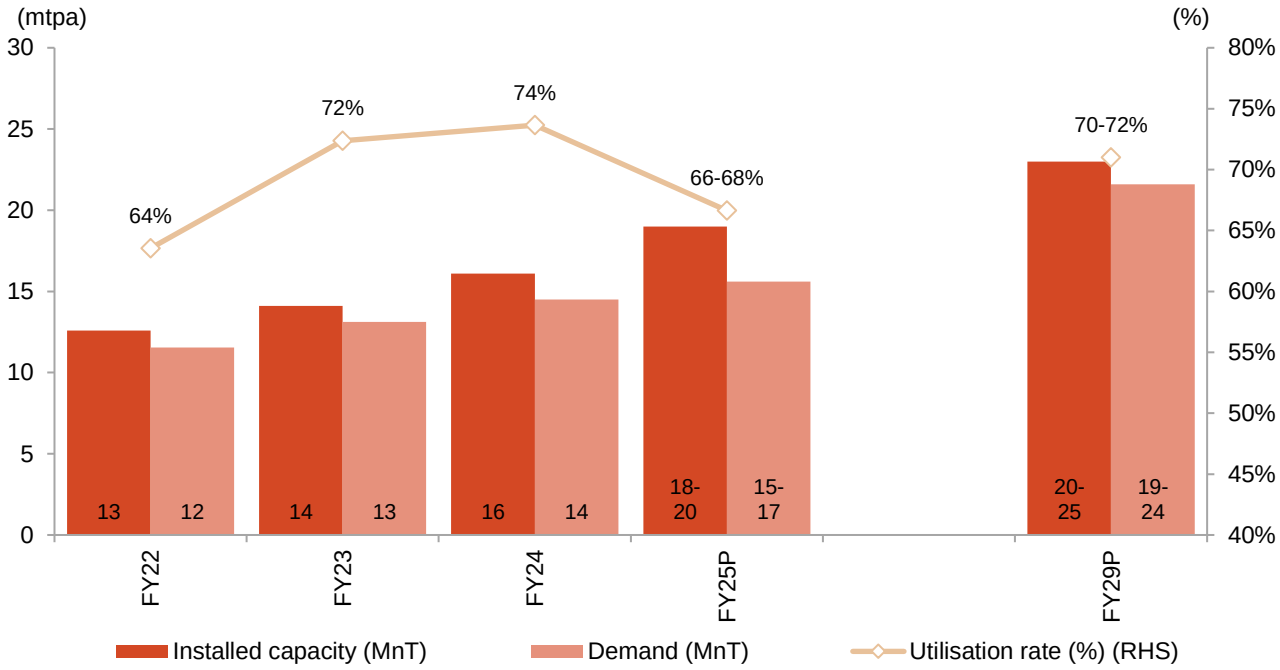


Source: CRISIL MI&A Research, industry
Note: Capacity utilisation is calculated on effective capacity – based on the date of commissioning of the plant; capacity utilisation is calculated as production in the region divided by effective capacity and does not take into consideration inter-regional movement

Capacity, demand-supply balance and utilisation in the north-east

In the north-eastern region, utilisation rate was almost steady at ~63% in fiscal 2021, limiyed on account of restrictions on production amid the pandemic. Although, with recovery in demand in fiscal 2022, operating rate improved to ~64%. Fiscal 2023 witnessed healthy demand growth spurred by the pre-election boost and higher traction from infra and housing. This resulted in a sharp rise in utilisation rates to ~72%. With a steady demand momentum and increase in capacity base, operating rates have just moderately improved in fiscal 2024 to ~74%. Going ahead, utilisation is expected to decline in fiscal 25 in lieu of higher supply against demand in the region. In the longer run, utilisation level to improve to 70-72% amidst healthy demand growth.

Demand–supply and utilisation

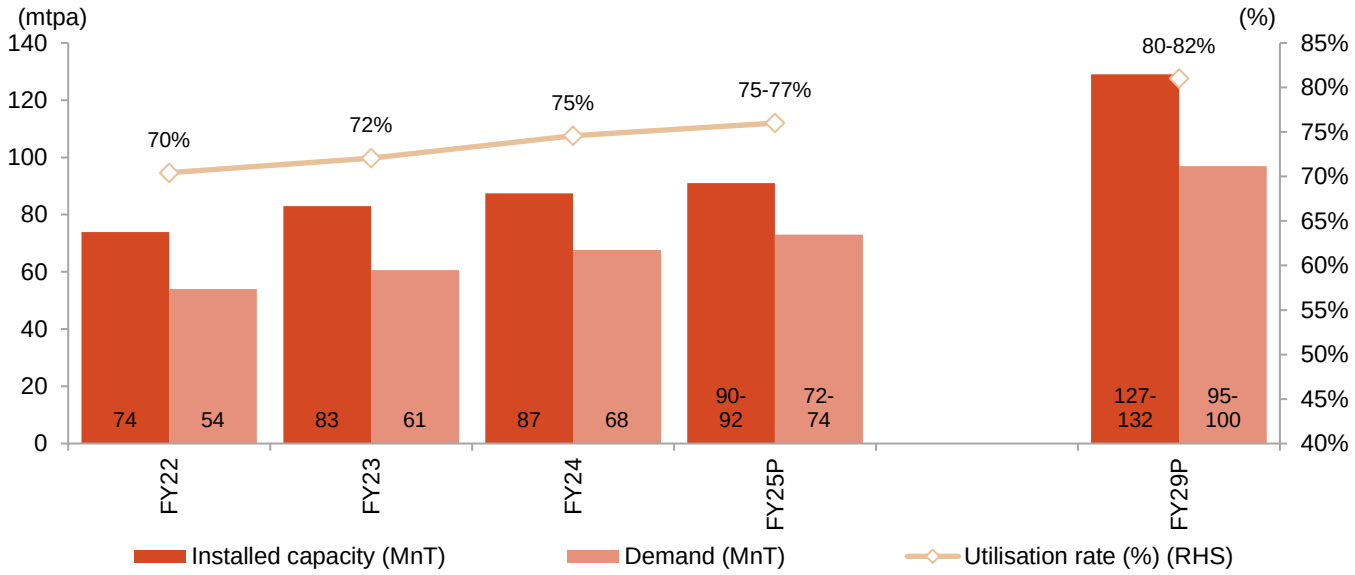


Source: CRISIL MI&A Research, industry
Note: Capacity utilisation is calculated on effective capacity – based on the date of commissioning of the plant; capacity utilisation is calculated as production in the region divided by effective capacity and does not take into consideration inter-regional movement

Capacity, demand-supply balance and utilisation in the central region

In the central region, capacity utilisation reached lows of ~67% in fiscal 2021 due to production shutdowns in the first quarter. However, it recovered in fiscal 2022 to reach ~70%, as demand rebounded on the back of pre-election spending in Uttar Pradesh and pick-up in housing and construction activity. Thereafter, in fiscal 2024, it improved to 75% on account of healthy traction from rural housing and infra segment coupled with lower capacity addition during the year (~4.5 MT added). In fiscal 2025, utilisation levels are expected to improve moderately due to the even lower capacity addition expected in the current fiscal. In the longer run it is expected to improve and operate at 80-82% level till fiscal 2029 due to strong demand prospects in the region.

Demand–supply and utilisation

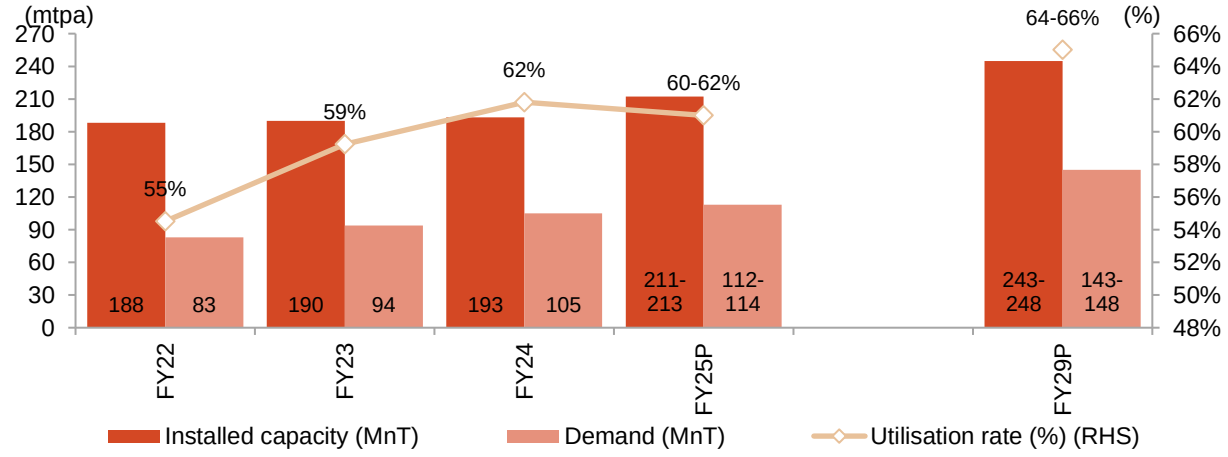


Source: CRISIL MI&A Research, industry
Note: Capacity utilisation is calculated on effective capacity – based on the date of commissioning of the plant; capacity utilisation is calculated as production in the region divided by effective capacity and does not take into consideration inter-regional movement

Capacity, demand-supply balance and utilisation in South

Capacity utilisation in the south is the lowest, owing to a wide gap between capacity and production over the years, further aggravated by a slump in demand. In fiscal 2021, utilisation was 50% amid extended local lockdowns because of the severity of Covid-19. In fiscal 2022, utilisation inched up to pre-pandemic levels of fiscal 2020 at ~55%, led by smart recovery in demand and modest capacity additions. Enhanced demand from the infrastructure and housing sectors and moderate capacity additions propelled utilisation to improve to ~59% in fiscal 2023. In fiscal 2024, the region breached the 60% mark for the first time in a decade as demand growth accelerated.The region is expected to continue to witness low-capacity utilisation compared with other regions. Utilisation rates are projected to remain at almost similar levels in fiscal 2025 and rise to 64-66% level over fiscal 2029 from now owing to healthy demand but limited by higher capacity additions in the region.

Demand-supply and utilisation



Source: CRISIL MI&A Research, Industry
Note: Capacity utilisation is calculated on effective capacity – based on the date of commissioning of the plant; capacity utilisation is calculated as production in the region divided by effective capacity and does not take into consideration inter-regional movement

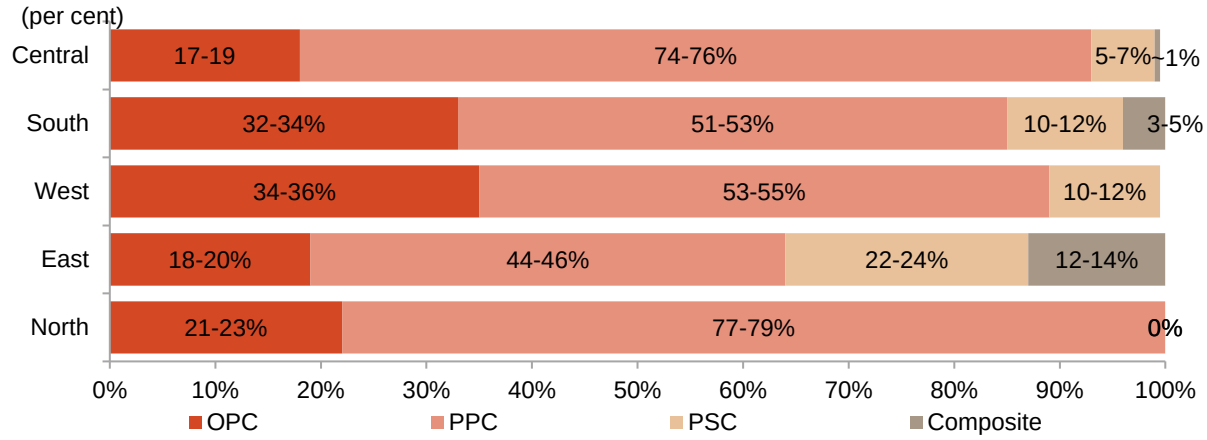
Summary of demand growth amid regional divergence

	FY 2022	FY 2023	FY 2024	FY 2025 P	FY25-FY29P
PAN-INDIA	8%	12%	11%	7-8%	6.5-7.5%
NORTH	12%	9%	12%	7-8%	6-7%
SOUTH	14%	13%	12.5%	7-8%	6-7%
EAST	1%	14%	9%	7.5-8.5%	8-9%
WEST	9%	10%	13%	6.5-7.5%	5.5-6.5%
CENTRAL	8%	12%	12%	6.5-7.5%	7-8%
NORTH EAST	7.5%	16.5%	10.5%	7-8%	7.5-8.5%

Source: CRISIL MI&A Research, Industry

6.4 Regional product split

Region-wise share of different types of cement (FY24):

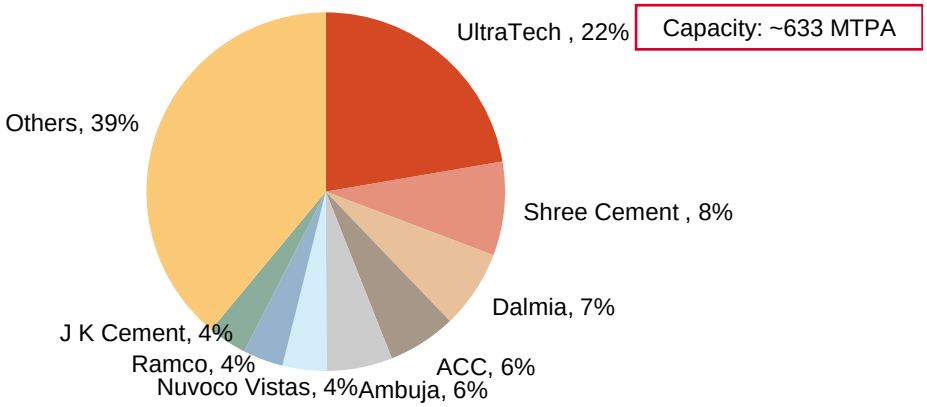


Source: CRISIL MI&A Research, Industry

Usage of OPC cement is the highest in the west and south followed by north. Being dominated by the infrastructure segment, share of OPC cement in the west is estimated to be 34-36%. However, due to the lack of availability of slag cement, share of PSC cement is lower, while that of composite cement is negligible. A similar trend is observed in the south. Only a minimal amount of composite cement is used in the housing segment. OPC and PPC cement are predominantly used in the north, owing to the dominant infrastructure segment, coupled with limited availability of slag cement in the region. On the other hand, the share of OPC is relatively lower in the eastern and central regions as the housing segment holds a significant proportion in the overall demand segments. Additionally, with the presence of steel plants in the eastern belt, slag cement is available in abundance, leading to the highest share of PSC and composite cement. The strong demand for OPC in South and West regions is also positive factor for GGBS demand as it is mixed with OPC while making concrete

6.5 Region-wise market share split of top players in terms of capacity

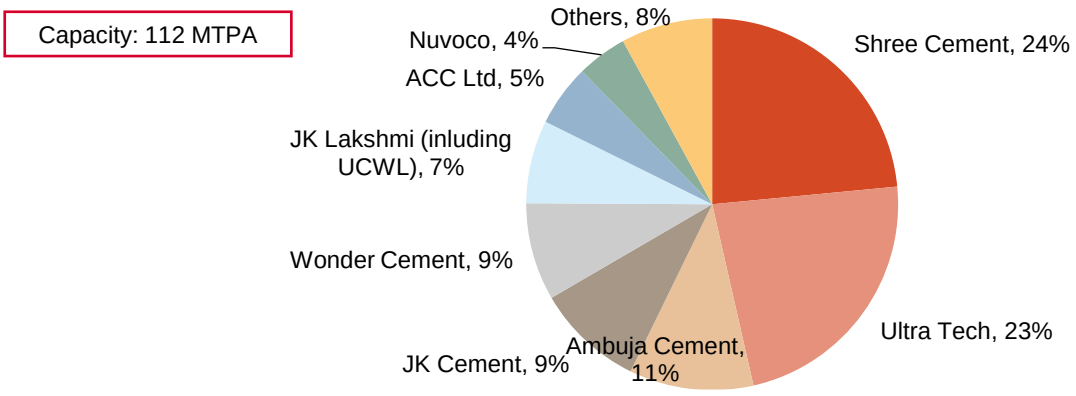
India – Player-wise capacity split, fiscal 2024



Note: Other at all India level includes more than 50 players

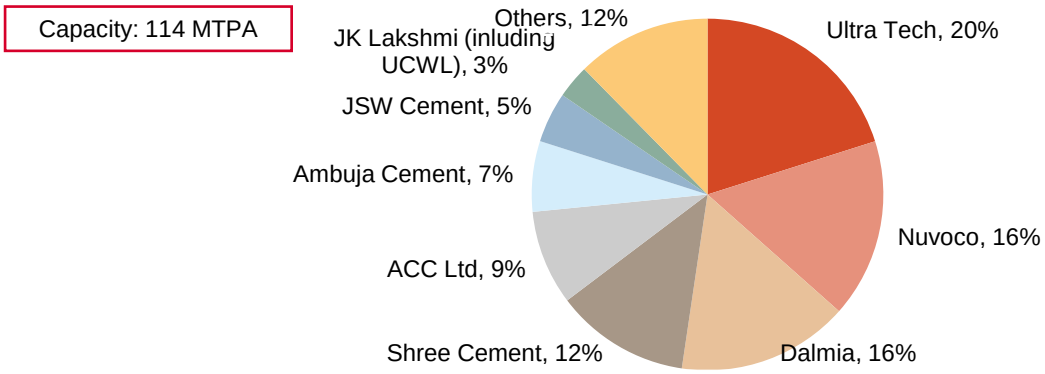
Source: CRISIL MI&A Research

North – Player-wise capacity split, fiscal 2023



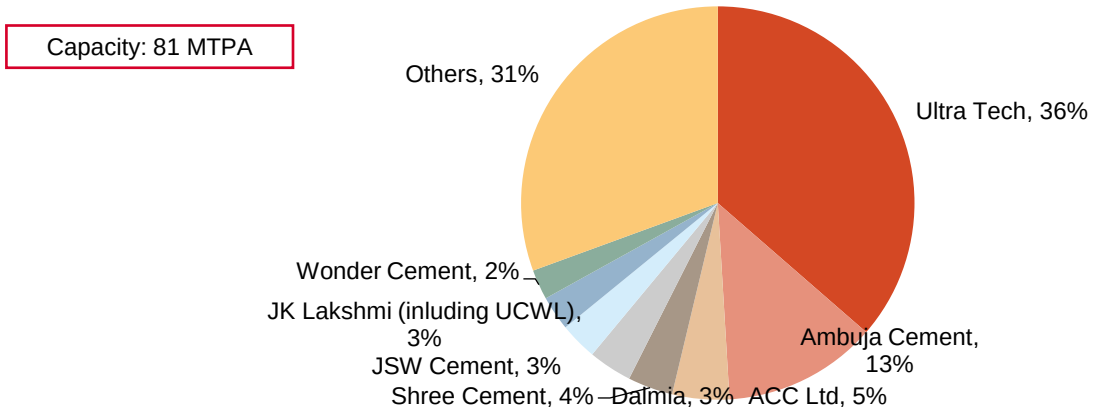
Note: North region includes 7 players; North includes Rajasthan, Uttarakhand, Delhi, Haryana, Himachal Pradesh, Jammu & Kashmir and Punjab
Source: CRISIL MI&A Research

East – Player-wise capacity split, fiscal 2023



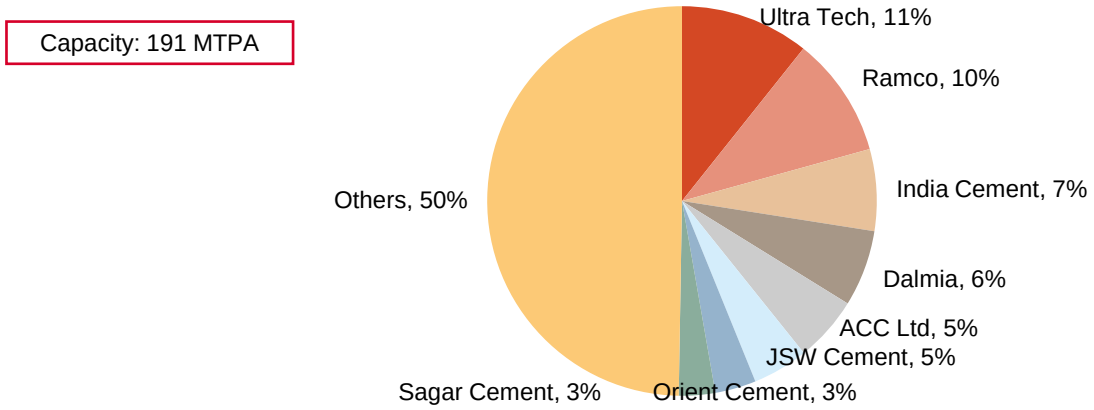
Note: East region includes 15 players; East- Chhattisgarh, West Bengal, Bihar, Jharkhand, Odisha, Meghalaya, Assam, Arunachal Pradesh, Sikkim, Mizoram, Nagaland, Tripura and Manipur
Source: CRISIL MI&A Research

West – Player-wise capacity split, fiscal 2023



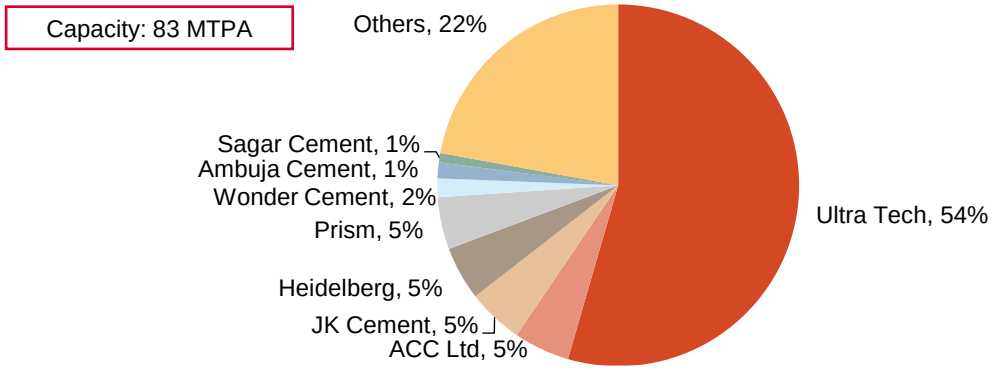
Note: West Region Includes 10 players; West- Maharashtra, Gujarat and Goa
Source: CRISIL MI&A Research

South – Player-wise capacity split, fiscal 2023



Note: South region includes more than 25 players; South- Andhra Pradesh, Karnataka, Kerala, Tamil Nadu, Andaman and Nicobar Islands, and Pondicherry
Source: CRISIL MI&A Research

Central – Player-wise capacity split, fiscal 2023



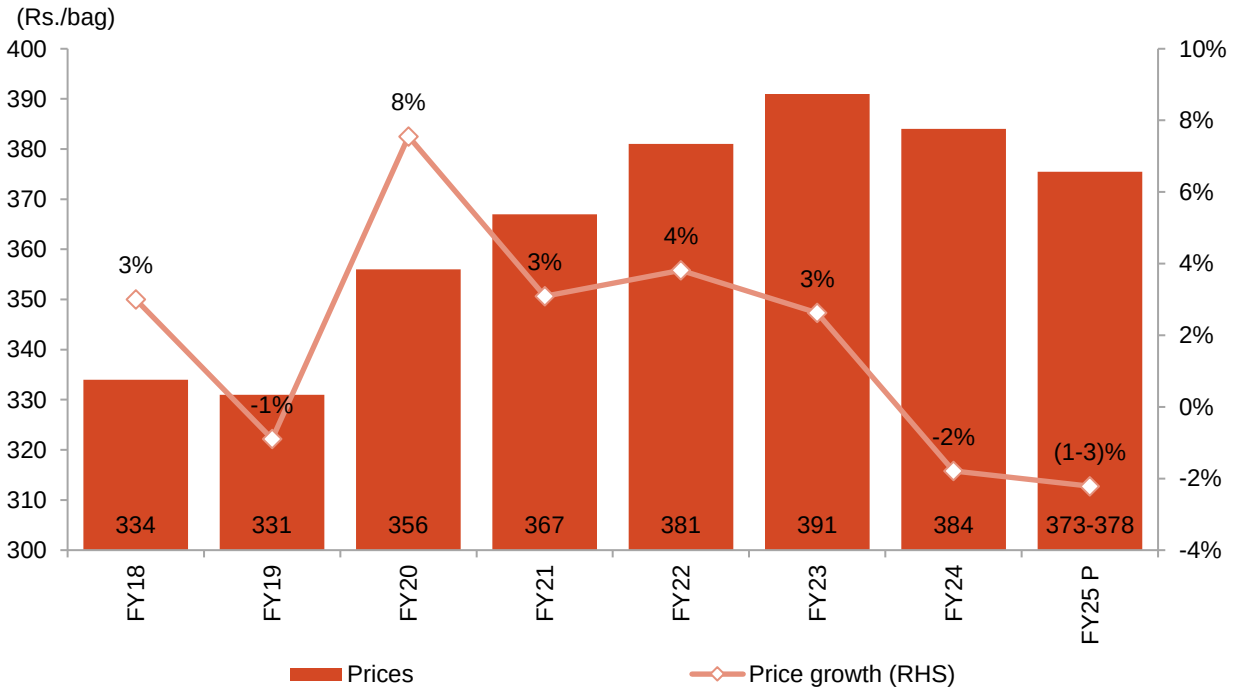
Note: Central region includes 8 players; Central- Uttar Pradesh and Madhya Pradesh
Source: CRISIL MI&A Research

7 Pricing, cost and profitability trend

7.1 All-India and regional pricing trends (historical and outlook)

Cement prices rose ~3% on-year in fiscal 2023 to Rs 391 per 50 kg bag, as players tried to cushion profitability amidst high-cost pressures. Further, as crude and coal prices started witnessing correction, cost pressures declined for industry players. Power and fuel cost that had skyrocketed began to decline in line with a fall in crude and coal prices during the first half of fiscal 2024. Costs continued to follow the downward trend and eased further. As a result, despite strong demand momentum, players were unable to implement hikes in order to capture a larger market share amidst rising competition. Hence, on a consecutive healthy base, prices declined 2% during fiscal 2024 at Rs 384 per 50 kg bag.

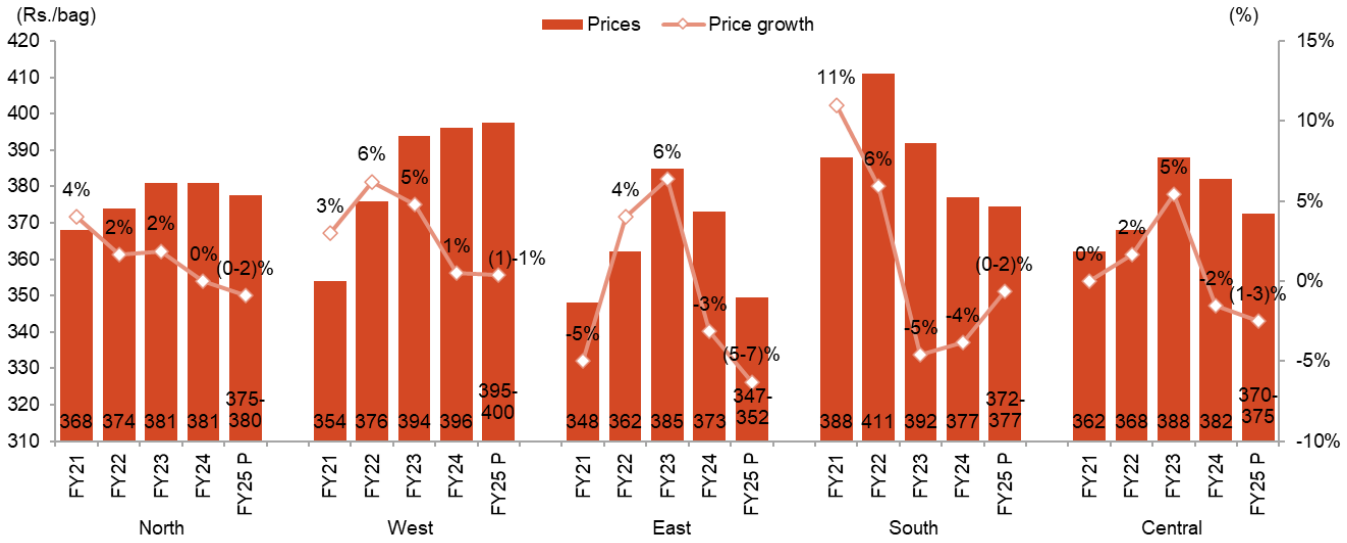
Pan-India trend in cement prices



Note: P- Projected; Cement prices are average of retail selling price (RSP) for category A players
Source: Industry, CRISIL MI&A Research

Going forward, in fiscal 2025, CRISIL MI&A Research expects cement prices to decline further 1-3% at Rs 373-378 per bag. This fall is expected on the back of moderation in demand growth and elevated competitive intensity.

Region-wise trend in cement prices



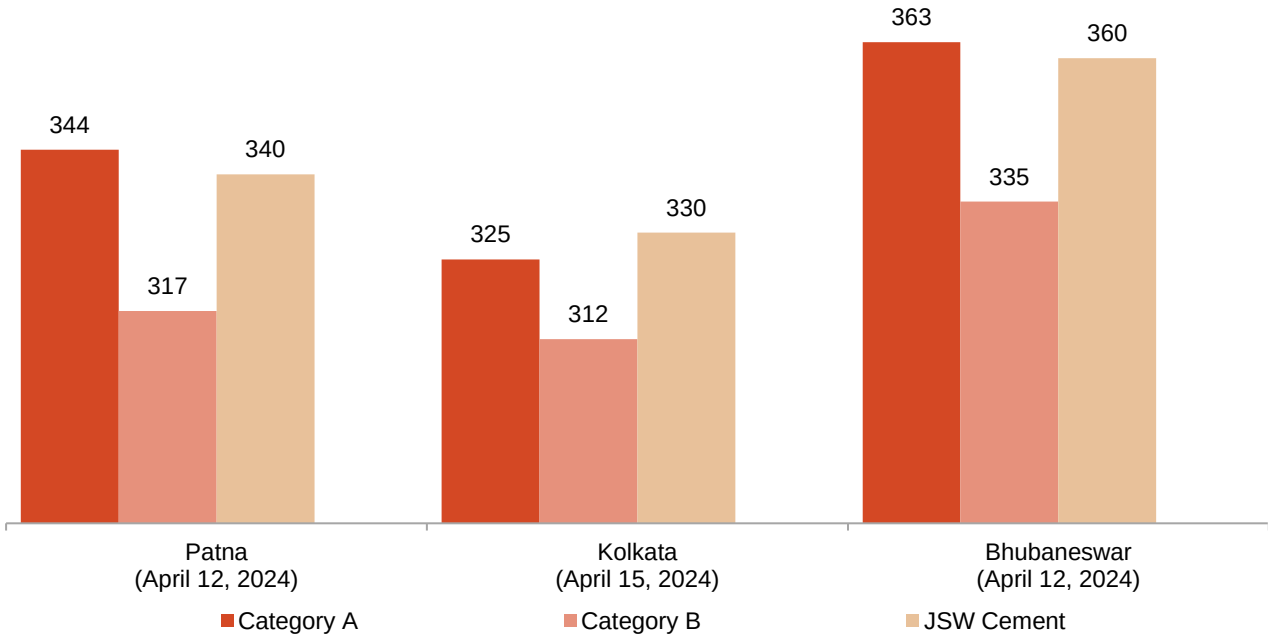
Note: P- Projected; cement prices are average of retail selling price (RSP) for category A players
Source: Industry, CRISIL MI&A Research

7.2 Comparison of JSW Cement prices with benchmark prices for Cat A and Cat B across four major cities in each region

The charts below show a comparison of the RSP (retail selling prices) of A category brands, B category brands and JSW Cement in the east, west and south markets. The categories are based on the prices of the brands in the respective regions. A category brands are 2-4 brands with the highest prices in a particular city. B category brands fall under next range of prices which is lower than A category brands' prices. The brands across the categories may vary per city. The categorisation is not based on the sales volume of the brands but only on the selling prices in the respective cities. RSP are sales prices for sales of 10-25 bags from the retail counter and are ex-counter prices. The prices are date-stamped in nature.

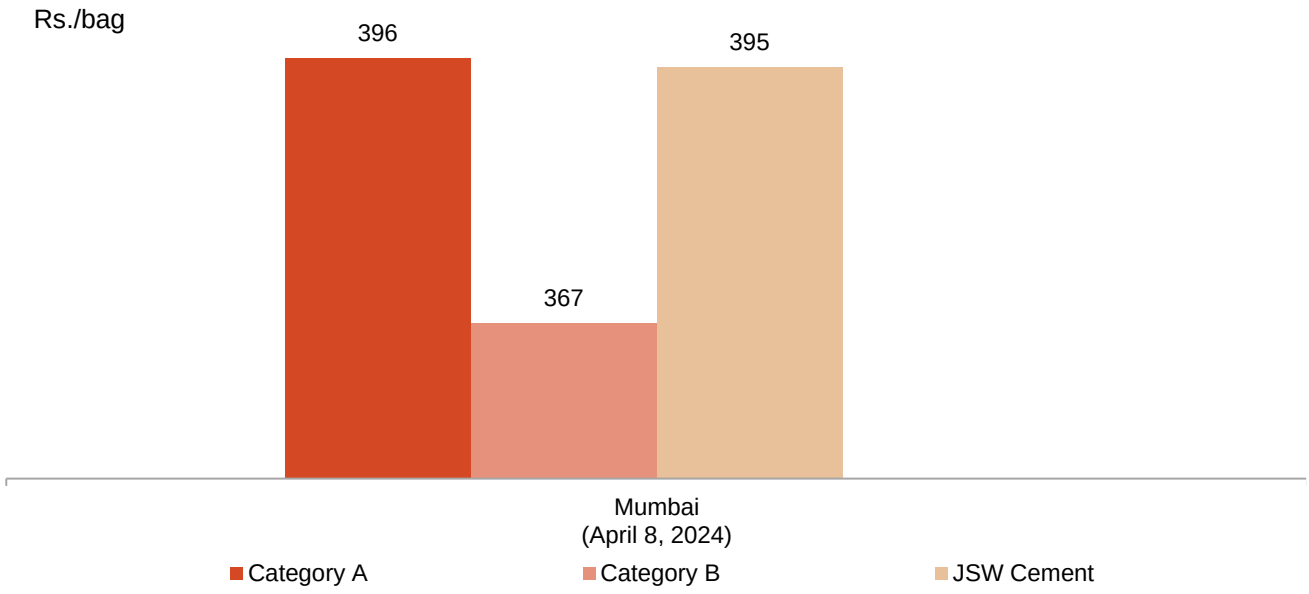
As on the dates mentioned in the following graphs, in the trade channel, JSW Cement is priced at par with other A category brands in all of the below mentioned regions.

RSP prices: East region



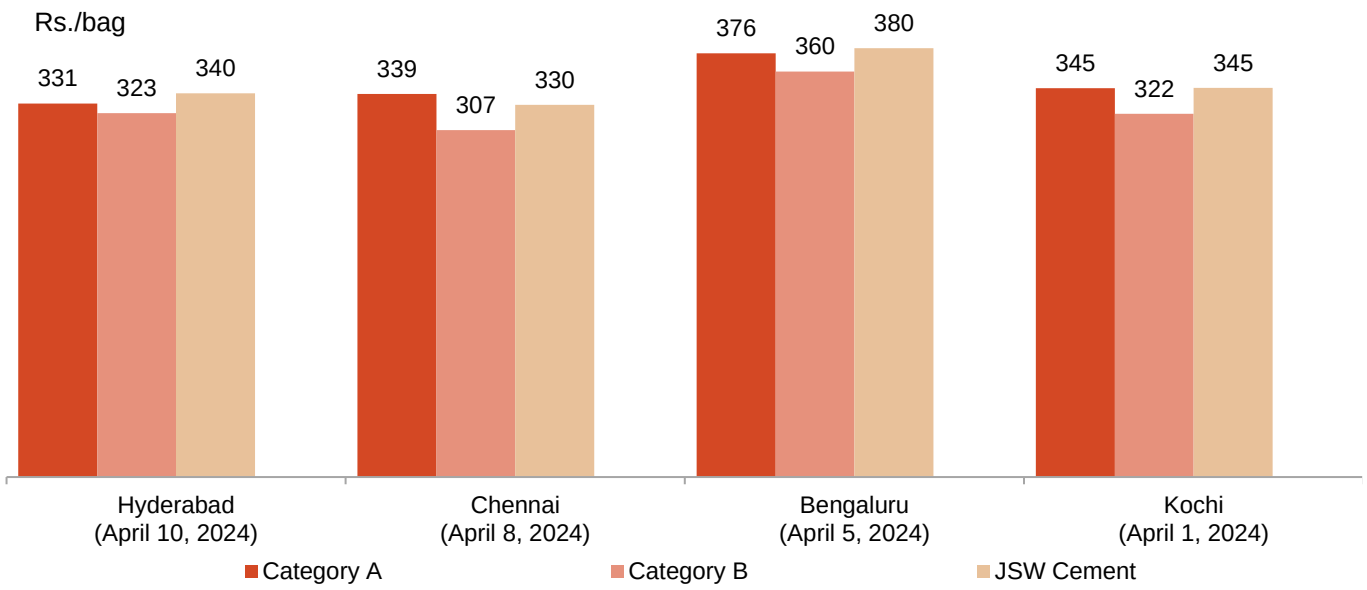
Source: Industry, JSW Cement, CRISIL MI&A Research
Note: JSW Cement prices as provided by the company

RSP prices: West region



Source: Industry, JSW Cement, CRISIL MI&A Research
Note: JSW Cement prices as provided by the company

RSP prices: South region

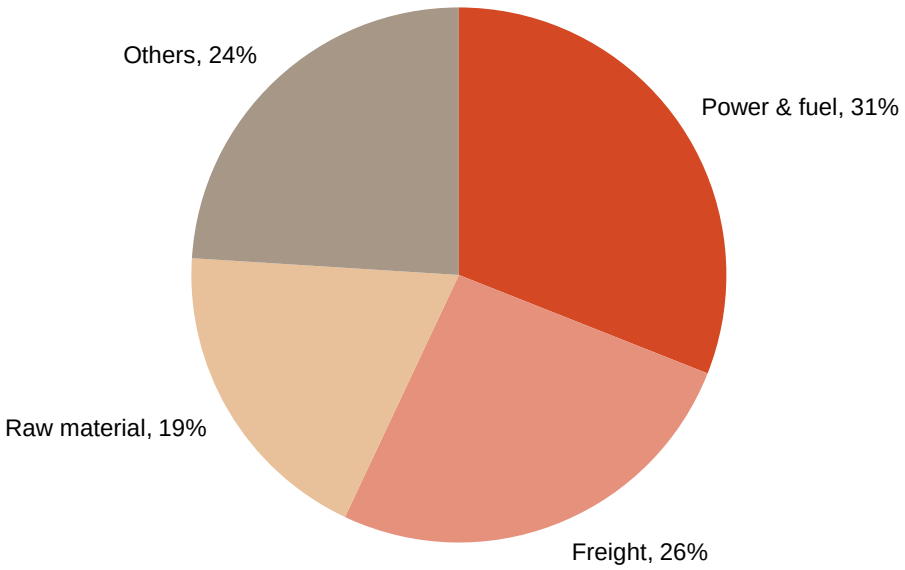


Note: For Hyderabad, category A brands do not include category A-premium brands which are amongst the fastest selling brands in the city
Source: Industry, JSW Cement, CRISIL MI&A Research
Note: JSW Cement prices as provided by the company

7.3 Cost break-up of cement industry

The cement industry is power-intensive with the power requirement of cement plants varying in accordance with the heat treatment process used. Most of the raw material cost (which accounts for a large component of the cement production cost), is incurred in procuring limestone. As cement is a low-value, high-volume commodity, transporting it also involves significant cost.

Major costs associated with cement production



Source: CRISIL MI&A Research, industry

7.3.1 Power and fuel

The cement industry is power-intensive, with power and fuel cost accounting for 30-32% of the total cost of sales of cement players. Coal is used to fire the kiln as well as to generate power for grinding the clinker. The power requirement of cement plants varies according to the heat-treatment process, i.e., dry process or wet process. While the wet process requires 1,300-1,600 kcal/MT of clinker and 110-115 kWh of power to manufacture one tonne of OPC, the dry process requires 720-800 kcal/MT of clinker and 95-110 kWh of power for one tonne of OPC. Specific fuel consumption and power consumption are lower for blended cement, such as OPC and PPC. Cement companies are increasingly opting for captive power plants to reduce their cost of production and dependence on grid power.

The Indian cement industry primarily uses fuels such as coal, pet coke and lignite to fulfil its fuel requirement. The government allocates specific quotas for coal on a sector-wise basis. However, such receipts prove insufficient for the cement industry, leading the players to go to the open market for incremental fuel requirements. In India, coal is primarily allocated to power and steel sectors; the cement industry only gets 3-4% of the country's total coal production. Therefore, in the past few years, players have been importing a significant proportion of their coal requirement from other countries. To benefit from the lower cost of petcoke, major cement players have made adjustments in their kilns and CPPs in recent years to handle petcoke, providing them fuel flexibility.

7.3.2 Raw material

Raw material cost accounted for 18-20% of the cost of sales of cement players for the first three quarters of fiscal 2024. Limestone constitutes a major share of this cost. Cement plants are generally located near

limestone quarries, as limestone cannot be transported economically over long distances. Limestone availability is largely confined to its cluster regions. Moreover, limestone is considerably bulky in nature. So, it does not make economic sense to transport it over long distances.

Other raw materials used in the cement industry include fly ash, slag and gypsum. Gypsum is available as a natural product and is also derived from sea water and chemical plants. It is mostly found in Rajasthan (which accounts for more than 80%), followed by Jammu & Kashmir (which accounts for ~15%). A small portion of 5% is found in states such as Tamil Nadu, Gujarat, Himachal Pradesh, Karnataka, Uttarakhand, Andhra Pradesh and Madhya Pradesh. Gypsum from Rajasthan is dispatched to cement plants in India, spread across Rajasthan, Gujarat, Madhya Pradesh, West Bengal, Uttar Pradesh, Bihar, Jharkhand, Chhattisgarh and Himachal Pradesh. In terms of proportion, gypsum accounts for 4-5% of a tonne of cement.

Fly ash is a fine, glass-like powder recovered from gases created by coal-fired electric power generation. It primarily consists of silica, alumina and iron. According to the Bureau of Indian Standards, for PPC, fly ash can account for 15-35% of the cement mass, while the BIS standard for slag cement (Portland blast furnace slag cement) allows slag to comprise 25-70% of the cement mass. Slag is a by-product of the steel-making process, produced during the separation of molten steel from impurities in steel-making furnaces and, like fly ash, is used as an additive in cement manufacturing.

However, unlike fly ash, the availability of slag in India is limited and is found mostly in the east, due to the concentration of steel plants in the region. The availability of raw materials is subject to supply disruptions and price volatility caused by various factors, including commodity market fluctuations, freight rates or changes in government policies.

7.3.3 Freight

As cement is a low-value, high-volume commodity, freight costs constitute a significant proportion at 25-27% of the total cost of sales.

There are three major modes of transport used by the cement industry: road, rail and sea. Rail is the preferred mode of transport for long-distance transportation due to lower freight cost. However, the availability of wagons and the extent of last-mile connectivity need to be taken into consideration. Road transportation is beneficial for short distances and bulk transportation, as it minimises secondary handling and secondary freight costs.

Currently, road is the most preferred mode, accounting for ~60% of the cement transported despite higher costs owing to pan-India availability and relatively lower costs involved in handling. Transportation by sea is the cheapest mode. However, only coastal players can take advantage of this mode, as they can transport clinker and cement more economically within the country and to other regions as well. Hence, a very small proportion of cement is transported by the sea route. In order to control freight costs, companies try to strategically locate plants close to raw material sources and end-user segments by opting for split location units.

7.3.4 Other costs

Other costs include employee cost, packaging cost, administration expenses, and repair and maintenance charges. These account for 23-25% of the cost of sales. Other expenses have increased over the past 3-4 years, led by rising marketing expenses amid stiff competition.

7.4 Trend in coal and pet coke pricing

7.4.1 Domestic coal

In India, the Coal India Ltd (CIL) accounts for more than ~82% of domestic coal production and is the primary supplier of fuel. CIL sells coal through long-term fuel-supply agreements (FSAs) and e-auctions. The FSAs in the non-regulated sectors (sponge iron, steel, cement and captive power plants), which account for ~90% of the total sales volume are signed/renewed based on an auction (under the Shakti policy). On the other hand, under e-auctions, which account for the remaining 10% of the total sales volume, fuel is sold on the spot at global market-aligned prices. E-auction sales are typically at a premium to the coal sold under the FSA mechanism.

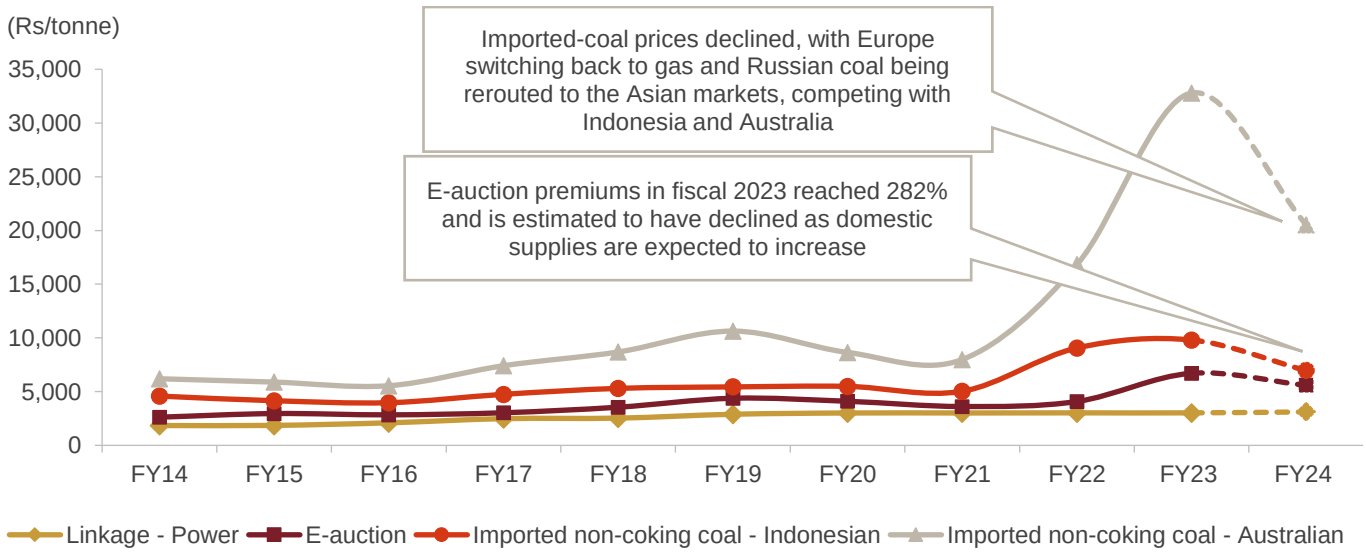
The notified coal price is primarily based on a cost-plus model and undergoes revision on an ad-hoc basis by CIL. The price revision depends on factors such as employee cost and that of consumables, such as fuel and explosives. Among various costs, the employee expense accounts for more than half of CIL's total operating cost, becoming a key determinant for the revision in coal prices. The government-owned miner also considers the demand-supply scenario, imported coal prices and cost of production from new projects for price revision. Subsequently, the price hikes are undertaken to maintain CIL’s profitability.

CRISIL MI&A Research estimates the following changes in domestic coal prices:

1) **Linkage prices**: CIL announced an 8% increase in the notified prices effective from May 2023. With this revision, the notified price for the lowest and highest grades, i.e., G10 and G2, will amount to Rs 1,117 and Rs 3,562, respectively. Additionally, the landed cost is estimated to stand at Rs 3,205 for G10 and Rs 6,132 for G2, taking into consideration the various costs such as royalty, sand-filling reclamation, clean environment duty, excise and GST. The price has been revised for grades G2 to G10, which are mainly used in the cement, fertiliser and sponge iron industries. In India, thermal power plants mostly rely on grades G11, G12 and G13 with calorific values between 3,400 kcal and 4,300 kcal. The impact of the price revision would be limited to plants that use higher grade of domestic coal for blending. The cement sector, which uses non-coking coal with calorific values between 4,000 kcal and 4,500 kcal will see a minimal impact as domestic coal accounts for only 15-20% of the fuel mix in terms of quantity, with the rest being pet coke and imported coal. While power and fuel costs account for 34-36% of the total industry cost, higher competitive intensity and declining input materials costs of pet coke and imported coal price have led to subdued cement prices in fiscal 2024.
2) **Auction of linkages**: The price of coal sold under auctions to the non-power sectors, such as cement, under long-term linkages (~30% higher than the price applicable for the power sector) is typically at a discounted price to imported coal. This gives companies with CIL linkages a competitive edge. Aiming for market-determined pricing, the Ministry of Coal introduced a new mechanism in the linkage policy for the non-power sectors in December 2019. This system stipulates that the existing linkages of non-power companies will not be renewed, while new ones will only be awarded through auctions, wherein players bid at a premium over the notified price. So far, CIL has conducted four tranches of linkage auctions for non-power sectors, with average premiums over the notified price increasing consecutively.

3) **Spot auctions**: Periodically, coal companies also sell through spot auctions for power and non-power sectors. Demand for spot-auctioned coal from non-power sectors increased, owing to the diversion of linkage coal to the power sector following coal shortage amid rising demand in the power sector. In fiscal 2023, CIL sold 53.3 million tonne of coal through spot e-auction at a premium of 252%, with Mahanadi Coalfields Ltd (MCL) accounting for 32% of the quantity offered. Additionally, it received the highest premium of 366% amongst other CIL subsidiaries during the same period. Premium offered in the first half of fiscal 2024 (April-September 2023) was 89%, compared with 335% in the same period of fiscal 2023. High premiums for these e-auctions indicate the demand sentiment. Between April-November 2023, premiums received by the Eastern Coalfields Ltd and Central Coalfields Ltd were the highest at 114%, followed by MCL at 107%.

Domestic coal pricing estimated to have been stable under the linkage route with reduced e-auctions



Note: In the graph, linkage-power, linkage–non-power and e-auction categories relate to domestic non-coking coal prices which are run of the mine and not delivered cost.
Source: Ministry of Coal, CRISIL MI&A Research, Industry publication, CIL

7.4.2 International coal

International coal prices have been retreating from their highs in 2022, but remain well above the 2017-2021 average. Global coal consumption reached an all-time high in 2022, led by India and China. A broad-based pick-up in economic activity across major economies led to an increase in non-coking coal prices accompanied with supply disruptions over the short term. Further, the tense geopolitical situation increased uncertainty, impacting coal demand.

In the past two years, coal prices declined on-year for the first time in the fourth quarter of fiscal 2023 and further witnessed a decline of ~54% in the first quarter of fiscal 2024, as prices cooled down from all-time highs caused by geopolitical tensions and impositions of ban on imports. Prices also cooled down sequentially by ~25%. Despite a jump in demand for thermal coal in China, India and South Korea, Indonesian thermal coal was under pressure as European sellers continued to sell supplies to relieve

pressure on their multi-month high stockpiles. Also, high-grade coal from Australia was under pressure, due to greater exposure to competition from LNG in Japan, South Korea and Taiwan.

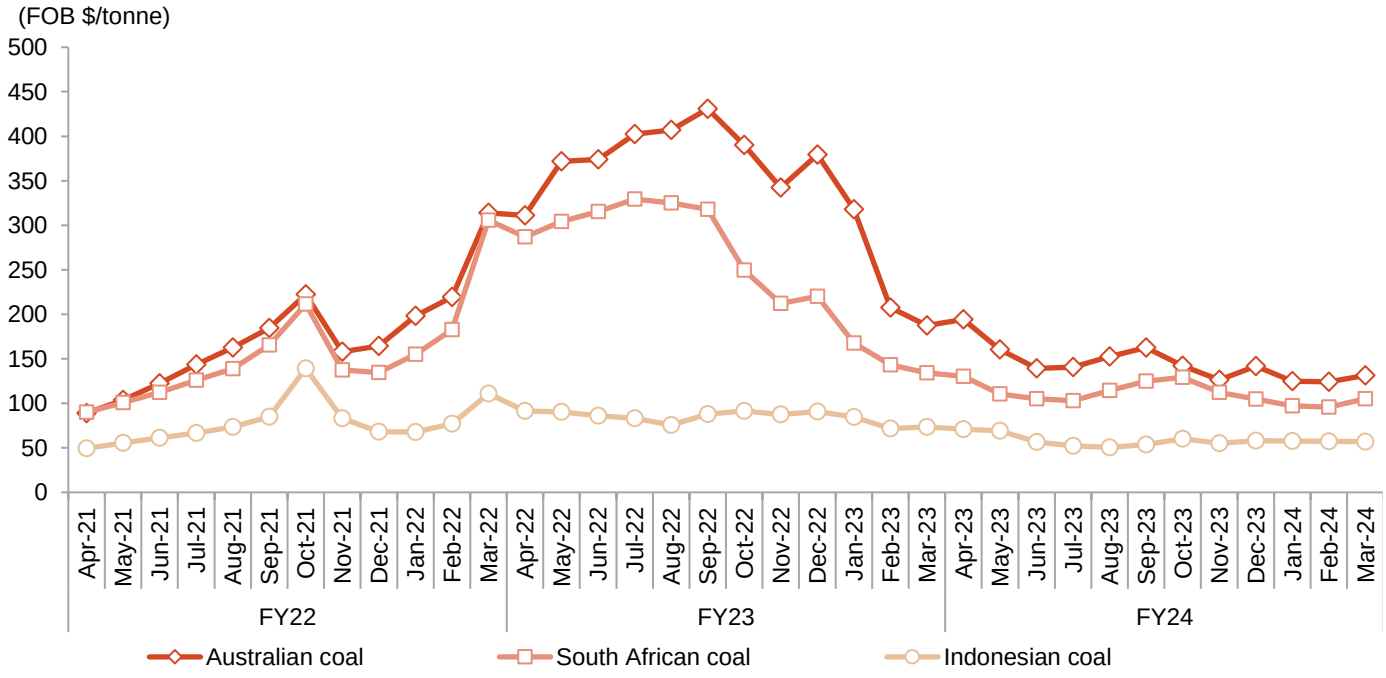
Coal prices declined further in the second quarter of fiscal 2024 by ~61% on-year and ~8% on-quarter. However, prices of Australian coal inched up in September 2023, due to fears of a supply crunch caused by threats of strike action by Australian LNG workers, which was resolved in late September. Robust demand from the Indian and Chinese power sectors contributed to on-month hike of Indonesian coal prices.

After cooling down for the past three quarters, coal prices declined further in the third quarter by ~55% on-year and ~3% on-quarter. However, prices of Australian coal inched up in December 2023, due to supply disruptions along with impact of tropical cyclone Jasper on major ports of Queensland. That being said, subdued demand from Indonesia's key export nations due to inventory build-up kept Indonesian coal prices under pressure during the quarter. Also, continuing logistical challenges have continued to hit South African thermal coal exports, leading to price decline during the quarter.

In the last quarter, coal prices tumbled further by ~39% on-year and by ~9% sequentially. Australian coal prices dwindled during the beginning of the quarter, as wet-weather challenges impacted Australian exports. Additionally, South African coal prices declined as well during January 2024, due to limited demand in Europe because of existing high inventory. However, prices have remained rangebound during the latter half of the quarter, as lower demand from India and China offset the supply constraints.

Overall, international coal prices (average of Australia, South Africa and Indonesia non-coking coal) cooled down ~54% on-year during full year fiscal 2024, indicating easing of energy costs.

Monthly coal price trend



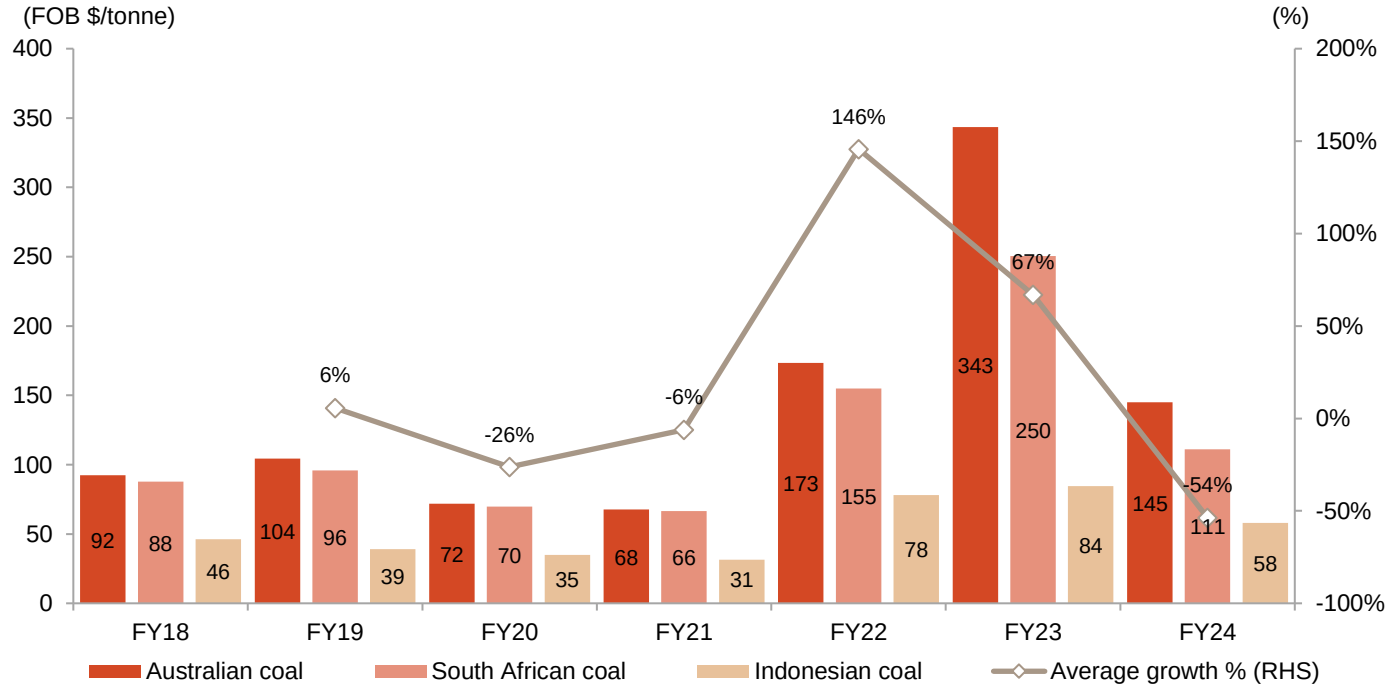
Source: CRISIL MI&A Research

CRISIL MI&A Research expects global non-coking coal prices of Australia (FoB Newcastle, 6,300 kcal/kg) to remain in the range of $130-135/MT, while Indonesian prices are expected to be at $54-58/MT for calendar year 2024, with the summary of some key factors driving our price forecasts below:

- First quarter of 2024: Subdued demand for heating requirement, due to milder temperatures in the key Australian markets of Taiwan, Japan and South Korea, as El Nino is expected to continue until April 2024. Indonesian prices are expected to be range between $56 per tonne and $58 per tonne during this period, as increasing domestic supply along with milder temperature will lead to lower thermal coal requirement. For India, increase in economic activity will be supported by domestic thermal coal supplies.
- Second quarter of 2024: Warmer temperatures are expected to increase power demand in Asian countries along with monsoon season in Australia, which usually leads to cases of mine flooding, thereby leading to supply-chain shocks.

Rising emission concerns in countries, such as the US and Canada, lack of adequate transport infrastructure in South Africa, and weather-related issues, such as the rainy season in Indonesia, are some risk factors, which remain key monitorables for the forecast.

Annual coal price trend



Source: CRISIL MI&A Research

7.4.3 Pet coke pricing

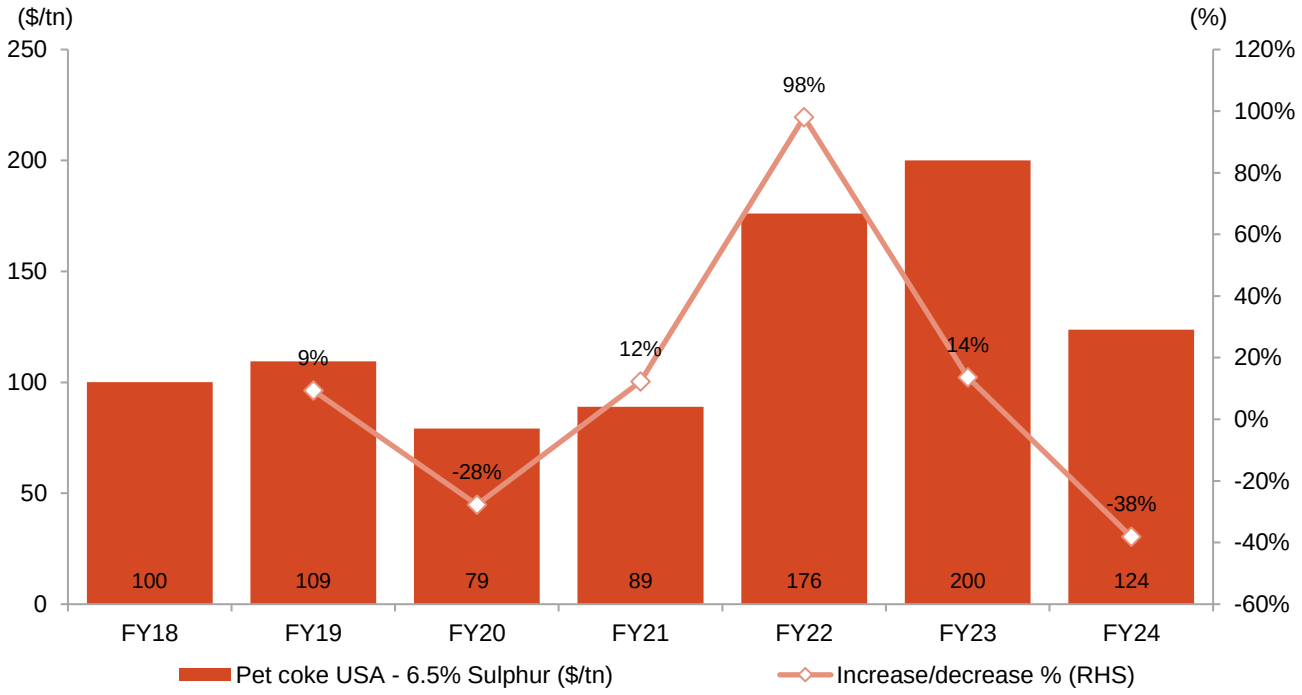
The cement industry is the key consumer of petcoke in India. While historically cement players have used more coal than petcoke due to better availability of domestic coal, players have shifted towards pet coke since fiscal 2016, as prices crashed globally. However, the cycle turned again in fiscal 2019, due to several regulatory changes aimed at cutting down industrial pollution.

Petcoke competes with coal as a feedstock in cement manufacturing. Cement plants generally use imported coal of 6,000 kilo calories (kcal) per tonne of calorific value, whereas petcoke has ~8,000 kcal per tonne value. While domestic coal is the first preference for cement manufacturers, its low availability leads to dependence on imports – coal or petcoke.

Usually the low-grade domestic coal (GCV between 4,000-4,600 kcal/kg) is used in captive power plants (CPP) and higher grades (above 5,500 kcal/kg) are used in clinker kilns. However, smaller captive power plants (<30MW) cannot use low-grade coal, due to poor ash-handling capabilities, further increasing the dependence on imported coal or petcoke. As cement players can use both petcoke and coal in modern kilns, without incurring much capex, switchover between the fuels is easy and depends on cost competitiveness. However, cement players in the eastern region with higher coal availability are expected to continue using coal, which is cost-competitive in comparison with domestic and imported petcoke. Further, several players have started blending biofuels, industrial waste and tar in their clinker to reduce costs and help in disposing waste material.

Pet coke prices increased sharply in fiscal 2022, because of a rise in crude prices led by geopolitical uncertainty. After staying elevated for the past two years, international pet coke prices started dwindling on-year since the second half of fiscal 2023 and declined a further ~47% in the first quarter of fiscal 2024, on a very high base of the previous fiscal, averaging at $128/tonne. International pet coke prices cooled down in line with the corrections in crude oil prices. Continuing the downward trend, international pet coke prices fell further on-year in the second quarter of fiscal 2024 by ~36% and also slid ~4% sequentially on a soft base to $122/tonne. In the third quarter, prices dropped ~30% on-year. However, prices rose ~6% sequentially, as crude oil prices started to rise moderately during the latter half of the second quarter and beginning of the third quarter, but stabilised at the end of the third quarter to $84/bbl. In the last quarter, with a marginal decline in crude oil prices, pet coke prices also dwindled on-year as well as sequentially by ~33% and ~11%, respectively. Overall, prices in fiscal 2024 averaged $124/tonne, indicating a sharp ~38% decline compared with the previous year.

Annual petcoke prices



Source: CRISIL MI&A Research

Pet coke (US) prices skyrocketed ~98% in fiscal 2022, despite a high base in fiscal 2021. Further, prices increased ~14% in fiscal 2023 compared with fiscal 2022, as prices soared during the first half of the fiscal but started easing during the second half. With the correction in crude oil prices, pet coke prices fell a sharp ~38% on-year during fiscal 2024.

Domestic pet coke (ex-refinery) prices follow the global trend in petcoke prices. Domestic pet coke prices rose ~80% in fiscal 2022 and a further ~32% on a high base in fiscal 2023, to average ~Rs 19,000 per tonne. Prices spiked in the first half of fiscal 2023 by ~62% on-year averaging to Rs 20,100 per tonne on the back of rising crude oil and international petcoke prices. However, prices plunged in the latter half of the fiscal to average Rs 17,900 per tonne. Prices moderated further by ~16% and ~11% on-quarter in the first and second quarters of fiscal 2024, respectively, averaging at ~Rs 14,800/tonne and Rs 13,100 per tonne, respectively. In the third quarter of fiscal 2024, domestic petcoke prices continued to decline on-year, but witnessed a moderate rise of ~6% on sequential basis on a soft base. In tandem with international petcoke prices, domestic pet coke prices witnessed correction in fiscal 2024 on the high base of two consecutive fiscals.

7.5 Trends in alternative fuel consumption

With India being the second largest cement producer in the world currently, the domestic cement industry is responsible for 7-9% of the country's carbon dioxide (CO_2) emissions. The substitution of expensive and CO_2-critical fossil fuels by alternative fuels (AF) is measured by the thermal substitution rate (TSR).

Cement plants are constantly looking for suitable and low-cost alternative fuels to bring down their fuel costs and reduce their CO_2 emissions. As of calendar year 2021, the share of alternative fuel in the domestic cement industry's fuel mix was estimated at 5-6%, according to the Cement Manufacturers' Association (CMA). The global benchmark was ~15% in 2020, as per the International Energy Agency (IEA).

The Indian government has set a target to increase the share of **alternative fuel use** by the cement industry **to 25%** by 2030 as part of its commitment to reducing carbon emissions and promoting sustainable development. The domestic cement industry is preparing its infrastructure, capacity and competence to enhance the TSR, including the installation of pre-processing platforms and adoption of newer technologies. The players are increasingly adopting alternative fuels, such as biomass, municipal solid waste and refuse-derived fuels, to reduce their dependence on fossil fuels and reduce their carbon footprint. Given below are some of the alternative fuels that can be used and usually available in gas, liquid and solid forms:

Category	Fuels
Gaseous fuels	Refinery waste gas, landfill gas, pyrolysis gas, natural gas
Liquid fuels	Tar, chemical wastes, distillation residues, waste solvents, used oils, wax suspensions, petrochemical waste, asphalt slurry, paint waste, oil sludge
Solid fuels	Paper waste, rubber residues, pulp sludge, sewage sludge, used tyres, battery cases, plastics residues, wood waste, domestic refuse, rice husks, refuse-derived fuel, nut shells, oil-bearing soils, diapers, etc

Use of alternative fuels in cement production offers the following benefits:

- **Lower greenhouse gas emissions**: The combustion of alternative fuels in cement kilns can significantly reduce greenhouse gas emissions. Fossil fuels, such as coal and petroleum coke have higher carbon content, leading to substantial CO_2 emissions. In contrast, alternative fuels often have lower carbon footprints, contributing to the overall reduction in CO_2 emission. By replacing a portion of fossil fuels with alternative fuels, cement kilns can help mitigate climate change and support global efforts towards carbon neutrality.
- **Cost savings**: Alternative fuels are often less expensive than conventional fossil fuels, which can help reduce operating costs for cement producers. In some cases, cement plants may even generate revenue by accepting and processing waste materials as fuel.
- **Increase in energy efficiency**: Many alternative fuels used in cement kilns possess high energy content. The kilns can harness this and reduce dependence on non-renewable energy sources. The efficient utilisation of alternative fuels not only contributes to energy conservation but also enhances the sustainability and competitiveness of the cement industry.
- **Waste management and resource conservation:** One of the primary benefits of using alternative fuels is the ability to utilise waste materials. Materials such as biomass, municipal solid waste and industrial by-products can be effectively repurposed as alternative fuels, reducing reliance on fossil fuels and facilitating a circular economy. By diverting waste from landfills and incineration, cement kilns offer a sustainable solution for waste management even as they help conserve valuable resources.

- **Air pollution reduction:** Alternative fuels emit lesser air pollutants than traditional fossil fuels. Combustion of alternative fuels in cement kilns reduces emissions of sulphur dioxide (SO_2), nitrogen oxides (NOx) and particulate matter. This will result in better air quality, providing a healthier environment for surrounding communities.

However, there are the following challenges, too:

- **Variable fuel quality**: Alternative fuels vary significantly in terms of composition and quality, which makes it difficult to maintain the operating conditions in the cement production process.
- **Refractory damage**: Some alternative fuels, such as waste plastics and biomass, can release alkalis, sulphur and chlorides when burned, which can damage the refractory linings in the kiln and pre-heater.
- **Permitting and regulatory requirements**: Cement plants must comply with permitting and regulatory requirements when using alternative fuels. This can be a complex and time-consuming process.
- **Local resistance**: In India, there is often local resistance to cement plants burning plastics, cloth and rubber in their alternative fuel mixes.

Despite these challenges, the use of alternative fuels in cement production is expected to continue to grow in the coming years. As cement producers seek to improve the sustainability of their operations, alternative fuels will play an increasingly important role in meeting these goals. The Reserve Bank of India has recommended the cement industry should be provided incentives to procure stubble from farmers of the northern states of Punjab, Haryana, Uttar Pradesh and Rajasthan, which can be used as biomass fuel. This will help reduce the industry's carbon emissions and lower its fuel costs.

Trend in TSR (%) of key players:

	FY19	FY20	FY21	FY22	FY23	FY24
ACC*	5.50%	6.90%	7.30%	-	9.20%	9.15%
Ambuja*	5.40%	4.20%	5.10%	-	6.30%	7.76%
UltraTech	3.90%	3.70%	3.10%	4.60%	5.20%	5.12%
Dalmia	4.30%	7.70%	7.60%	13.00%	17.00%	-
Shree	NA	NA	0.98%	2.40%	3.50%	2.37%
Nuvoco	4.60%	6.40%	4.70%	4.50%	9.00%	-
JSW Cement (India)	-	8.26%	4.23%	7.10%	8.14%	6.89%

Note: ACC and Ambuja followed calendar year reporting until 2021; fiscal 2023 data is from January 2022 to March 2023
Source: Company reports and publications

7.6 Trends in waste heat recovery systems (WHRS)

Hot gasses produced during cement manufacturing can be considered a potential option to improve energy efficiency of the cement manufacturing units. Large quantities of hot flue gases are generated from boilers, kilns, ovens and furnaces. If some of this waste heat could be recovered, a considerable amount of primary

fuel could be saved. Waste heat recovery means allowing the waste heat to leave the process but converting it into electricity before it is discharged at a lower temperature into the environment.

In the waste heat recovery system (WHRS), waste heat available in the exhaust gases could be recovered and used for drying the moisture in the raw material and coal, or to generate power. To generate power, the hot gases from the preheater and cooler are passed through the waste heat recovery boiler (WHRB). Water is circulated through the WHRB. Latent heat from the hot gas is transferred to the water and converted to steam. The steam is expanded in the turbine and then condensed, and the condensed water is passed through the WHRB and the process repeats. The electricity generated would offset a portion of the purchased electricity, thereby reducing the electricity demand.

Cement players have been serious investors in WHRSs with the objective of channelising released energy into the system and saving on power costs. Large-scale players have considerable amount of installed WHRS capacity to meet their energy demands.

WHRS capacity of large-scale players (as of March 2023)

Players	WHRS capacity (MW)
Ultratech Cement	210
Shree Cement	211
Nuvoco Vistas Corporation (consolidated)	45
ACC Ltd	22.4
Ambuja Cements	53.5
JK Lakshmi (consolidated)	36
JK Cement (grey cement)	42.3
Birla Corporation	43.4
Dalmia Bharat	66
JSW Cement	21.2

Source: Company annual reports, CRISIL Research

7.7 Trends in renewable power usage

Coal-fired power plants have dominated the Indian power generation landscape, with large manufacturing industries also relying on coal-based captive power plants. However, of late, manufacturers have been shifting to clean energy sources, especially wind and solar, on the back of falling capital cost for setting up renewable capacities and sharpening focus on lowering carbon emissions.

Also, coal-based capacity additions, which stood at ~89 GW over fiscals 2013 to 2017, resulted in significant capacity build-up, particularly in the private sector. Consequently, falling plant load factors owing to unutilised capacities and rising debt because of under construction and stuck projects impacted capacity additions of power generation companies (gencos). Therefore, incremental coal-based additions plunged over the past few years.

Over fiscals 2023 to 2027, conventional power capacity additions are expected to continue to fall to 32-33 GW from ~34 GW between fiscals 2018 and 2022. Lower power demand and the government's focus on increasing the share of renewables in the country's energy mix are likely to prod gencos to go slow on new conventional capacity addition plans over the subsequent years as well. Also, fresh project announcements are limited, as players are opting for the inorganic route for expansion given the availability of assets at reasonable valuations — ~24 GW of stressed power assets are awaiting debt resolution.

Still, the inherent flexibility of coal-based capacities to quickly scale up or down generation to meet variations in demand will support capacity additions in the medium term; renewable generation does not have this flexibility. Coal capacity additions, though, are expected to be driven entirely by central and state companies, as major private gencos, such as Tata Power Company and JSW Energy, have announced ambitious targets to add renewable energy capacities, signalling a decisive shift.

In fact, renewable energy capacity addition has grown rapidly over a low base, with the total installed base reaching ~905 MW in fiscal 2023 from ~290 MW in 2017. Most of the additions were, however, in the solar space, with wind providing support as well.

Cement players have been employing the same strategy. Most large and mid-sized players have been investing heavily in renewable capacities not only to limit carbon emissions but also to lower the cost of energy. The top 15 cement players in India, accounting for close to 80% of total grinding capacity, have added close to 600 MW of renewable capacities over the past decade, along with considerable investment in WHRS. And several players, such as UltraTech Cement, have set a target to completely shift to renewable energy by 2050.

7.8 Trends in Profitability

Fiscal 2021-22: Margins contracted by ~457 bps in fiscal 2022 on back of rising power, fuel and freight costs. The cement industry is power-intensive, with power, fuel and freight cost accounting for 50-55% of the total cost of sales of cement players as of fiscal 2022. After providing some breather over FY19 and FY20, power and fuel & freight costs witnessed a sharp rise since the second half of fiscal 2021 on the back of rising coal, pet coke and diesel prices. Power, fuel and freight cost skyrocketed by 36-37% and 6-9%, respectively, in fiscal 2022, driving cost upwards. Raw material cost only saw moderate rise in fiscal 2022 as players benefitted from the removal of limestone mine transfer charges as per the MMDR Amendment Bill, 2021. Overall, the cost of sales increased by 11-13%, led by power/fuel and freight costs, which led to margin contraction of ~457 bps in fiscal 2022 driving margins to 20% levels; higher realisation on the back of cement prices rising by ~4.5% in fiscal 2022 on an already high base limited any further erosion in margins.

Fiscal 2022-23: The cement industry's margins further contracted in fiscals 2023, deteriorating by ~623 bps, majorly on the back of elevated power and fuel costs, which rose by 31-33% after rising by 36-37% in fiscal 2022. In early 2022, prices of petcoke and coal, both shot up due to supply constraints caused by Russia Ukraine conflict and remained elevated on-year basis despite some corrections. Coal prices also remained sticky on back of various reasons: 1) Supply constraints 2) Weather disruptions in key mining areas 3) strong demand from Japan, Taiwan, European countries. Hence, power and fuel rose by 31-33% in fiscal 23, driving costs upwards. Raw material cost, accounting for ~18% of total cost, saw 10-

12% escalation on back of higher slag prices, higher limestone costs due to rising share of newer mines as well as mining cost and higher inward freight costs led by higher diesel prices. Consequently, total cost rose by 13-14% leading to margin contraction of ~623 bps, thus reaching to ~14% margin levels in fiscal 2023 from a high of ~25% in fiscal 2021. Pick-up in realisations and healthy uptick in volume cushioned a sharper shrinkage in margins in the fiscal.

Annual profitability trend (Cost & margin as % of revenue)

	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25F
Raw material cost	12.77%	13.62%	13.67%	14.46%	16.40%	17.78%
Power & Fuel cost	19.89%	18.23%	23.54%	29.66%	24.89%	22.61%
Freight cost	22.42%	22.20%	22.61%	22.23%	22.15%	22.31%
Other Cost	23.35%	20.99%	19.79%	19.50%	19.01%	18.45%
Margins	21.6%	25.0%	20.4%	14.2%	17.6%	18-20%

Source: CRISIL MI&A Research, industry

Fiscal 2023-24: Margins expanded by ~340 bps to ~17.6% in fiscal 2024. A large part of this was because of decline in energy prices in line with softening of crude oil prices. As a result, power & fuel cost fell by 16-18% after skyrocketing in previous fiscal. Steady diesel price coupled with higher volume growth led to decline in freight cost by 1-3%. Other costs also moderated in line with lower packaging costs (led by declining crude oil prices). However, raw material cost jumped by 11-13% during the year as fly ash and slag prices continued to climb northward on account of blended cement demand acceleration and inflation. Overall, the cost of sales reduced by 4-6% in the fiscal, largely on account of lower power and fuel costs and freight costs.

Fiscal 2024-25 P: After rebounding in fiscal 2024, the operating margin of cement players is expected to further improve and expand in fiscal 2025 by 100-150 bps at an 18-20% margin. Despite lower realisations, margins are expected to improve largely due to a further 10-12% drop in power and fuel costs amid softening of petcoke and coal prices. Freight expenses are expected to marginally inch down by 1-3% on account of the reduction in lead distances of players due to aggressive expansions. On the other hand, despite rising continuously for the past three years, raw material costs are expected to further rise in fiscal 2025 due to higher limestone costs and elevated flyash and slag prices. At an overall level, the total cost of sales is expected to dwindle by 2-4%, leading to margin expansion of 100-150 bps this fiscal.

However, impact of geopolitical issues and/or supply constraints on commodity costs will remain key monitorable.

Annual profitability trend

	FY22	FY23	FY24	FY25P
Net realisations	5.5-6.5%	4-6%	(1-2)%	(1-3)%
	Rs 267/bag	Rs 281/bag	Rs 277/bag	Rs 270-275/bag
Power & fuel costs	36-37%	31-33%	(16-18)%	(10-12)%
Raw material	3-4%	10-12%	11-13%	6-8%
Freight expenses	6-8%	2.5-3.5%	(1-3)%	(1-3)%
Cost of sales	11-13%	13-14%	(4-6)%	(2-4)%
Operating margin	~457 bps	~(623)bps	~340 bps	100-150 bps
	20.4%	14.2%	17.6%	18-20%

Source: CRISIL MI&A Research, industry

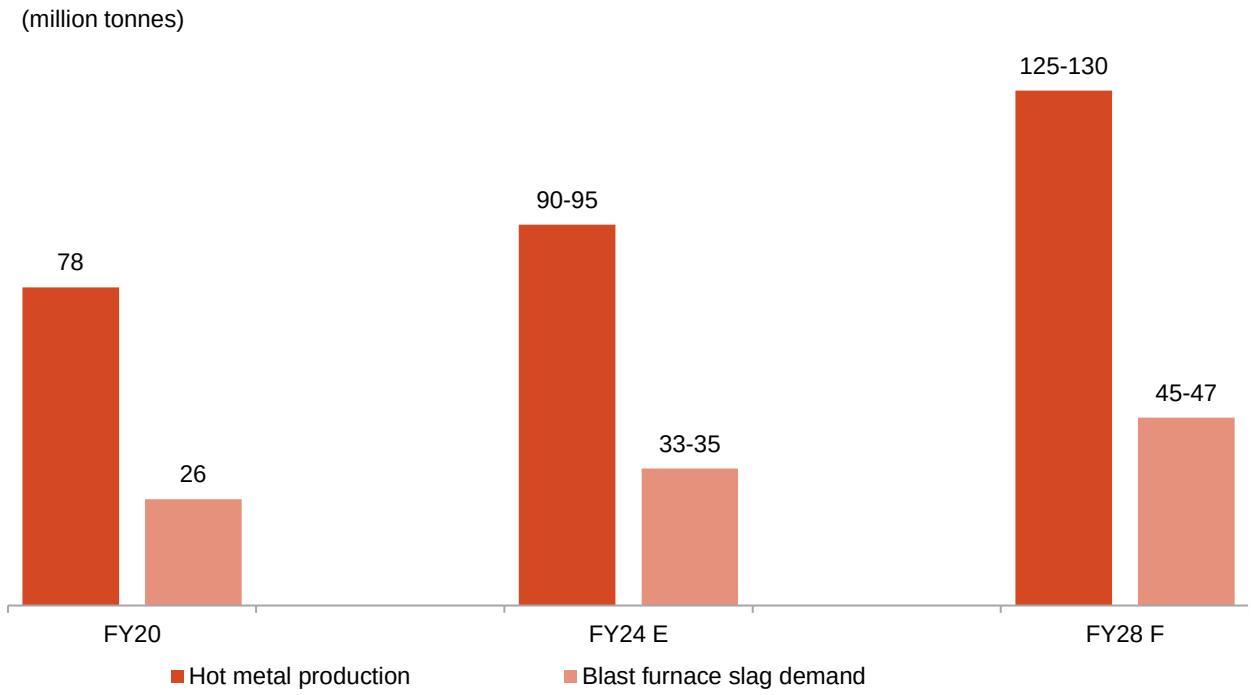
8 Overview of availability of blast furnace slag in India

8.1 Overview of hot metal and blast furnace slag

Production of hot metal in India is estimated to have reached 90-95 million tonne in fiscal 2024 from 78 million tonne in fiscal 2020, clocking a CAGR of 4-5%. The growth was driven by domestic availability of raw materials such as iron ore and cost-effective labour. The steel industry and its associated mining and metallurgy sectors have seen major investments and developments in the recent past and the industry has also been boosted by government initiatives.

Slag is a non-metallic by-product of steel plants obtained from blast furnaces. It is formed when iron oxide is converted into pig iron in the blast furnace using coking coal and fluxes. Iron ore, coke and limestone are fed in the furnace and the resulting molten slag floats above the molten iron at a temperature of 1,500-1,600ºC. Production of blast furnace slag is proportional to the hot metal production in the country. Limited availability for blast furnace slag in the neighbouring countries given rise to exports as well, though in small quantity. Import of this slag has been negligible over the years. In fiscal 2020, demand for blast furnace slag in India was estimated at 26 million tonne. This is estimated to have reached at 33-35 million tonne in fiscal 2024, at a CAGR of 6-7%.

Hot metal production and blast furnace slag demand: Review and outlook



E – estimated; F – forecast
Source: CRISIL MI&A Research, Industry

Going forward, planned capacity expansions by key players, such as Tata Steel, SAIL, JSW Steel, Jindal Steel & Power (JSPL) and ArcelorMittal Nippon Steel India (AMNS), through the blast furnace route is expected to result in 7-9% CAGR in hot metal production between fiscals 2024 and 2028 taking the

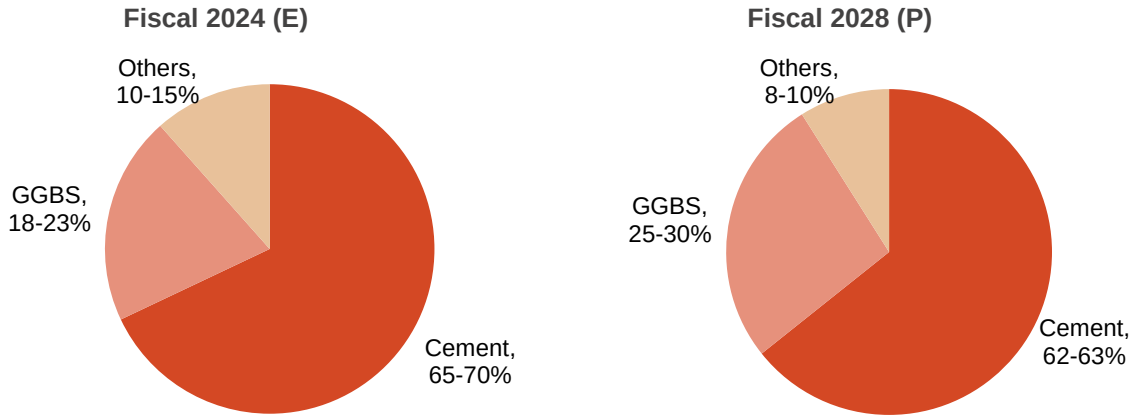
production to 125-130 million tonne. Demand for blast furnace slag, meanwhile, is expected to reach 45-47 million tonne, clocking a CAGR of 8-9%.

8.2 Application of blast furnace slag

The blast furnace slag is amorphous and reactive, due to the presence of very high glass content. One of the key applications of this slag is in cement manufacturing. Cement manufacturers use blast furnace slag as key raw material to produce Portland slag cement (PSC) and Portland composite cement (PCC). The silicates in glass composition act as supplementary cementitious material and mineral admixture for concrete making. It is also used as performance booster of Ordinary Portland cement (OPC). India is estimated to have produced 441 million tonne cement in fiscal 2024. Of this, PSC was 10%, PCC 3-4% and OPC 23%. Hence, share of the cement industry in blast furnace slag consumption was estimated to have been 65-70% during the fiscal. Demand for cement in the country is expected to log a CAGR of 5-7% between fiscals 2024 and 2028 to reach at 553-558 million tonnes, driving the demand for furnace slag as well.

The molten slag obtained from blast furnace is quenched to produce granular particles called granulated blast furnace slag (GBFS). GBFS is dried and ground into a very fine powder to make Ground granulated blast furnace slag (GGBS), another key application of blast furnace slag. Currently, the share of this application is estimated at 18-23% of the total blast furnace slag consumed in the country. Given the advantages of GGBS and increasing awareness about it (as discussed in section 9 of the report), its adoption is set to increase going forward. To decarbonise the cement industry the role of GGBS is very important, since it can substantially reduce carbon dioxide eliminations into the atmosphere from the clinker making process in cement manufacturing. This is expected to improve the share of GGBS in total BF slag demand to reach 25-30% by fiscal 2028. Other applications of blast furnace slag include coarse and fine aggregates among others.

Applications of blast furnace slag (fiscals 2024E vs 2028P)



E: Estimated; P: Projected
Note: Others include coarse and fine aggregate amongst other applications
Source: CRISIL MI&A Research, Industry

Also, screened slag is manufactured by screening blast furnace slag. Screened slag can be used as an alternative to river sand and crushed rock fines to fill in the pores of concrete structures to increase density thereby improving concrete strength and durability.

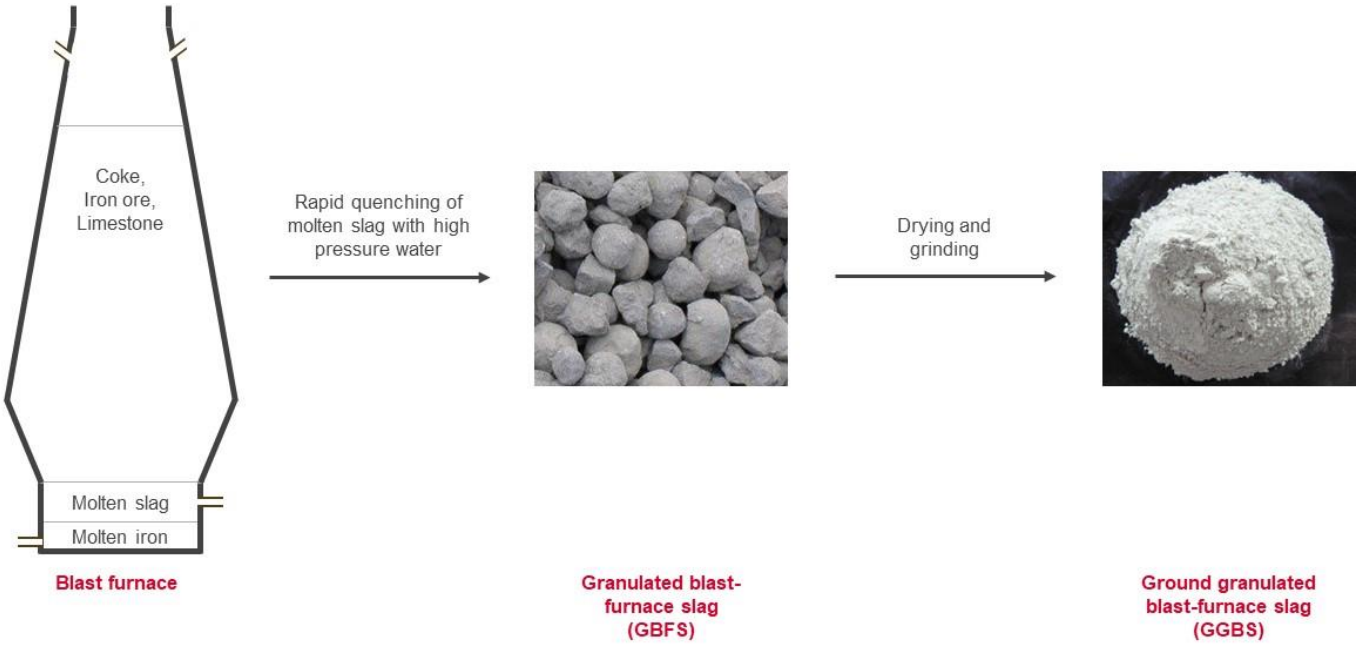
9 Ground granulated blast-furnace slag

9.1 Overview

Slag is a byproduct formed when iron oxide is converted into pig iron in the blast furnace, using coking coal and fluxes. It is rich in oxides of calcium, alumina and magnesia etc. Iron ore, coke and limestone are fed in the furnace and the resulting molten slag floats above the molten iron at the temperature of about 1,500 to 1,600^{o}C. The slag is poured into a granulator and is rapidly quenched through high-pressure water jets, to produce granular particles. This granulated slag is called GBFS. Water-quenching happens in a controlled environment to avoid crystalline formation. GBFS is then dried and ground into GGBS. A typical GGBS processing unit comprises of yard and silos, high pressure grinding roll press, dynamic separator, bucket elevator, air slides, bag filters etc.

GGBS is a highly eco-friendly product as it is produced entirely from blast furnace slag, which is a by-product of the steel manufacturing process. It is a cementitious material mainly used in cement and concrete. It is rich in calcium silicate hydrates (CSH), which enhances its strength and durability.

Production process of GGBS



Source: CRISIL MI&A Research, Industry

9.2 Application and advantages of mixing GGBS in concrete

GGBS is a strength-enhancing compound that improves the durability of a concrete structure. In fact, studies show that concrete made with GGBS continues to gain strength over the time. Studies by institutes such as Indian Institute of Technology (IIT) and Central Road Research Institute (CRRI) also prove that using GGBS in combination with Ordinary Portland cement (OPC) makes concrete structures durable. This is brought out by primary interactions with industry players as well, which suggest that concrete with GGBS and cement has higher strength than concrete made with OPC.

Some of the key studies were:

1. A research project, 'Potential use of ground granulated blast furnace slag as supplementary cementitious materials in concrete,' by the Department of Civil Engineering at IIT Bombay, under the project code 15JSWC001, used GGBS as supplementary cementitious material in various percentages to assess the performance of concrete and its durability.

Mix proportions of the concrete

ID	Cement (kg/m3)	GGBFS (kg/m3)	Cementitious material content (kg/m3)	Water (kg/m3)	w/b	Fine aggregate (kg/m3)	Coarse aggregates (kg/m3)	
							12.5 mm	20 mm
100	400	0	400	180	0.45	918	460	457
60:40:00	300	200	500	170	0.34	880	441	439
50:50:00	250	250	500	170	0.34	878	441	438
40:60	200	300	500	170	0.34	877	440	437
30:70	150	350	500	170	0.34	875	439	436

Source: Research conducted by IIT Bombay (Project code: 15JSWC001)

Compressive strength tests of the concrete specimens were undertaken as per IS 516.

Compressive strength (MPa) of concrete

ID	3 days	7 days	28 days	56 days	365 days
100	20.71	29.49	56.06	59.14	67.71
60:40:00	23.96	38.81	64.21	69.99	95
50:50:00	21.25	34.69	58.7	61.19	83
40:60	17.13	30.24	58.03	65.56	80
30:70	16.61	29.35	52.4	57.04	77

Source: Research conducted by IIT Bombay (Project code: 15JSWC001)

Except for 30:70 combination, GGBS based concretes resulted in better compressive strengths when compared with OPC base concrete, at all the ages. At the age of 56 days, the compressive strength of even 30:70 combination is close to that of OPC based concrete. Among all the combinations, 60:40 achieved higher compressive strength and higher rate of gain of strength than other combinations. From the results, it is evident that the GGBS based concretes achieved high early strengths and higher strength gain at later ages as well.

Results of flexural strength tests (as per IS 516) of the concrete specimens were:

Flexural strength (MPa) of concreteID	28 days	56 days
100	5.76	6.12
60:40	5.27	5.55
50:50	5.63	6.62
40:60	4.82	5.91

30:70	4.58	5.48

Source: Research conducted by IIT Bombay (Project code: 15JSWC001)

The flexural strength of GGBS based concretes is more than 4.5 MPa which is the minimum flexural strength requirement for rigid pavement. At age of 56 days, mixture with 50% OPC and 50% GGBS achieved relatively higher flexural strength and other combinations yielded comparable strength with OPC based concrete.

2. CRRI, Delhi also undertook a research project, 'Design and evaluation of pavement quality concrete mixes using ground granulated blast furnace slag as partial replacement of cement.' CRRI evaluated various properties of concrete containing GGBS. A control mix was prepared without GGBS and with different proportions of GGBS as a partial replacement to OPC.

The studies have shown that an increase in GGBS proportions (upto a certain extend) leads to reduced RMC costs for customers, increased flexural strength and durability, reduced life cycle repair and maintenance costs and greener RMC mixes.

Mix proportions of the concrete

Mix designation	GGBS replacement level (%)	Cement (kg/m3)	Slag (kg/m^3)	Sand (kg/m^3)	10 mm (kg/m3)	20 mm (kg/m3)	Water (kg/m3)
S0	0	400	0	724.626	344.711	805.454	166.000
S10	10	360	40	723.801	344.292	804.744	166.000
S20	20	320	80	722.936	343.873	803.495	165.994
S30	30	280	120	722.000	341.460	802.540	165.987
S40	40	240	160	721.197	343.051	801.575	165.997
S50	50	200	200	720.320	342.636	800.600	165.970
S60	60	160	240	719.448	342.221	799.636	165.965

Source: Research conducted by CRRI, New Delhi

The results of the compressive and flexural strengths tests performed by CRRI were:

Compressive and flexural strengths of concrete

Mix designation	Compressive strength, (N/mm^2)			Flexural strength, (N/mm^2)		
	7 days	28 days	90 days	7 days	28 days	90 days
S0	31.15	45.2	55.88	3.5	5.4	5.8
S10	32.85	48.43	57.93	3.7	5.3	6.2
S20	45.39	53.8	58.59	4.3	5.7	6.6
S30	33.02	49.78	59.47	4.1	5.6	6.7
S40	32.85	45.78	61.00	3.9	5.5	6.9
S50	31.20	45.00	56.23	3.6	5.3	5.8
S60	30.48	37.59	46.65	3.0	4.0	4.9

Source: Research conducted by CRRI, New Delhi

The results show that both short term (7 and 28 days) and long term (90 days) compressive as well as flexural strength of concrete increased when cement is partially replaced by GGBS up to a level of 40%. When 50% cement is replaced with GGBS, the strength of the concrete remains almost same.

Multiple studies showed m*ulti-fold advantages of GGBS concrete vs. pure OPC concrete or fly-ash-based concrete*, such as*:*

- Reduced thermal cracks because of lower heat of hydration
- Reduced shrinkage cracks
- Improved workability and smooth finish
- Improved cohesion
- Better resistance against chemicals such as chlorides, sulphates and carbon dioxide
- Higher compressive strength (initial as well as long term)

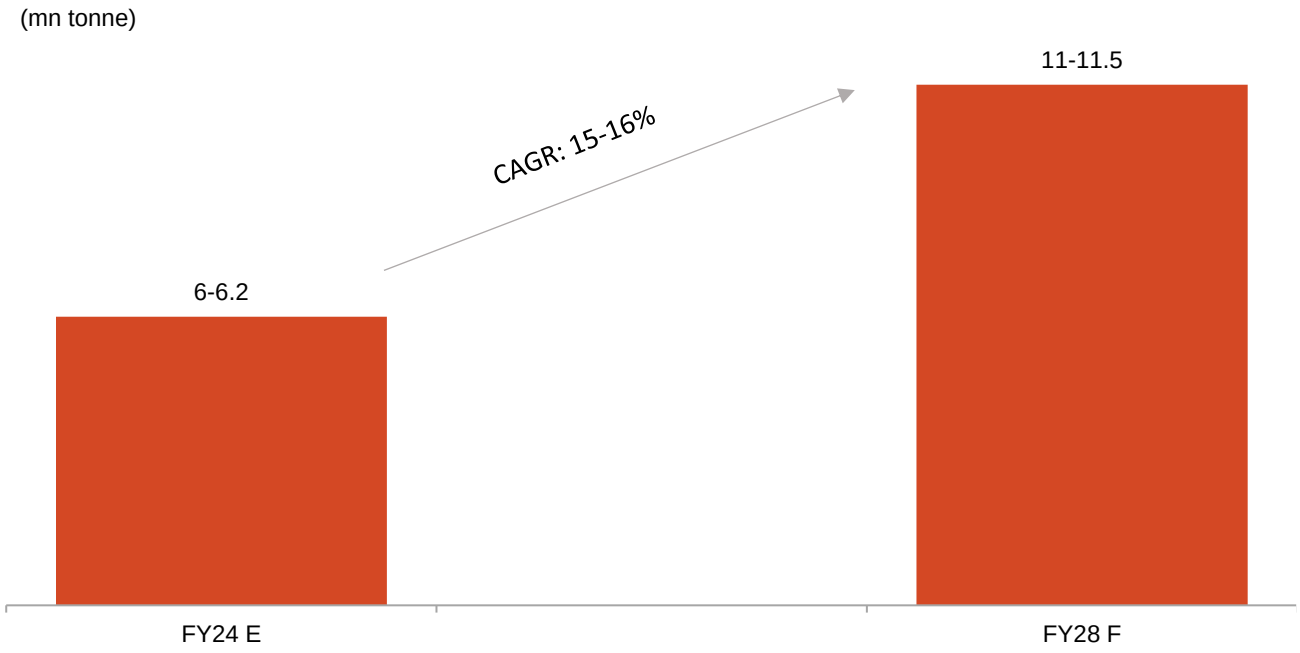
- Higher flexural strength
- Improved durability

In fact, GGBS was found to be one of the most effective replacement materials in concrete manufacturing. Our market interactions suggest that GGBS has a replacement potential of 25-70%, based on the required application. For example, in case of foundations of high-rise buildings, the replacement can be as high as 60-65%, whereas for surfaces above the ground, the replacement can be at 40-50%. Also, the industry uses GGBS across concrete grades, as per the mix design requirements.

9.3 Demand and outlook of GGBS in India

GGBS is a strength-enhancing compound that improves durability of concrete structure. Thus, the demand for GGBS in the country, which was estimated at 6.0-6.2 million tonne in fiscal 2024, is expected to grow at 15-16% CAGR over four years, to 11.0-11.5 million tonne in fiscal 2028.

GGBS demand and outlook



E – estimated F – forecast
Source: CRISIL MI&A Research, Industry

The sustained rise in demand will be because of GGBS being one of the most effective materials that can be used as replacement (for OPC and fly ash) in concrete manufacturing and growing awareness about the product's benefits among decision makers and certifying authorities.

In fiscal 2024, the penetration of GGBS (GGBS-to-RMC ratio) was estimated at ~6%. With improving penetration of RMC and rising adoption of GGBS, the penetration of GGBS is expected to improve to 7% by fiscal 2028.

Increasing adoption of GGBS is expected to be led by efforts of industry participants, including JSW Cement, which are making efforts to educate key influencers about the product's benefits, conducting

successful design-mix trials at project sites, presenting the results to certifying authorities, and getting necessary approvals from project management consultants, who are key decision makers as well, and concerned government departments, if any.

Also, the various studies being conducted proving the benefits for using GGBS in concrete structures is gradually improving the awareness among the stakeholders, and, thus, willingness to pay for the products.

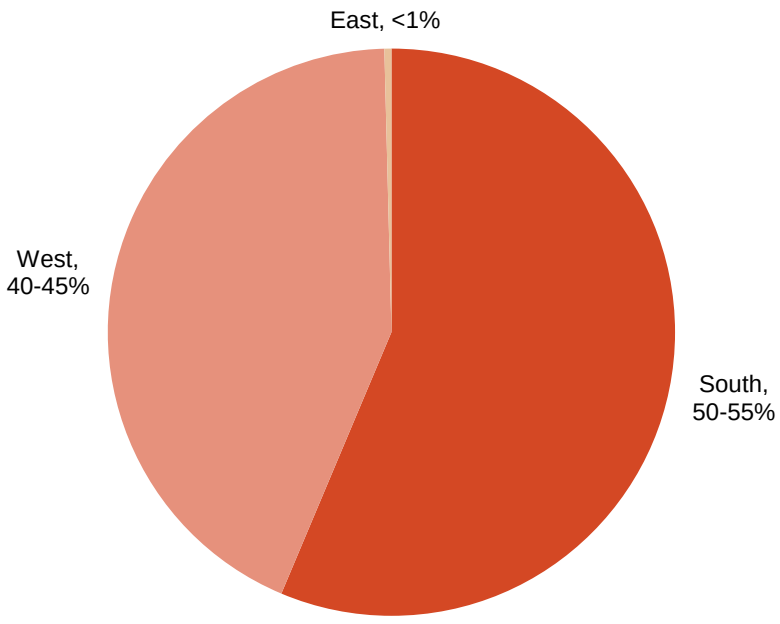
The key concern, though, is timely delivery and availability of the product near the project site, as transporting GGBS to distant sites can add to the overall cost of the project.

9.3.1 Segregation of demand across regions

The key raw material required to manufacture GGBS is blast furnace slag. Hence, GGBS manufacturers are concentrated around sources of blast furnace slag. Also, transporting GGBS to construction sites situated at a distance is not economically viable. Therefore, GGBS produced in a region is largely consumed in that region.

Availability of blast furnace slag is majorly concentrated in southern and eastern India. Hence, southern India consumes more than half of the total GGBS consumed in the country. Western India is the second largest GGBS consumer. The eastern region is at a nascent stage of adopting GGBS, with the cost of alternatives a key monitorable. There is no production and consumption of GGBS in northern India owing to the absence of availability of blast furnace slag.

Region-wise GGBS consumption (fiscal 2024)



Source: CRISIL MI&A Research, Industry

Among the states in southern and western India, Karnataka, Telangana and Maharashtra are leaders in terms of adoption of GGBS. Andhra Pradesh and Gujarat have also shown fair adoption. In fact,

Hyderabad, Mumbai, Pune and Bengaluru are using GGBS in key infrastructure projects (i.e., metro, airport, highway, sea-links, etc), high-rise buildings, marine applications (dams and shore protection structures), and effluent and sewage treatment plants.

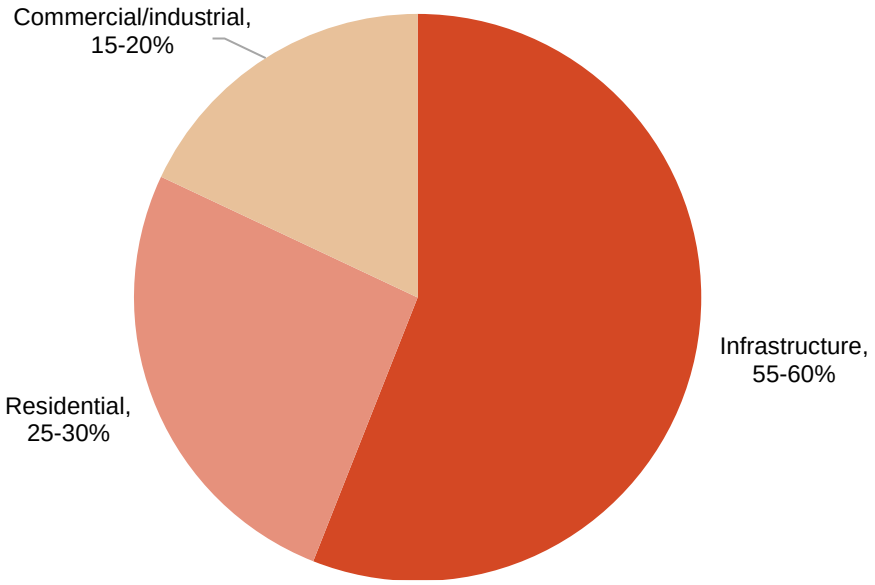
(The list of some certifications available where GGBS usage is permitted and the list of some of the projects where usage of GGBS has been approved are provided in the annexure.)

9.3.2 Demand across end-use segments

More than half of GGBS demand in the country is from infrastructure projects. Residential and industrial/commercial projects are the other two end-use segments. Indeed, infrastructure projects such as metros, roads and bridges, etc have shown the highest adoption of GGBS.

In the residential segment, GGBS adoption can be observed in large real estate projects. High-rise buildings and township projects are using GGBS. GGBS finds application in foundation works owing to low heat of hydration.

End-use segment-wise GGBS demand (fiscal 2024)

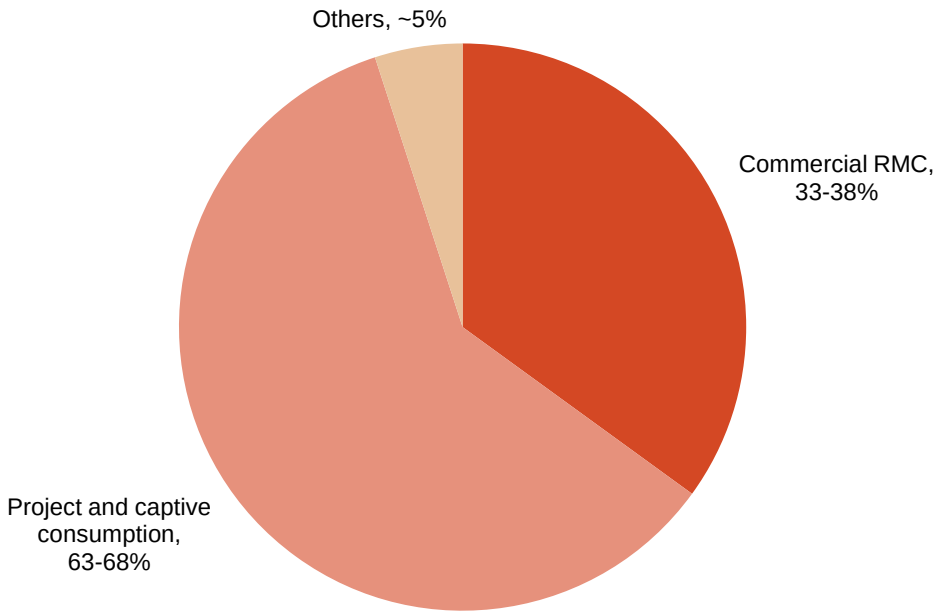


Source: CRISIL MI&A Research, Industry

9.3.3 Segregation of demand by application

GGBS is commonly used as a cementitious material in blended cement as a replacement for Portland cement in concrete production. Commercial RMC, and project and captive consumption are major applications of GGBS, accounting ~95% share in fiscal 2024.

Application-wise GGBS consumption (fiscal 2024)



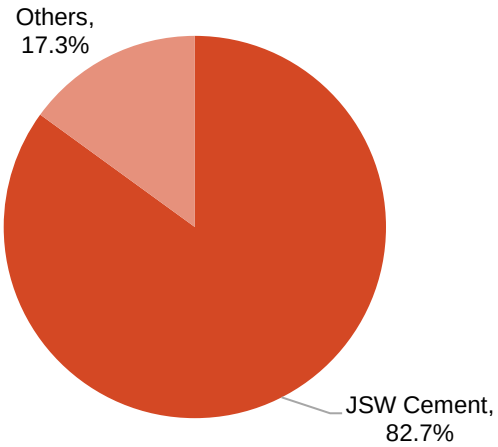
Note: Others include cement product industries, dry mix mortar, AAC blocks, grouts, soil stabilisation, etc.
Source: CRISIL MI&A Research, Industry

Soil stabilisation, AAC (autoclaved aerated concrete), grout, dry mix products, microfine GGBS and geopolymers are some of the upcoming applications of GGBS.

9.3.4 Supply of GGBS

The demand for GGBS in India was estimated at 6.0-6.2 million tonne in fiscal 2024. JSW Cement was the largest supplier of GGBS in India during the year, with 82.7% share. Company's sales stood at ~5.08 million tonne in fiscal 2024.

Share of GGBS suppliers in India (fiscal 2024)



Source: CRISIL MI&A Research, JSW Cement, Industry

The company has six GGBS manufacturing units – in Vijaynagar (Karnataka), Dolvi (Maharashtra), Nandayal (Andhra Pradesh), Salem (Tamil Nadu), Jajpur (Odisha), and Salboni (Odisha), with Vijaynagar and Dolvi plants contributing over 85% to the total GGBS sold by the company in fiscal 2024.

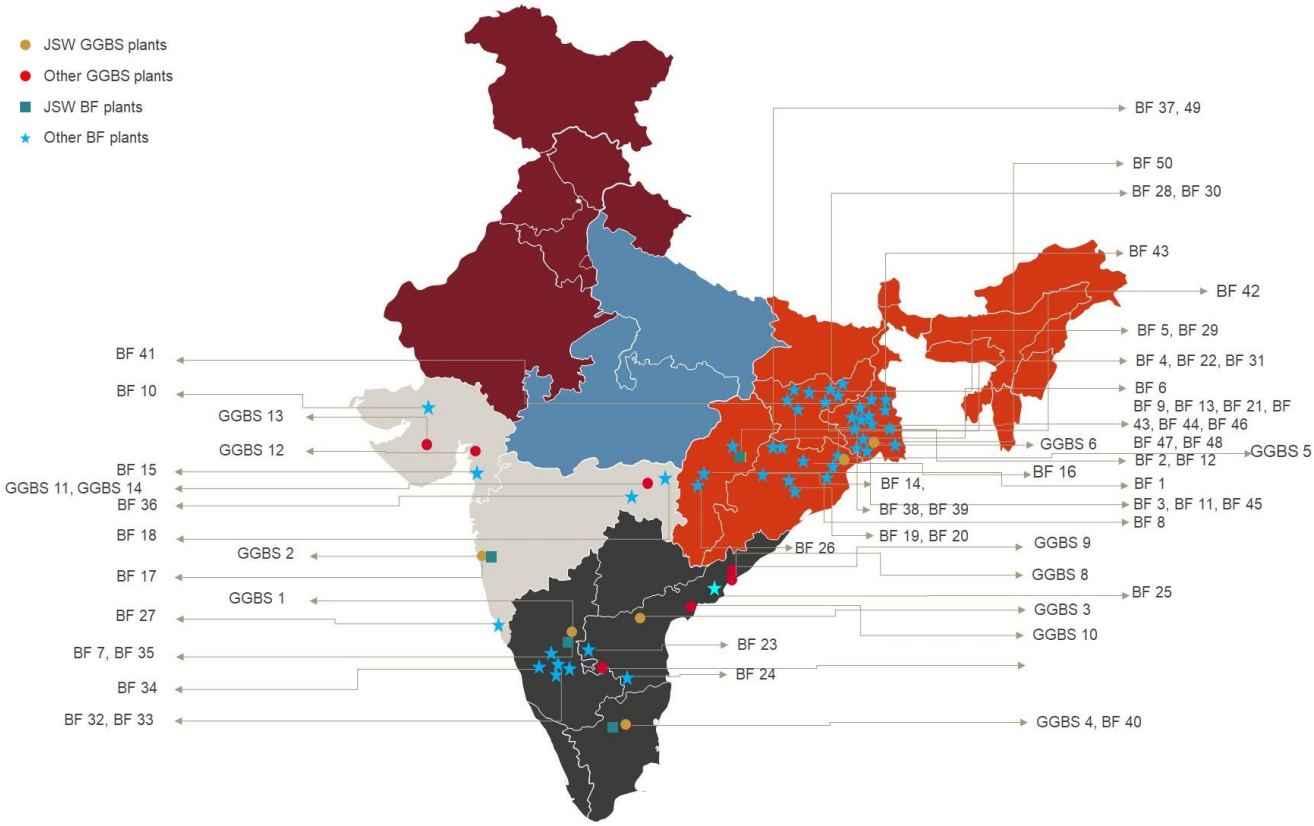
GGBS sold by JSW Cement in the past three fiscals

	FY22	FY23	FY24
GGBS sold (million tonne)	3.13	3.85	5.08

Source: JSW Cement, CRISIL MI&A Research

Other notable Indian suppliers of GGBS are Sri Balaha Chemicals Pvt Ltd (Andhra Pradesh), Sagar Cements Ltd (Andhra Pradesh), My Home Industries Pvt Ltd (Andhra Pradesh), Chettinad Cement Corporation Pvt Ltd (Andhra Pradesh), Ultrafine Minerals & Admixtures Pvt Ltd (Maharashtra), Suyog Elements India Pvt Ltd (Gujrat), Pyramid industries (Gujrat) and STP & Sons (Maharashtra).

GGBS manufacturers and blast furnaces in India



Note: The map is not accurate to scale
The names of GGBS manufacturers and blast furnaces are provided in the annexure
Source: JSW Cement, CRISIL MI&A Research

GGBS is ground to less than 45 microns. It consists of silicates and alumina silicates of calcium, which gives it a glassy structure. The physical and chemical properties of GGBS depend on the quality of slag used to produce it. The following two key factors affect the quality of slag:

- Glass content: The molten slag from the blast furnace is poured into a granulator and is rapidly quenched through high pressure water jets to produce granular particles. The process of water-quenching should be undertaken in a controlled environment to avoid crystalline formation. A good quenching process leads to achieving a glass content of 92-96%. The reactivity index of GGBS is affected by the chemical composition and glass content. This index plays a vital role in determining the cementitious performance of GGBS.
- Consistency in chemical composition: The blast furnace slag is rich in oxides of calcium, alumina and magnesia, etc. In order the control the quality of GGBS, it becomes imperative that consistency is maintained in the chemical composition of the raw material, i.e. slag being used.

Thus, a GGBS producer such as JSW Cement, which has control over the quality of raw materials, is able to provide better quality GGBS to its consumers.

9.3.5 **Pricing of GGBS**

GGBS is a niche product. Its price is driven by the availability of slag because of utility of slag in other applications, prices of other alternative products available in the region and logistic costs.

Currently, GGBS is, on average, priced at ₹ 4,000-4,500/tonne. The price of GGBS is slightly higher in the western region as compared to southern region, due to differences in demand / supply scenario of fly ash and cement between the regions.

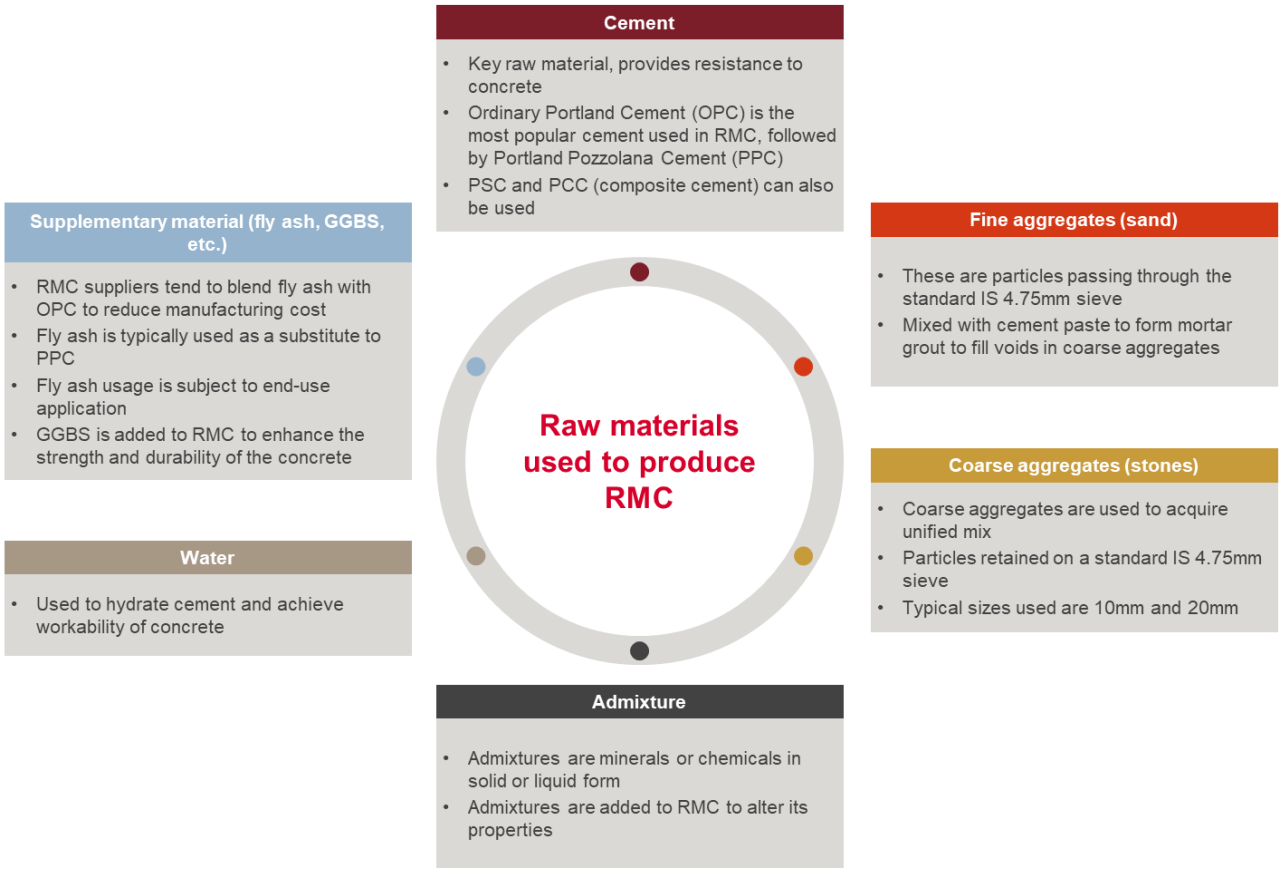
Adoption of GGBS in the eastern region is at a nascent stage as the region is still experimenting with the product. Also, prices of other available alternatives are much lower in the eastern region. Thus, price of GGBS is very low in the region. Certain flagship projects in northern India have used GGBS. Prices in northern India are determined more by incurred logistics cost.

10 Ready mix concrete

10.1 Manufacturing process

Ready mix concrete (RMC) is a concrete product that is delivered in a ready-to-use mode. It simplifies the construction process by eliminating the need for on-site mixing. The Indian standards specification IS 4926:2003 defines RMC as concrete mixed in a stationary mixer in a central batching and mixing plant or in a truck mixer and supplied in fresh condition to the purchaser, either at the site or into the purchaser's vehicles. Raw materials for RMC constitute cement, aggregates, water and admixtures, which are weigh batched in the plant using a pan mixer.

Raw materials used to produce RMC



Source: Industry, CRISIL MI&A Research

Raw material composition of RMC

Raw material	Volume share (%)
Cementitious products* (cement, fly ash, GGBS)	12-15%
Coarse aggregate	42-45%
Fine aggregate	35-37%

Additives/admixtures	<0.5%
Water	6-8%

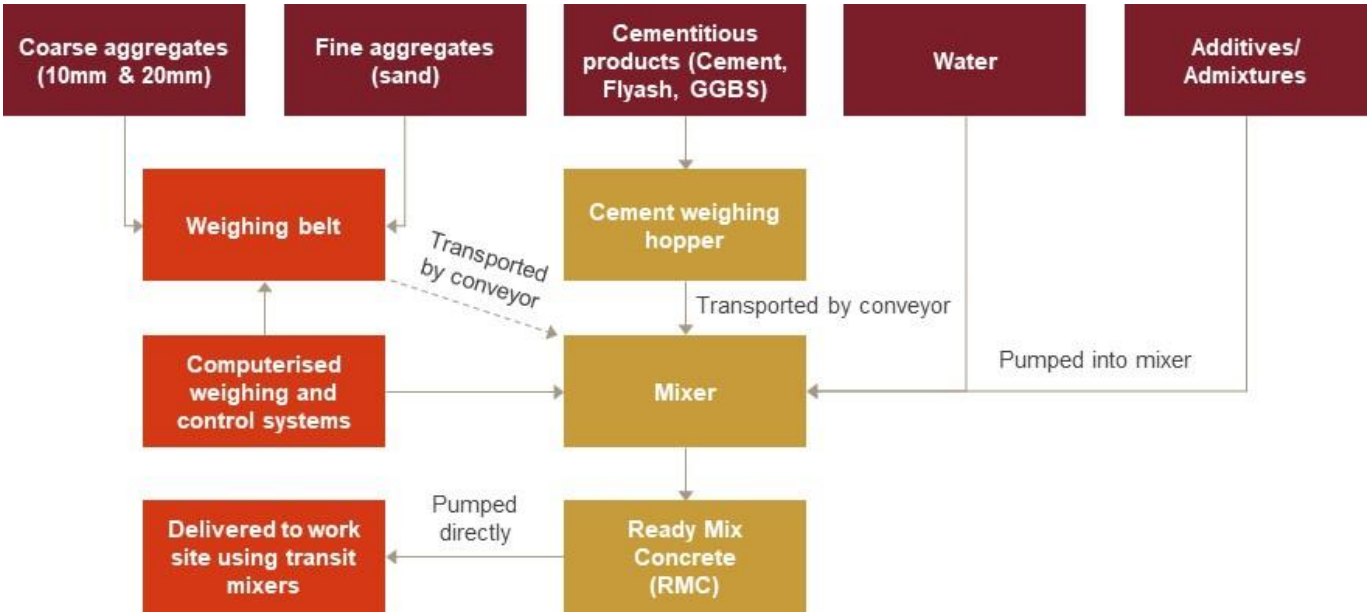
*Note: * The quantity and type of cementitious products varies depending on grade required to obtain influential mix designs*
Source: Industry, CRISIL MI&A Research

10.2 Manufacturing process

RMC is manufactured in centrally batched plants and is then transported to the construction sites in transit mixer trucks. A typical RMC batching plant consists of the following components:

- Storage units: Airtight silos for cement, bins for aggregates and tanks for water/admixtures
- Front end loader for transporting aggregates
- Conveyor belts
- Dust collection system
- Computerised laboratory for controlling the batching and mixing of ingredients
- Transit mixers
- Placement equipment such as concrete pumps

Production process



Source: Industry, CRISIL MI&A Research

Precise batching of cementitious products, fine and coarse aggregates, water and additives/admixture is caried out at the central plant. Raw materials are carefully measured and mixed as per required specifications. Raw materials are mixed in a batching mixer at a regulated speed for a suitable duration as required by the quality mix. The entire mixing process is carried out by computer-aided scientific controls and methods. Stationary plant mounted mixing is preferred due to fast production capability and improved concrete quality control.

After completion of mixing/batching at the plant, concrete is released into the transit mixer truck. Concrete is required to be discharged from the truck mixer within two hours from the time of loading. Thus, the job site is preferred to be in the vicinity of the batching plant, at a distance of 30-40 km. Discharging of RMC is done directly from the truck mixer through chute or is pumped by static or mobile pumps at the pouring point with horizontal and vertical pipelines. Pumps discharge RMC quicker than other available options. Hence, they are preferred at critical job locations. Finally, RMC is typically discharged within 30 minutes after reaching the construction site through pumps or conveyor belts.

RMC product types and applications

Grade	Classification in terms of strength	Applications
M10	Ordinary	Levelling course, footing, concrete roads, etc
M15		Levelling course, footing, concrete roads, etc
M20		Real estate: slab, beam, columns, footings, etc
M25		Real estate: slab, beam, columns, footings, etc
M30	Standard	Roads and real estate: slab, beam, columns, footings, etc
M35		Roads and real estate: slab, beam, columns, footings, etc
M40		Roads and bridges: slab, beam, columns, footings, etc
M45		Path/runways, roads, bridges: beam, columns, concrete girders, etc
M50		Path/runways, roads, bridges: beam, columns, concrete girders, etc
M55		Roads and bridges: beam, columns, concrete girders, concrete piers, etc
M60-M100	High-very high	Long bridges, dams, coastal construction, high rise buildings, etc

Source: Industry, CRISIL MI&A Research

Our interactions with RMC industry stakeholders indicated that M20, M25 and M30 are the most widely used grades in real estate and concrete road construction in India. The composition of RMC changes with grade types. Further, the pricing of each grade varies on the basis of the quantity of raw material used for its production.

Cement quantity increases for higher RMC grades. Higher the quantum of cement used, greater is the strength of concrete produced. Hence, higher grades are stronger and are largely used in high rise formations and strength-intensive structures.

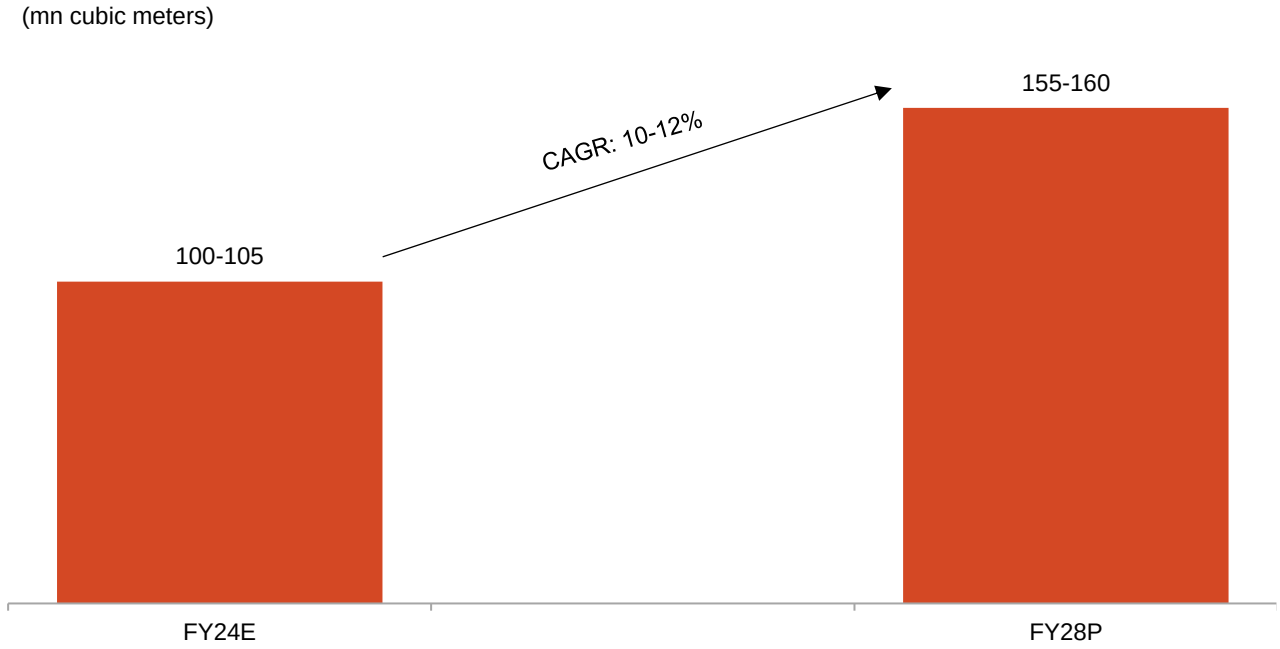
10.3 **Demand assessment and outlook**

Domestic demand for RMC was 90-92 million cubic metre in fiscal 2023. It is estimated to have increased 11-12% on-year to 100-105 million cubic metre in fiscal 2024.

Future looks promising as well. CRISIL MI&A Research projects domestic demand for RMC to increase at a four-year CAGR of 10-12% to 155-160 million cubic metre by fiscal 2028, by the government's infrastructure push. Healthy investments in commercial real estate are expected to provide further momentum to RMC demand from industries such as IT, BFSI, tourism, hospitality, education, capital goods, etc. Increasing adoption of RMC and industrial construction comprising small and medium-scale

enterprises, power plants, sewage treatment plants, few ports, airports, etc will continue to support RMC consumption.

RMC demand and outlook



E: Estimate; P: Projection
Source: CRISIL MI&A Research, industry

11 Sustainability in the cement industry

11.1 Impact of the cement industry on climate

The cement industry is one of the highest emitting industrial sectors, releasing CO2 majorly through direct and indirect emissions. Under direct emissions, there are two main activities: calcination and fuel combustion.

Fuel combustion is an energy-related emission, which occurs when fossil fuels are used to heat a pre-calciner or rotary kiln. It accounts for 30-35% of total CO2 emissions generated in the cement production process. The other primary source of direct emissions is 'process emission', which involves chemical reactions in the pre-calciner to decompose limestone (calcium carbonate), representing about 50-55% of the total CO2 emissions generated in the process.

Indirect emissions account for the remaining 10-15% CO2 emissions, with power/electricity and logistics accounting for 8-10% and 2-5% of CO2 emissions, respectively. The share of CO2 emissions in Greenhouse Gas (GHG) emissions is the highest, accounting for close to 98-99% of the total emissions, while those of NOx and Methane remain negligible.

The cement sector accounts for almost 8% of the global CO2 emissions. China is the largest cement producer, accounting for about 55% of global production. India is the second-largest cement producer and consumer, accounting for ~8% of the global installed capacity – and this expected to grow further. As of 2021, overall emissions are led by China at ~853 million metric tonne (MnMT) of emissions, followed by India (~149 MnMT), Vietnam (~54 MnMT), Turkey (~44 MnMT), US (~41 MnMT) and Indonesia and Saudi Arabia (~29 MnMT each).

India's emission and energy intensity related benchmarks for the cement industry are better than those of the global benchmarks. The domestic cement plants have an energy intensity of 3.1GJ/tonne of clinker and 80kwh/tonne of cement versus the global average of 3.5GJ/ tonne of clinker and 90kwh/tonne of cement. Also, India's carbon-emissions intensity at 550 kgCO2 /tonne of cement produced is much lower than that of the global intensity of 600-650 kgCO2/tonne.

India versus global benchmarks

Particular	Unit	India average	Global average
Power intensity per tonne of clinker	GJ/tonne	3.1	3.5
Power intensity per tonne of cement	Kwh/tonne	80	90
Carbon emission intensity	$kgCO_2$/tonne	550	630

Source: CRISIL MI&A Research

After power generation, which accounts for ~46% of total carbon emissions in India, the next highest emitting sector is the cement industry, accounting for ~30% of carbon emissions. Cement sector, accounting for 28% of carbon emissions of total industrial emissions, is the second largest emitting-industry after steel and iron sector out of all industrial sectors in India. Of the total CO2 emission in India,

the cement sector contributes around 7-9% versus 45-47% from the power sector, 11-13% from the iron and steel sector, and 12-14% from transportation, according to the IEA, 2021.

11.2 Regulations and government policies: Carbon reduction opportunities

In India, both the Central Pollution Control Board (CPCB) and the respective State Pollution Control Boards (SPCBs) deal with environmental issues. Cement plants must also comply with the charter on Corporate Responsibility for Environment Protection (CREP) and various environmental acts and regulations notified by the Ministry of Environment, Forests and Climate change (MoEFC). Key regulatory authorities are CPCB, SPCB, MoEFC and National Council for Cement and Building Materials (NCB). Even the Supreme Court of India has stepped in from time to time asking the industry to reduce emissions, indirectly impacting the cement industry.

To curb the ill-effects of emitting pollutants in the industry, the MoEFC has issued emission standards for rotary kilns (with co-processing of waste) under Section 6 and Section 25 of the Environment Protection Act,1986.

Permissible emission under Section 6 and Section 25 of the Environment Protection Act,1986

Particulate matter	**30 mg/Nm3**
SO2	100 mg/Nm3 (pyritic sulphur in limestone is less than 0.25%)
	700 mg/Nm3 (pyritic sulphur in limestone is between 0.25 to 0.5%)
	1,000 mg/Nm3 (pyritic sulphur in limestone is more than 0.5%)
NOx	600 mg/Nm3 (800 for rotary kiln with in-line calcinatory)

Source: CPCB, CRISIL MI&A Research

These pollution limits were notified on May 9 and May 10, 2016, with the condition the cement plants must comply with them by March 31, 2017

Cement plants in India are clustered in a few limestone rich regions. Rajasthan has the maximum installed capacity in India for both cement and clinker followed by Southern states of Andhra Pradesh, Karnataka, and Tamil Nadu (~29% of total capacity). While Rajasthan have been often impacted by the regulatory changes to limit pollution in Delhi, there are no major state related policies for emission control in southern states apart from the ones laid out by CPCB/SPCB and MoEFC. However, in the longer run, stricter measures are expected across states in line with India's Nationally Determined Contribution (NDC). Players are also subject to certain fines/penalties in lieu of any environmental breach depending upon the impact of the breach.

Perform, Achieve and Trade (PAT) is a regulatory instrument to reduce Specific Energy Consumption in energy-intensive industries, with an associated market-based mechanism to enhance cost effectiveness through Energy Savings Certificates, which can be traded. The Bureau of Energy Efficiency (BEE) has rolled out six PAT cycles until March 31, 2020, with 1073 Designated Consumers (DCs) covering 13 sectors. A total savings of about 26 million tonnes of oil equivalent (MToE) are projected, translating into avoiding of about 70 MnT of CO2, will be achieved by March 2023. The cement sector has surpassed the targets of the PAT scheme by 80%.

Global standards: Countries such as South Africa, Australia, Germany and many other European countries have stipulated the emission limits for sulphur dioxide at as low as 50 mg/Nm3. Similarly, countries such as Colombia, Germany and other European countries have nitrogen oxide emission limit at as low as 200 mg/Nm3. The Cement Sustainability Initiative (CSI) is a global effort by 25 major cement producers with operations in more than 100 countries, which believe there is a strong business case for the pursuit of sustainable development.

11.3 Technology shift: Roadmap to net-zero future

11.3.1 Substitution of clinker with blended cement

Blended cement uses waste products such as fly ash, slag, etc instead of clinker – the main contributor to CO2 emissions – in the cement manufacturing process. Thus, blended cement, such as Portland pozzolana cement (PPC), Portland slag cement (PSC) and composite, reduces embodied greenhouse gas emissions. In fact, higher the cement-to-clinker ratio, lower is the emissions .

That said, different blended cement types have different clinker requirements, leading to varied emission intensity .

India versus global benchmarks

Type of cement	Minimum clinked requirement	Slag requirement	Fly ash requirement	Cement-to-clinker ratio
OPC	95%	-	-	~1.05
PPC	65%	-	0-35%	~1.54
PSC	25%	25-70%	-	~4.00
Composite	35%	20-50%	15-35%	~2.86

Source: CRISIL MI&A Research

11.3.2 Alternative fuels and increased energy efficiency to reduce CO2 emissions

Technologies such as waste heat recovery systems, reducing the use of fossil fuels, as well as converting current fossil fuel-based facilities into renewable biomass fuel-based units are various steps taken by companies to reduce emissions.

Coal and petcoke – two of the most carbon-intensive fuels – are typically used to heat cement kilns. Hence, one of the ways to lower emissions is through the use alternative fuels, owing to their lower carbon intensity vis-à-vis coal and petcoke.

To be sure, cement plants are actively looking for suitable and low-cost alternative fuels to lower fuel cost and reduce CO2 emission. As of 2021, the % of alternative fuel use in the Indian cement industry was estimated at 5-6%, according to Cement Manufacturers Association of India. This was considerably lower than the global average of ~15% in 2020, as per the International Energy Agency (IEA).

The substitution of expensive and high CO2 intensity fossil fuels with biomass, municipal solid waste and refuse-derived fuels is measured by thermal substitution rate . According to the IEA, mixed fuels are 20-25% less carbon-intensive than traditional fossil fuels.

In India, the government has set a target of 25% alternative fuel use in the cement industry by 2030 as part of its commitment to reducing carbon emissions and promoting sustainable development.

11.3.3 Green cement and LC3 gaining traction

Green cement is cement produced by companies through manufacturing techniques that reduce carbon emissions . Compared with OPC, green cement consumes ~60% less thermal energy and the carbon emission intensity is also 60% lower.

Another product is limestone calcined clay cement (LC3). This new type of cement is based on a blend of limestone and calcined clay. LC3 can reduce CO2 emissions by up to 40%, is made using limestone and low-grade clays, which are available in abundant quantities, is cost effective, and does not require capital intensive modifications to existing cement plants. JK Lakshmi Cement has partnered with Society for Technology and Action for Rural Advancement to integrate calcined clay technology into its operations to produce LC3.

11.4 Government initiatives supporting green cement

Governments globally are recognising the urgency of promoting green cement production. Some key initiatives are:

- Public procurement of green cement: A growing trend involves governments leveraging their purchasing power to incentivise the use of green cement in public infrastructure projects. For instance, the UK aims to achieve net-zero embodied carbon in all new government buildings by 2029, with green cement a critical material to achieve this goal. Estimates suggest that if just 20% of global cement demand were met by green cement, CO2 emissions could be reduced by 15%, highlighting the potential impact of such policies
- Financial incentives: Some governments are also offering tax breaks or subsidies to producers manufacturing green cement. India provides tax benefits on electricity used for production of blended cements containing fly ash and slag, encouraging their use as clinker replacements
- Research and development support: Governments are investing in research and development focused on advancing green cement technologies. The EU, through its Horizon 2020 programme, has funded research projects exploring innovative low-carbon cement formulations and alternative clinker production methods

By supporting these advancements, governments can help accelerate the development and commercialisation of green cement. These initiatives also highlight a growing commitment from governments to promote green cement, which will not only accelerate its wider adoption but also contribute to a more sustainable construction industry.

11.5 Avenues and challenges in achieving manufacturing sustainability

A considerable 8% of global CO2 emissions are from the cement industry, with clinker production, a key stage in the manufacturing process, responsible for about half of those emissions.

There are two main avenues for achieving sustainability. The first involves operational improvements. By replacing fossil fuels with alternative fuels such as biomass or industrial waste in kilns, manufacturers can lessen their reliance on carbon-heavy sources of energy. Additionally, incorporating industrial byproducts such as fly ash and slag into cement blends reduces the need for clinker, lowering the overall CO2 footprint.

Industry estimates suggest that these two methods alone can contribute considerable in reducing a large proportion of the emissions by 2050.

However, challenges remain. Modifying existing kilns might be necessary for the alternative fuels, and large-scale implementation of some promising technologies, such as carbon capture and storage, are still under development.

Still, the environmental benefits are considerable.

By embracing these advancements and optimising the processes, the cement industry can significantly reduce its carbon footprint and contribute to a greener environment.

12 Competitive Landscape

12.1 Competition overview

The Indian cement industry is highly fragmented, with the presence of a few large players and several medium-sized and small players. Top five players – UltraTech Cement, Shree Cement, Ambuja Cement (including ACC Ltd,) Dalmia Cement and Nuvoco Vistas Limited holding a ~54% share by grinding capacity. The industry has various entry barriers, such as high capital costs, long gestation period, and inadequate availability of raw material, as well as transportation barriers, as railways and roadways are expensive modes compared with the sea transport. However, sea transport has difficulties associated with the procurement of land near coastal areas for setting up of the grinding units and other associated costs for infrastructural facilities at port regions. Over the past decade, the Indian cement industry has seen many large mergers and acquisitions. Some have been in the form of global companies acquiring domestic players, while others have been domestic companies looking to consolidate their market position. Since demand growth is likely to pick up only gradually from the current levels, due to the pandemic-led disruption, further industry consolidation is likely in the near term.

Domestic manufacturers can broadly be bucketed into pan-India, regional and standalone players. Pan-India players are large players, such as ACC and Ambuja, UltraTech Cement, Shree Cement and Dalmia Cement. Players whose presence is restricted to one or two regions are categorised as regional players. Key players in this segment include Nuvoco Vistas (concentrated in the east, central and north), India Cement (south and west), JK Cement (north and south), JK Lakshmi Cement (east, west and north), Kesoram Industries (south), Chettinad Cement (south) and Ramco Cements (south and east). Players such as Panyam Cement, Penna Cement, Star Cement and Sanghi Cement are operational in a few states within a region.

Pan India and regional players

Pan-India (multiregional) players	Regional players
Pan India: UltraTech Cement, Ambuja Cement, ACC Ltd	Nuvoco Visatas, India Cement, JK Cement, JK Lakshmi Cement, Kesoram Industries, Chettinad Cement, Ramco Cements, Panyam Cement, Penna Cement, Star Cement, Sanghi Cement
Multiregional: Shree Cement, Dalmia Cement, JSW Cement	

Source: CRISIL MI&A Research

Characteristics of pan-India and regional players

UltraTech Cement Ltd is the largest manufacturer of grey cement, ready-mix concrete (RMC) and white cement in India. It is one of the leading cement producers globally too. It has 24 integrated plants and 29 grinding units, one clinkerisation unit and eight bulk-packaging terminals. Apart from this, it has one white cement unit and three wall-care putty units. Its operations span across India, the UAE, Bahrain, Bangladesh and Sri Lanka. UltraTech is also India's largest exporter of cement, with a presence in countries around the Indian Ocean and in the Middle East.

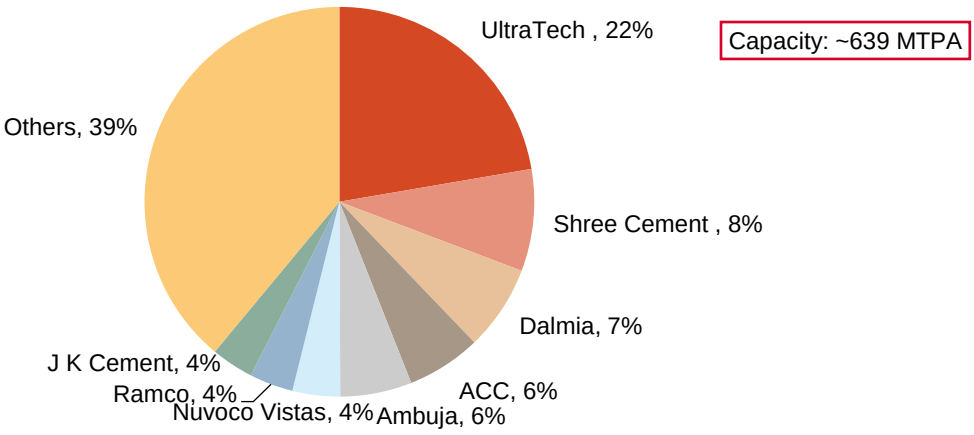
Ambuja Cement Ltd was first incorporated as Gujarat Ambuja Cement Ltd in 1983. The company commenced cement production in 1986. It is now a part of the global conglomerate, Lafarge Holcim, and is among the leading cement companies in India. Ambuja has five integrated cement manufacturing

plants and eight cement grinding units, with operations in India and Nepal. The company has integrated plants in Gujarat, Himachal Pradesh, Maharashtra, Rajasthan and Chhattisgarh, and grinding units at Punjab, West Bengal, Uttarakhand, Uttar Pradesh, Himachal Pradesh and Gujarat. As of fiscal 2023, Ambuja had a cement capacity of 31.5 million tonne.

Formed in 1936, ACC Ltd is India's oldest manufacturer of cement and RMC. It was formed by amalgamating 10 cement companies promoted by the Tata, Khatau, Kellick Nixon, and FE Dinshaw groups. In 2005, ACC Ltd and Ambuja Cement Ltd became part of the Holcim group of Switzerland. In 2022, ACC became a part of the Adani group. The company is a pan-India -player with major cement plants in the eastern and southern regions. The company operates 17 cement and clinker plants as well as 90 RMC units, and has integrated plants in Andhra Pradesh, Chhattisgarh, Himachal Pradesh, Jharkhand, Karnataka, Madhya Pradesh, Maharashtra, Odisha, Rajasthan, Tamil Nadu, Uttar Pradesh and West Bengal.

Regional players such as Ramco Cement and JK Cement have a strong hold in the local markets where they operate, due to cost leadership, market advantage and proximity to raw material sources.

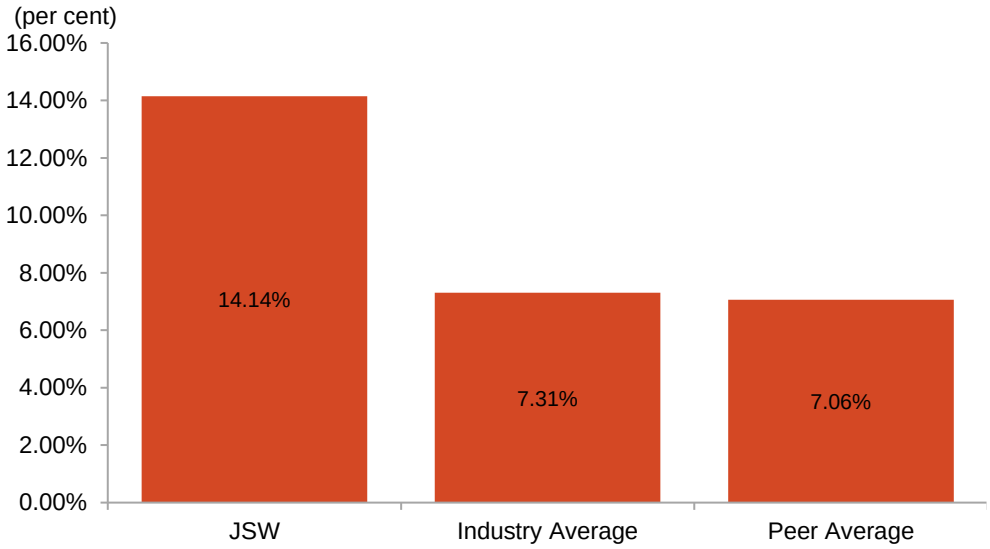
Market share of large (top 8) cement manufacturers, Fiscal 2024



Source: CRISIL MI&A Research

12.2 Financial and operational benchmarking

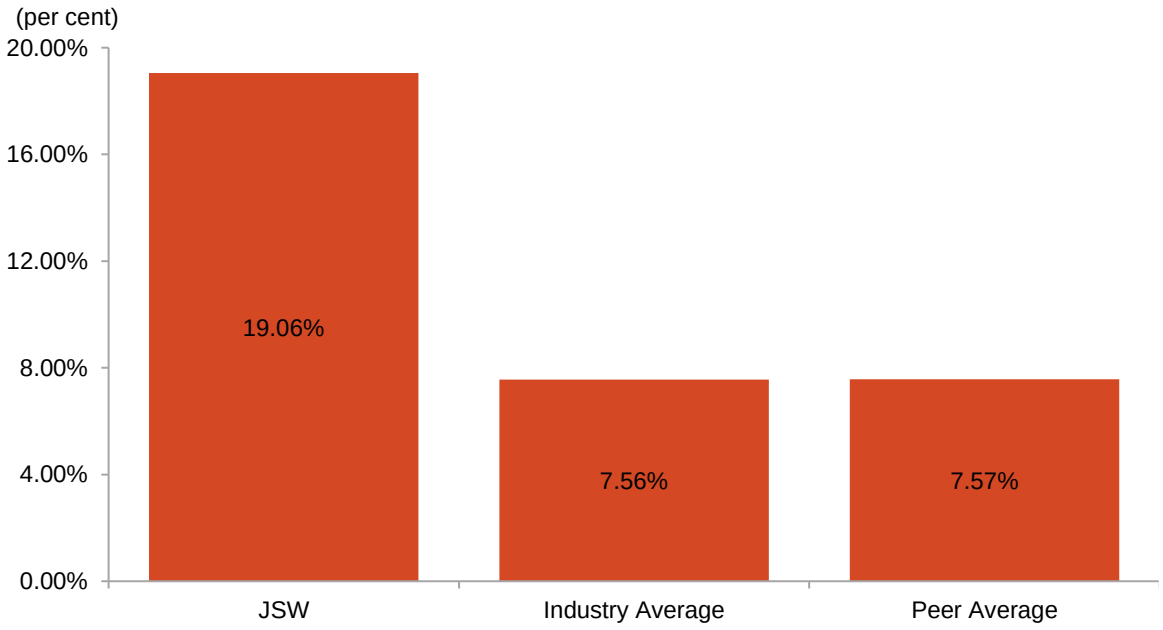
Capacity Growth 10-year growth (FY14-24 CAGR)



Source: Company annual reports
Industry average and peer average has been defined in the notes at the end of this section

Sales Volume 10-year growth (FY14-24 CAGR)

JSW Cement has clocked in higher sales volume growth in past decade (FY14-24 CAGR), past 5 years (FY19-24 CAGR) and annually in FY24 against FY23 compared to industry group and peer group (*Check notes at the end of this section for definition of industry and peer group*).



Source: Company annual reports

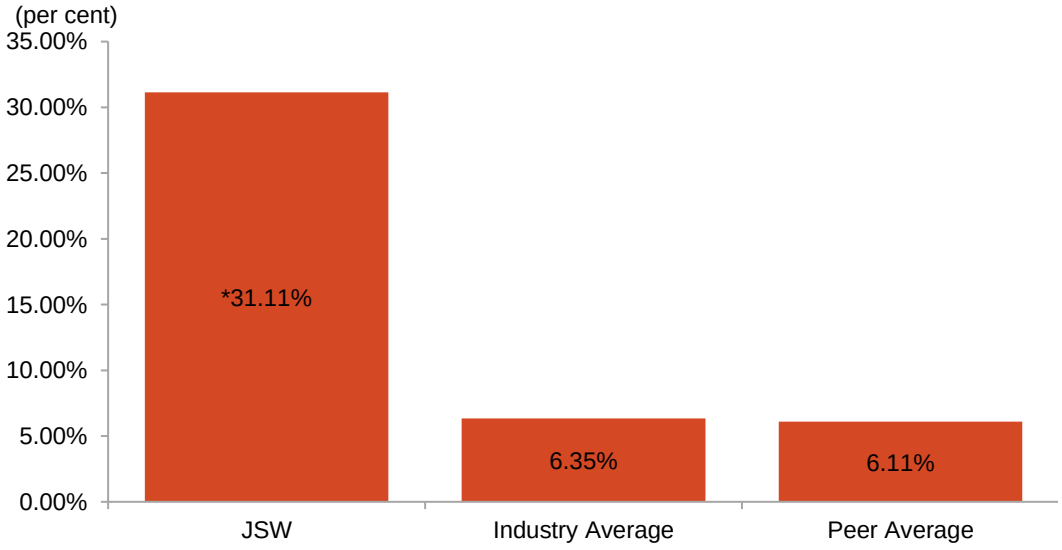
JSW Cement's sale volume increased from 2.19 MMT in FY14 to 12.53 MMT in FY24, which equates to CAGR of 19.06% as shown in chart above.

Sales Volume 5-year growth (FY19-24 CAGR)

Source: Company annual reports

JSW Cement's sale volume increased from 7.35 MMT in FY14 to 12.53 MMT in FY24, which equates to CAGR of 11.26% as shown in chart above.

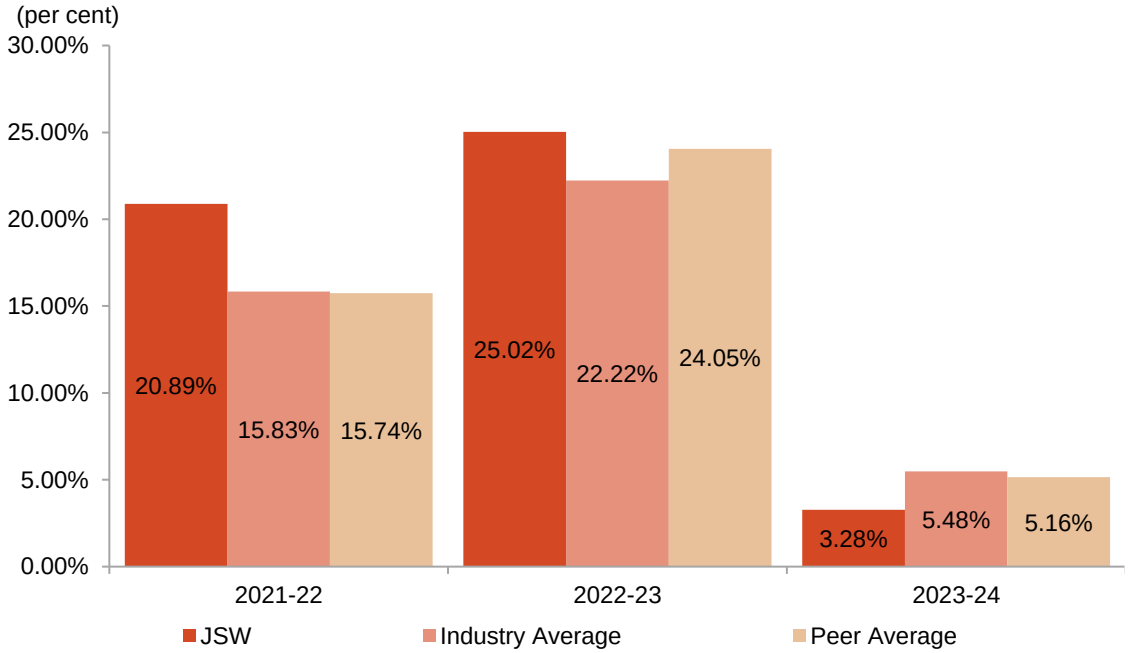
Sales Volume annual growth (FY23-24)



Source: Company annual reports

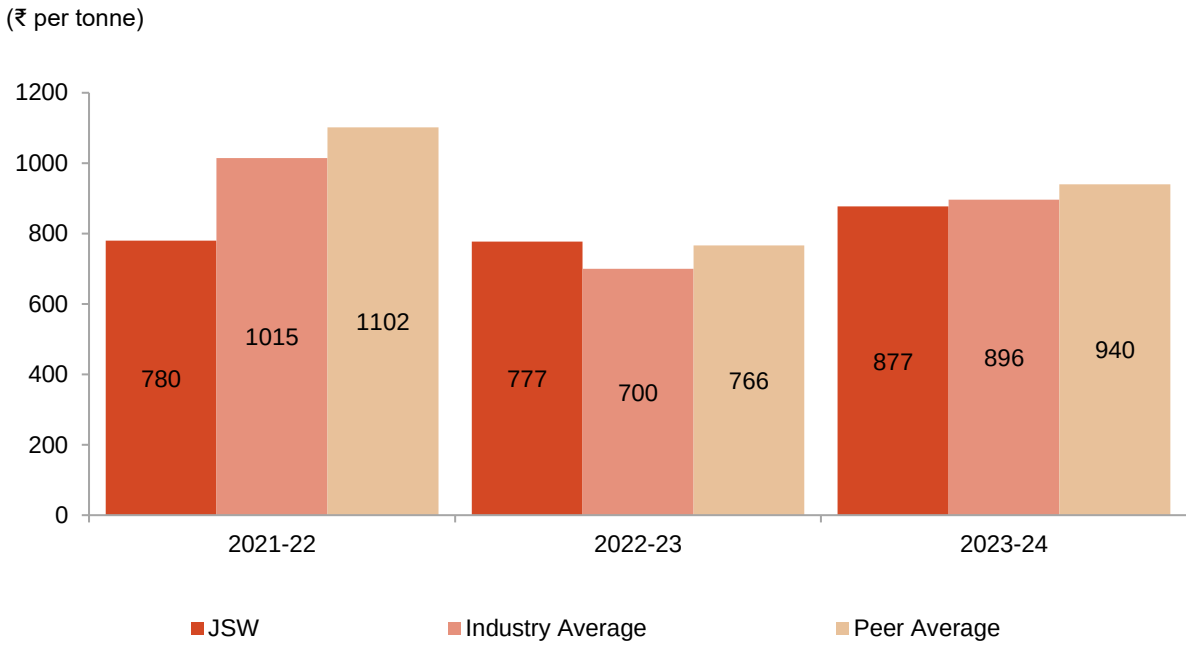
* Excluding volume sold from JSW Cement FZC in FY23

Revenue growth (%)



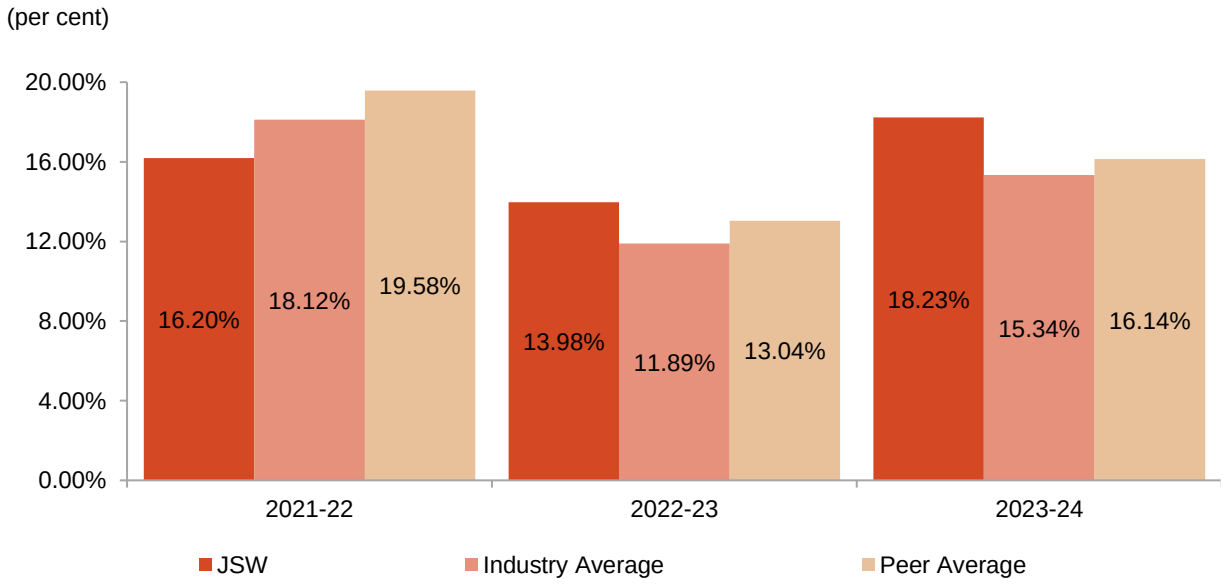
Source: Company annual reports

Operating EBITDA per tonne (Rs/tonne)



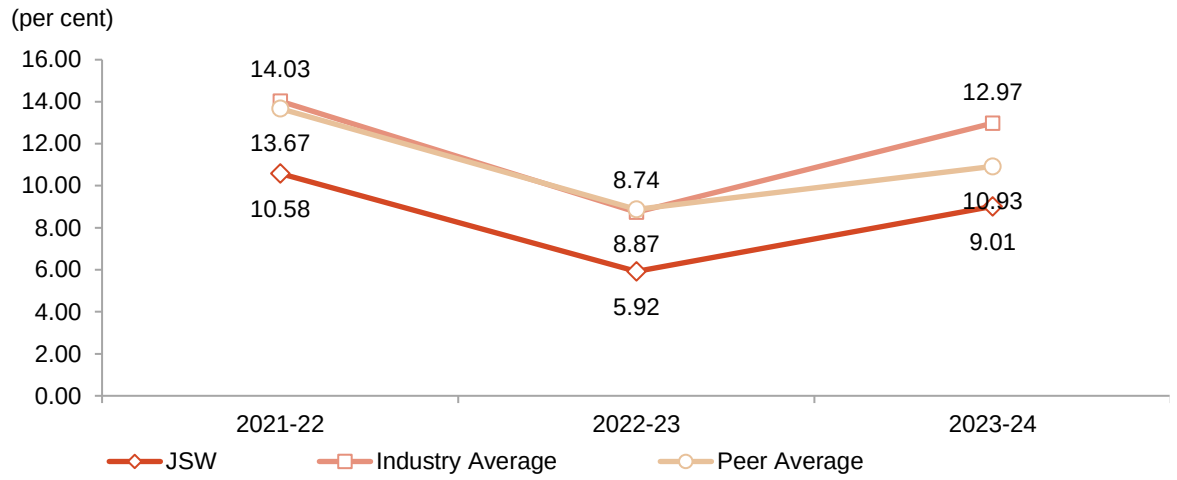
Source: Company annual reports

Operating EBITDA Margin (%)



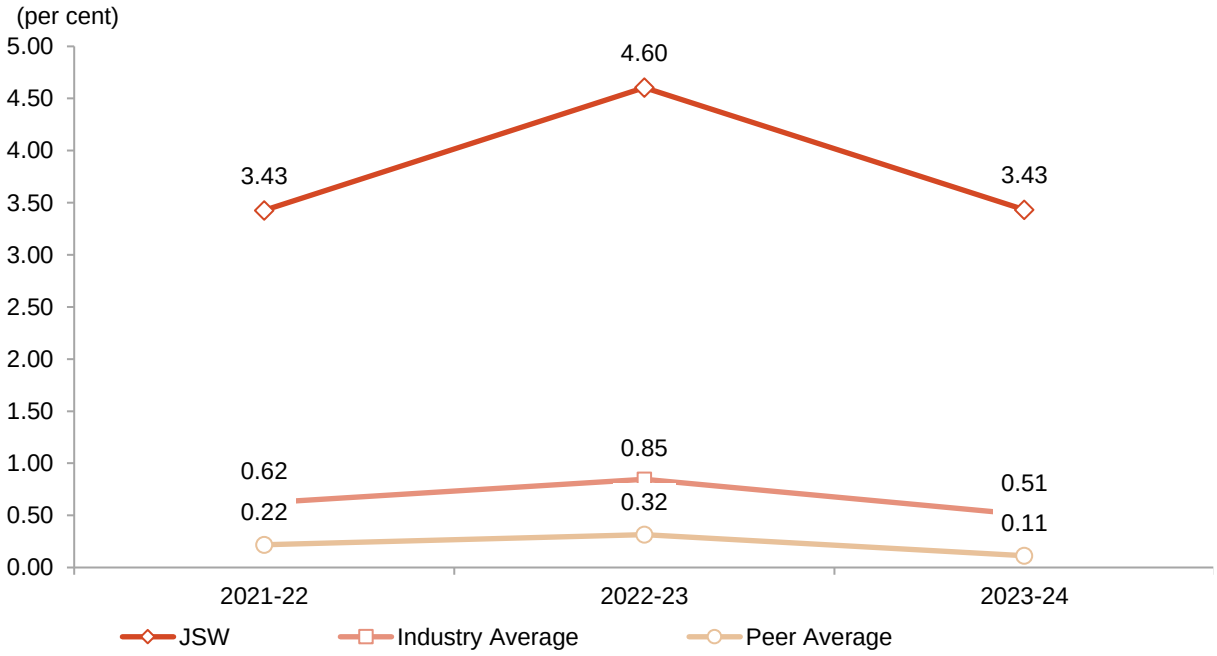
Source: Company annual reports

RoCE (%)



Source: Company annual reports

Net debt/Operating EBITDA (times)



Source: Company annual reports

Waste usage as percentage of Raw material

JSW Cement has the highest waste usage as a % of raw material among the peers mentioned in the table below:

Company	FY22	FY23	FY24
Ambuja Cements Limited	13.89%	13.80%	29.03%
Dalmia Bharat Ltd	39.00%	42.00%	41.00%
JK Cement Limited	22.40%	22.70%	21.00%
Shree Cement Limited	27.23%	27.96%	24.41%
The India Cements Limited	-	-	-
The Ramco Cements Limited	16.00%	14.00%	16.00%
UltraTech Cement Ltd	19.12%	20.60%	20.84%
Peer-Average	**22.94%**	**23.51%**	**25.38%**
JSW Cement	**66.00%**	**75.00%**	**64.08%**

Source: Company annual reports

Emission intensity of major players

CO_2 emissions in kg per tonne of cementitious material

	FY22			FY23			FY24		
Company	**Scope 1**	**Scope 2**	**Total**	**Scope 1**	**Scope 2**	**Total**	**Scope 1**	**Scope 2**	**Total**
Ultratech Cement Ltd	582	11	593	557	16	573	557	16	573
Ambuja Cements*	529	22	551	513	21	534	559	22	581
Shree Cement	530	-	-	521	14	535	542	11	553
Dalmia Bharat Ltd	489	20	509	463	23	486	459	15	474
Ramco Cements	-	-	-	-	-	591	-	-	590
JK Cement	535	18	553	520	28	548	512	51	563
The India Cements Limited	-	-	-	-	-	-	-	-	-
Peer Average			**552**			**545**	**526**	**23**	**556**
JSW Cement	**220**	**46**	**266**	**173**	**33**	**206**	**241**	**29**	**270**

Top global cement companies	**CY 2022**			**CY 2023**		
	Scope 1	**Scope 2**	**Total**	**Scope 1**	**Scope 2**	**Total**
Holcim	562	37	599	545	36	581
Heidelberg#	551	-	-	534	0.93	535
Cemex	562	53	615	541	51	592
CRH	-	-	566	-	-	562
Global Peer Average			**593**			**568**

Source: Company annual reports
Note: Total emission is addition of Scope 1 and 2
Peer group average of scope 1, scope 2 and Total emissions is average of the reported numbers of the above-mentioned ompanies
Top global cement companies mentioned above have installed cement capacity of more than 40MTPA
**For Ambuja, FY22 is January-December 2022 and FY23 is January 2023-March 2024*
#Heidelberg distinguished its market- and location-based Scope 2 emissions for the first time in 2023. Data for prior years is not available.

In fiscals 2022, 2023 and 2024, JSW's carbon dioxide emission intensity was 266 kg per tonne, 206 kg per tonne and 270 kg per tonne, respectively, which was approximately 52%, 62% and 51% lower than the average of emissions reported by Indian peer group.

JSW Cement's Co2 emission intensity in FY24 was ~53% lower compared to average Co2 emission intensity of global cement companies (mentioned in the above table) in 2023.

Clinker ratio of peer companies

Clinker ratio of peer set as of FY24:

Clinker ratio	FY24
Ambuja Cements Limited	64.30%
Dalmia Bharat Ltd	59.30%
JK Cement Limited	63.70%
Shree Cement Limited	64.66%
The India Cements Limited	-
The Ramco Cements Limited	77.00%
UltraTech Cement Ltd	69.60%
JSW Cement Ltd	**46.60%**
Peer-Average	**66.43%**

Source: Company reports

JSW's clinker ratio of 46.60% is lower than the average clinker ratio of 66.43% among the peer cement manufacturing companies mentioned in the above table as of Fiscal 2024.

Notes

1. All financials have been adjusted based on CRISIL Ratings standards.

2. Financial data for FY24 is as per financial statements of Annual reports, given the annual report of the company is published as on July 31st, 2024. Otherwise, financial data taken as per

quarterly results. FY24 numbers for such companies are subject to changes post release of Annual reports.

3. Raw Material cost includes cost of material, purchase of stock-in-trade, changes in inventories

4. Company set for Peer group: 7 companies accounting for 58-60% of Pan-India capacity as of fiscal 2024

Ambuja Cements Limited-(Consolidated), Dalmia Bharat Ltd -(Consolidated), Shree Cement Limited-(Consolidated), UltraTech Cement Ltd -(Consolidated), India Cements Ltd -(Consolidated), J.K.Cement Ltd-(Consolidated), The Ramco Cements Limited-(Consolidated)

5. Company set for Industry Average: 18 companies accounting for 75-80% of Pan-India capacity as of fiscal 2024

Ambuja Cements Limited-(Consolidated), Birla Corporation Ltd -(Consolidated), Dalmia Bharat Ltd -(Consolidated), Deccan Cements Ltd, Heidelberg Cement India Limited, India Cements Ltd -(Consolidated), J.K. Cement Ltd -(Consolidated) , JK Lakshmi Cement Ltd-(Consolidated) , Orient Cement Limited, Prism Johnson Limited-(Consolidated), Sagar Cements Ltd -(Consolidated), Saurashtra Cement Ltd. -(Consolidated), Shree Cement Limited-(Consolidated), Shree Digvijay Cement Co. Ltd. -(Consolidated), Star Cement Limited-(Consolidated), The Ramco Cements Limited-(Consolidated), UltraTech Cement Ltd -(Consolidated), Nuvoco Vistas Corporation Ltd –(Consolidated)

13 Regulations and manufacturing process

13.1 Government policies and regulations impacting cement sector

13.1.1 Environmental regulations

In India, environmental issues are handled by the Central Pollution Control Board (CPCB) and the state pollution control boards (SPCBs). To ensure compliance with emission standards, SPCBs undertake routine inspection of cement plants and limestone quarries. In accordance with the actions of the environmental surveillance squad, the CPCB also inspects cement facilities to ensure compliance with emission requirements. The Corporate Responsibility for Environmental Protection (CREP) charter, which promotes corporate responsibility for environmental protection, must be followed by cement companies.

The Indian cement industry needs to comply with the environmental acts and regulations implemented by the Ministry of Environment, Forest and Climate Change. These regulations cover a variety of environmental aspects, including noise pollution, use of forest land and wildlife, generation and discharge of trade effluents, and generation and discharge of air pollutants under the Water (Prevention & Control of Pollution) Act, 1974. The following acts are applicable to the cement industry:

- Water (Prevention and Control of Pollution) Cess Act, 1977
- Air (Prevention and Control of Pollution) Act, 1981
- Environment (Protection) Act, 1986
- Hazardous Waste (Management Handling and Transboundary Movement), 2008
- Forest (Conservation) Act, 1980
- Factories Act, 1948
- Wildlife (Protection) Act, 1972
- Mines Act, 1952

13.1.2 Evolution of Cement Industry

With a total capacity of about 637 million tonnes as of 2023-24, India is the world's second largest cement producer in the world after China with ~8% share in global cement production. However, the growth rate of cement was slow around the period after independence due to various factors like low prices, slow growth in additional capacity and rising cost. In 1956, the price and distribution control system was set up to ensure fair prices for both the manufacturers and consumers across the country and to reduce regional imbalances and reach self sufficiency.

With the easing of licensing, price & distribution controls aided rapid capacity expansions, which led to a surplus position. The evolution can be split into three distinct periods:

- Total government control (up to 1982)
- Partial decontrol (1982 to 1989)
- Total decontrol (after 1989)

Total government control (1942-1982)

In this phase, the government exercised strict control by fixing production limits, prices and distribution channels to ensure fair prices for consumers and commensurate remuneration for producers across the country. The price set was based on the cost of production of cement throughout the country plus a marginal profit. The price also considered freight cost component that was averaged for the whole of India. However, producers lacked incentives to minimise costs, which drove up the average cost of production.

Partial government decontrol (1982-1989)

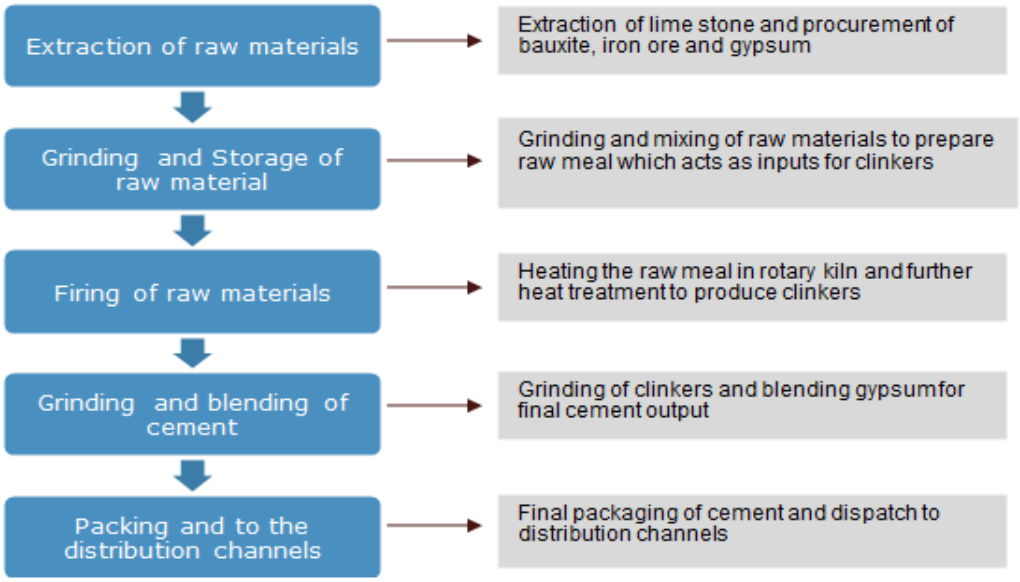
Recognising the uniform price system's inefficiencies, the government introduced a system of partial decontrol in 1982. While existing producers had to sell 66.4 per cent of their produce to the government at a ceiling price, new and sick units had to sell half of the output. The balance could be sold in the open market. While producers earned a stable profit on the levy sale to the government, gains from open market sales decreased, as market supply increased, which heightened competition. Thus, the government gradually reduced the levy quota and hiked retention prices to boost profitability from open-market sales.

Total decontrol

In 1989, the government completely removed price and distribution controls. A subsidy scheme replaced the freight pooling system to ensure availability of cement at reasonable prices in remote regions. In 1991, Economic liberalization policies opened the Indian economy, leading to increased foreign investment in various sectors, including cement. In 1997, The Indian government allowed 100% foreign direct investment (FDI) in the cement sector, which opened up opportunities for the industry and was marked by huge investments.

13.2 Cement production process

Stages of cement manufacturing



Source: CRISIL MI&A Research, industry

Key inputs

Limestone is a key input in clinker production. Additives such as bauxite, iron ore and gypsum are added to it to manufacture cement. The grades of limestone and proportion of additives used determine the quality of cement produced. Similarly, the choice of fuel depends on availability, cost and process efficiency. Players are considering using alternatives generated from agro waste, waste oils, animal meal, rice husk, etc to address the shortage in these inputs and their rising prices.

Stage 1: Manufacturing clinker

Step1: Limestone Mining, exploration, drilling and blasting

In limestone benching, the quality of the input is assessed and compared with benchmarks before the additives are mixed. The benched limestone is then drilled and blasted into small pieces. Blasting takes place in two stages - primary and secondary - wherein if the limestone pieces are not small enough in the first stage, they are further broken down in the second stage. After blasting, the limestone is extracted and transported for crushing.

Step 2: Crushing

Here the limestone is crushed to make particles suitable for blending and storage. After this, all raw materials including additives are ground. The fineness depends on the process requirement and the grinding mill used. Generally, crushing is done in two stages, in a primary crusher and a secondary crusher. The primary crusher is either a mobile and self-propelled unit operating near the quarry face, or a semi-mobile unit moved at infrequent intervals, or a static unit. The secondary crusher is static unit and is used if required.

Step 3: Pre-homogeneous stage

In this stage, crushed limestone is packed and transported for stacking in piles. The stacked limestone is then reclaimed by a reclaimer which transports the limestone to a hopper, where additives like silica,

alumina, and iron ore are added to make the mixture uniform, so as to reduce chemical variations in limestone.

Step 4: Raw mill grinding

Here, the raw meal (comprising limestone, clay and additives) is finely ground (so that it reacts fully) before being burnt in the kiln. There are two types of mills: while vertical roller mills are used for huge capacities, ball roller mills are used for smaller plants. Choice of the mill is also influenced by the type of raw material, power consumed and project outlay. Modern mills use separators/classifiers, which separate the fine product and return the coarser particles to the grinder.

Step 5: Blending and storage

The raw meal/feed is stored in the first silo while continuously blended in the second silo. The feed could also be simultaneously blended and stored in one large silo, wherein blending is done through a series of orifices in the base, with limited fluidisation.

Step 6: Pre-heating stage and kiln

After being blended, the raw meal is heated in a preheater followed by a rotary kiln, ensure better product quality. Preheater consists of vertical cyclone chambers where the raw material passes through and comes in contact with hot gases from kiln.

The shape and size of the kiln is also central to cement-making. The kiln is lined with refractory bricks for insulation throughout high-heat zones. The kiln is cylindrical and slightly inclined horizontally (by 3-4 degrees), and completes 2-4 revolutions per minute. While earlier, alumina refractory bricks were used, mostly in the pre-heating stage, light-weight, high-strength variants are being used now. Analog instrumentation panels are being replaced by digital ones. The introduction of microprocessors has helped cement makers adapt to a slew of automatic control processes in the plant.

The solid material passes down the opposite to the flame. Gas, oil, or pulverised coal is used to ignite the flame at the lower or front-end of the kiln. The formation of clinker involves multiple processes, beginning with the evaporation of water, thermal decomposition of clay minerals (at 300-650 degree Celsius), calcite formation (at 800-950 degree Celsius), liquid formation (at about 1,250 degree Celsius), and finally, formation of clinker (at 1,400-1,450 degree Celsius).

The clinker then passes into a cooler, before being ground further. The heat is reclaimed and recycled to the kiln as secondary combustion air. Introduction of precalcination has increased clinker output by 2-2.5 times and aided the use of low-calorific value coal, as well as various agricultural and industrial combustible wastes. Systems have been developed to use fuels like lignite and petcoke and other alternatives. Single kilns capable of producing more than 6000 tonnes per day capacity have already been installed.

Stage 2: Clinker to cement

Step 1: Grinding and blending

Cement is produced in a separate grinding mill by grinding cooled clinker with gypsum. Depending upon the grade and type of cement being manufactured ,blast-furnace slag, fly ash, natural pozzolanas, etc, or limestone are also added to the clinker. The Mixture of clinker, gypsum and Fly Ash/ Slag is then ground

into a fine and homogenous powder in a ball mill/vertical roller mill/roller press. The cement is stored in silos before being dispatched either in bulk or as bags.

Grinding

Moving over from ball mills (open/closed circuit systems), there are various upgraded technologies that have been developed. Closed-circuit systems: Cement plants use a closed-circuit system, where material from the grinding mill is taken to an air separator or a classifier. Here, based on the particle's size, the mass is separated into 'fine product' stream and a 'coarse reject' stream. The 'coarse reject' stream is then reground. The diameter of the mill is up to 4.5 metres, with a length to diameter (L/D) ratio of around 3. The 'coarse reject' stream is recirculated at a rate like that of the clinker feed.

The closed-circuit grinding system is more efficient than the open circuit system, as the rejected particles can be re-circulated, and power consumption is also lower (especially for higher compression cement). However, for making ordinary portland cement (OPC), energy savings are lesser as the clinker percentage is higher.

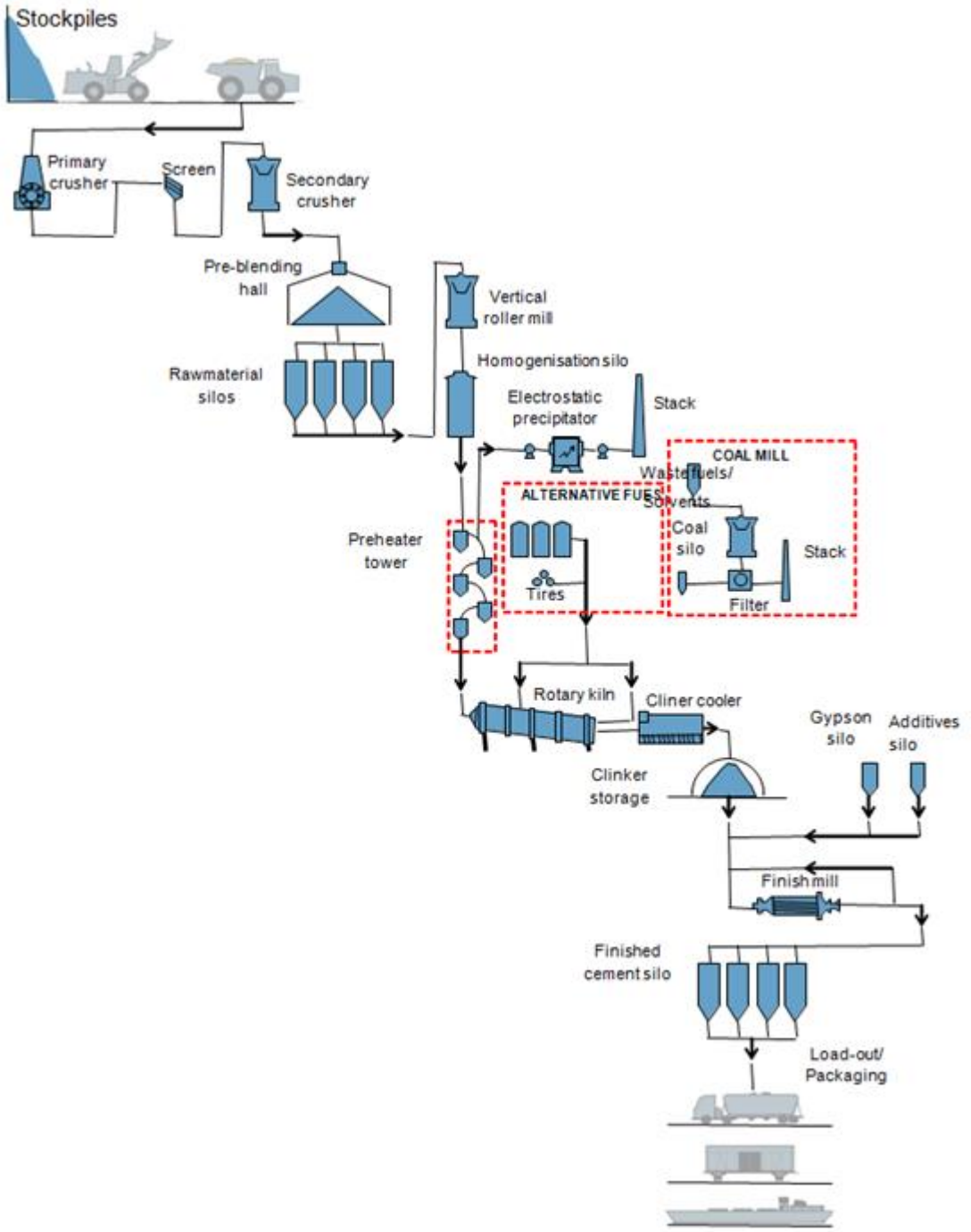
Thus, closed-circuit grinding systems consume 35-40 kWh/tonne. In case higher compression cement variants which harden rapidly such as the OPC-43 and OPC-53 grades, 3-5 per cent of energy is saved, as compared to the open circuit grinding system, where the energy consumption is 55 kWh/tonne.

Vertical Roller Mill (VRM): This is another breakthrough in the grinding process. Besides a higher drying capacity, the VRM consumes 20-30 per cent lesser power as compared to ball mills.

High Pressure Grinding Rolls (HPGRs): HPGRs operate in different modes: open circuit, pre-treatment with circulation, pre-treatment with de-agglomeration & recirculation and closed circuit. Such installations could increase capacity by up to 200 per cent and consume 30-40 per cent less power, compared with ball mills.

Horizontal roller mill: This can produce uniform raw meal and has advantages in processing raw materials containing higher percentage of quartz. However, this technology system is yet to be adopted in India.

Cement manufacturing process



Source: CRISIL MI&A Research, industry

Heat treatment processes

There are four heat treatment processes – dry, wet, semi-wet and semi-dry. Until the 1970s, the wet process was predominantly used. However, since the early 1980s, use of the dry process has increased significantly.

Dry process: This process is commonly used globally to manufacture cement as it is more energy efficient. In the dry process, the kiln feed has moisture content of 0.5%.

Wet process: In this process, the kiln feed has a moisture content of 30-40% and deflocculates (for reducing viscosity) to enable pumping.

Semi-wet process: In this process, the slurry is dehydrated in a filter press to form a cake with moisture content of ~20%.

Semi-dry process: Here, the raw meal is pre-treated, as in the dry process. In an inclined rotating dish or drum, the raw meal is made into nodules of ~15 mm spheres, with moisture content of ~12%.

From cement storage silos, cement is extracted and conveyed to packaging machines. Through a process of microprocessor-based filling and weighing, the cement is packed in polypropylene or laminated bags, maintaining a uniform bag weight of 50 kgs.

Use of alternative fuels

The cement industry predominantly uses coal-based power, generating 3,200-3,300 kilo joules/kg of heat. Burning fossil fuels such as pulverised coal/oil in the rotary kiln generates high-grade heat. But as these fuels are progressively becoming expensive and difficult to procure, there is an increasing need for alternative fuels such as agro waste, waste oils, animal meal and rice husk. These are being tested and used based on the manufacturing method, cost-effectiveness and availability.

13.3 Threats and Challenges in Cement Industry

India's cement industry stands as a formidable force, holding the position of the world's second-largest cement producer. However, the industry in India faces several challenges, including environmental concerns, land acquisition, logistics issues, etc. Major risks faced by the industry are:

Environmental concerns

The cement industry is identified as one of the 17 categories of highly polluting industries as per Central Pollution Control Board (CPCB). Process of calcination is the largest CO2 contributor in cement manufacturing which accounts for ~60% followed by fuel combustion (30%) and power and other logistics (10%). In cement production, large amounts of CO2 are emitted, about 900kg-1 tonne of CO2 per tonne of clinker. Share of CO2 in greenhouse gas emissions is the highest, accounting for close to 98-99% of the total emission while that of NOx and Methane remains negligible. However, with higher focus towards sustainability and net-zero emissions, the government can play a pivotal role in facilitating the industry's transition towards greener practices by implementing green public procurement policies. To maintain pace with sustainability goals, players are focusing on alternative energy/fuel consumption, usage of renewable sources and increasing share of blended cement to limit clinker usage.

Volatility of input costs

Power and fuel costs account for a large chunk of cost of sales (~30% as of fiscal 2024). Imported coal and pet coke are the key fuels used in captive power plant and clinkerisation kiln, respectively. Prices of these commodities are governed by global demand and supply and are volatile in nature. After soaring high in fiscal 2023, energy prices have dwindled by 16-18% in fiscal 2024 on-year basis in line with correction in

crude oil prices post Rusia-Ukraine conflict. However, any further geo-political tension impacting crude/coal prices, to remain key monitorable.

Increased competition

The Indian cement industry is fragmented, with the presence of few large players and many medium and small players. Players can be broadly classified as pan-India, regional and standalone. During last decade, a rush of expansions, mergers, acquisitions and consolidations has reshaped the industry. Large acquisitions in the industry had been in the form of foreign players acquiring domestic companies followed by M&A between domestic players. Taking into account the capex plans of the large players, the cement industry is on the road to becoming more competitive, with more consolidations expected. Indeed, while most of the stressed assets have been acquired over the past five years, CRISIL MI&A anticipates an acceleration in consolidation where other relatively weak mid-size and small assets will be the focus.

Alternatives to cement

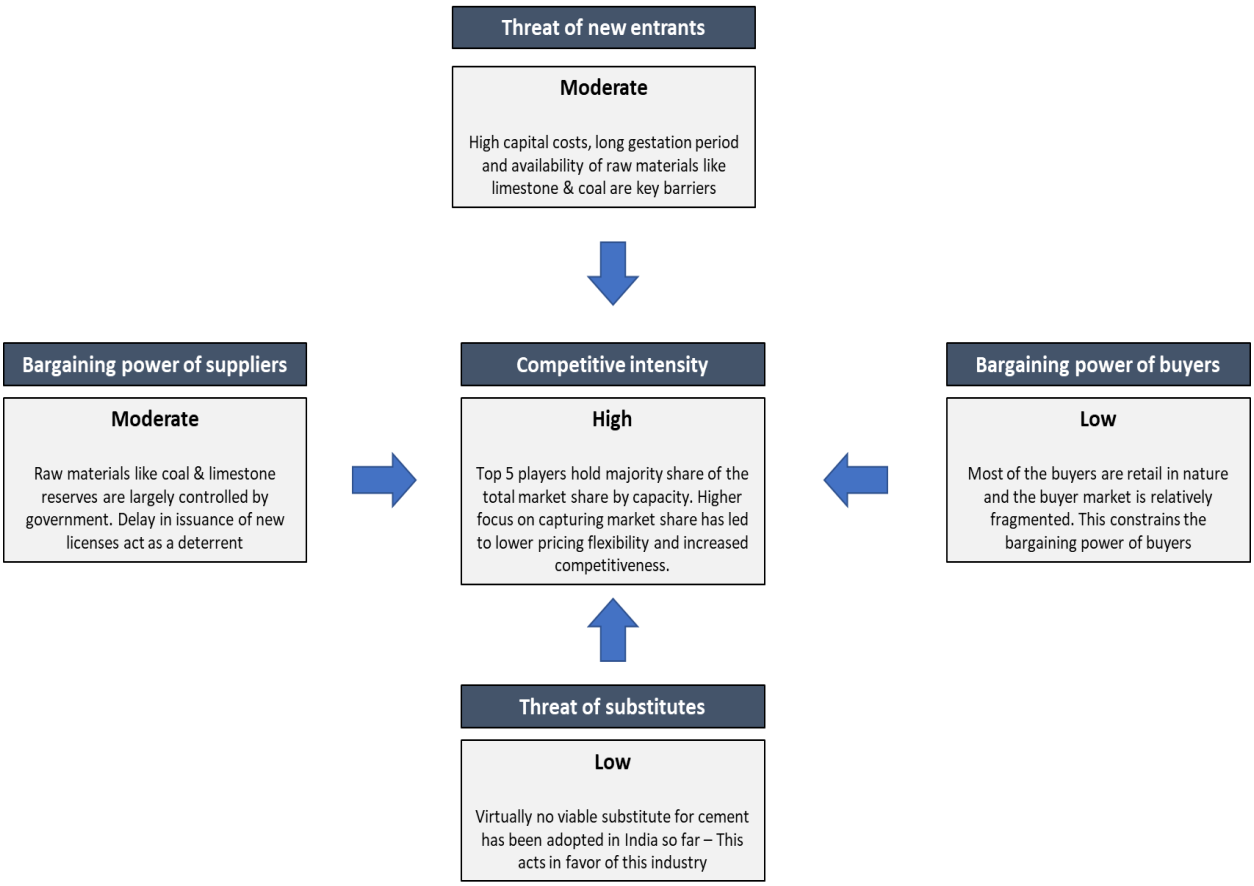
There are several alternatives to traditional Portland cement that can help reduce the environmental impact of the cement industry. While such technologies/products are at nascent stage in India, adoption of the same has started globally. It includes:

Geopolymers - Geopolymers are made from fly ash, waste product from coal-fired power plants, and alkaline activators such as sodium hydroxide or potassium hydroxide. Geopolymers have been shown to have similar strength and durability to Portland cement, but they have a much lower carbon footprint.

Limestone Calcined Clay Cement (LC3) – it is a new type of cement that is based on a blend of limestone and calcined clay. LC3 can reduce CO2 emissions by up to 40%, is made using limestone and low-grade clays, which are available in abundant quantities, is cost effective and does not require capital intensive modifications to existing cement plants.

Calcium sulfoaluminate (CSA) cement: CSA cement is made from calcium sulfate and aluminum silicate. It has a lower clinker content than Portland cement, which means that it produces less CO2 emissions. CSA cement is also more resistant to sulfate attack, making it a good choice for use in applications where concrete is exposed to seawater or other aggressive chemicals.

Porter’s five force analysis



Source: CRISIL MI&A Research, industry

Threats and challenges for RMC and GGBS industry

Raw material are the fundamental substances or components essential for the production of RMC and GGBS. Non availability of consistent and good quality blast furnace slag in case of GGBS, and aggregates, admixtures in case of RMC are key concern areas of the industry. Price fluctuation of these raw material also is a challenge for these industries. Further, transporting the raw material and the finished product over a long distance adds to the total cost and is a key concern for the industry. Availability of skilled and trained manpower for operations and maintenance of equipment and plant too remain a key challenge for the RMC and GGBS industry.

14 Annexure

14.1 List of some of the certifications that allow the use of GGBS

Sr. no	Relevant certification
1	IS 456-2000 for Plain and Reinforced Concrete Code of Practice
2	Ministry of Railways - Guidelines for the Use of High Performance Concrete in Bridges (RDSO)
3	Municipal Corporation of Greater Mumbai (Various road tenders)
4	CPWD specifications (Volume 1) – 2009
5	Maha Metro – UFC-01: Design of Construction of Underground Stations at Shivaji Nagar and Civil Court and Associated Tunnels
6	Department of Atomic Energy -Specification for Civil Works (2015)
7	Indian Roads Congress (IRC :15-2017)
8	Indian Road Congress – Guidelines for Use of High Performance Concrete in Bridges (IRC: SP: 70-2005)

Source: Industry, CRISIL MI&A Research

14.2 List of some of the projects where use of GGBS has been approved in India

Sr. no	GGBS approvals in various projects
1	Ahmedabad Metro Rail Corporation Limited
2	Bangalore Metro Rail Corporation Limited
3	Delhi Metro Rail Corporation Limited
4	Pune Metro Rail Maha Metro
5	Mumbai Metro Rail Corporation Line #3
6	National Highway Authority Of India
7	Proposed NH66 – Indapur, Maharashtra to Zarap, Maharashtra (Mumbai Goa highway)
8	Proposed NH17 – Panjim, Goa to Mangalore, Karnataka
9	NH75 - Addahole to Bantawal
10	NH4b - JNPT phase #2 to Kalamboli - Ashoka Buildcon limited
11	NH4b - gavan phata interchange - Kumar JM Mhatre JV
12	NH65/NH50/NH52/NH52k — Latur, Nilanga
13	NH211 – Solapur, Mahrashtra to Yedshi, Maharashtra
14	NH266 – Tasgaon, Maharashtra to Shirdhon, Maharashtra
15	NH75 – Hassan, Karnataka to Maranahally, Karnataka

16	NH166 6 NH166e - Nagaj to Path to Mulchandi
17	Maharashtra State Road Development Corporation Limited
18	Nagpur Mumbai Samruddhi Expressway
19	Mangaon, Maharashtra to Dighi port, Maharashtra
20	Tala, Maharashtra to Agardanda, Maharashtra
21	NH548C Satara, Maharashtra to Mhaswad, Maharashtra
22	APTIDCO & APRCDA Andhra Pradesh
23	Bengaluru International Airport
24	PWD Goa-Zuari river bridge project Goa
25	GSIDC Goa - Mandovi river cable stayed bridge project Goa
26	Dedicated Freight Corridor Corporation Of India Limited
27	Konkan Railway Corporation Limited
28	Mumbai Coastal Road South
29	Vizhinjam International Seaport
30	Mumbai Pune corridor - project for capacity augmentation
31	Bharat Ratna Babasaheb Ambedkar Memorial, Mumbai
32	Director General of Naval Ports (Naval Dockyard)
33	Shriram Janm Bhoomi Teertha Kshetra, Ayodhya
34	3rd Vashi creek bridge- Thane creek bridge TCB3
35	Mumbai Elevated Metro Line 2B
36	Cisco Mass Housing, Navi Mumbai
37	NH361- four lining of choker aloha section of Latur Nanded road
38	NH6 four lining work of package 4, section Amravati Chikghli section
39	Surat Metro Rail Corporation

Source: JSW Cement, CRISIL MI&A Research

14.3 List of blast furnace units in India

BF Sr. no.	Plant name	Location	BF capacity (tonnes)
BF 1	Jayaswals Neco Industries Ltd.	Raipur, Chhattisgarh	650000
BF 2	JSW Ispat Special Products Limited	Raigarh, Chhatisgarh	612500
BF 3	Orissa Metaliks Private Limited	Kharagpur, West Bengal	390000
BF 4	Atibir Industries Co. Ltd (Unit II)	Giridh, Jharkhand	600000
BF 5	Tata Steel Long Products Limited	Jamshedpur, Jharkhand	650000
BF 6	Tata Steel Ltd	Jamshedpur, Jharkhand	9600000
BF 7	JSW Steel Ltd	Vijaynagar, Karnataka	12000000

BF 8	Bhushan Power And Steel Ltd	Sambalpur, Odisha	2500000
BF 9	Shyam Metalics	Bardhaman, West Bengal	60000
BF 10	Electrotherm (India) Limited	Kutch, Gujarat	277200
BF 11	Rashmi Metaliks Ltd	West Medinipur, West Bengal	170333
BF 12	Jindal Steel And Power Ltd	Raigarh, Chhattisgarh	3050000
BF 13	Jai Balaji Industries Limited (Unit-IV)	Bardhaman, West Bengal	80500
BF 14	SMC Power Generation Limited (Unit II)	Jharsuguda, Odisha	120000
BF 15	Arcelor Mittal Nippon Steel India Ltd	Surat, Gujarat	3490000
BF 16	Sree Metaliks Limited	Kendujhar, Odisha	36000
BF 17	JSW Steel Ltd	Dolvi, Maharashtra	8000000
BF 18	Sunflag Iron And Steel Co Ltd.	Bhandara, Maharashtra	600000
BF 19	Jindal Steel And Power Ltd	Angul, Odisha	3200000
BF 20	Tata Steel	Meramandali, Odisha	3919000
BF 21	Jai Balaji Industries Ltd. – I	Bardhaman, West Bengal	30118
BF 22	Balmukund Sponge And Iron Pvt.Ltd	Giridh, Jharkhand	39600
BF 23	Arjas Steel Pvt Ltd (Gerdau Steel)	Anantapur, Andhra Pradesh	300000
BF 24	Sri Kalahasthi Pipes Limited (Lanco)	Chittoor, Andhra Pradesh	300000
BF 25	Vizag Steel Plant	Visakhapatnam, Andhra Pradesh	7300000
BF 26	SAIL - Bhilai Steel Plant	Bhilai, Chhattisgarh	7500000
BF 27	Vedanta Limited	Ponda, Goa	625000
BF 28	Electro Steels Ltd	Bokaro, Jharkhand	1450000
BF 29	Narsingh Ispat Ltd	Seraikela, Jharkhand	163875
BF 30	SAIL - Bokaro Steel Plant	Bokaro, Jharkhand	4360000
BF 31	Swati Concast And Power Pvt Ltd	Giridh, Jharkhand	72000
BF 32	Kalyani Steels Ltd	Koppal, Karnataka	480000
BF 33	Kirloskar Ferrous Inds Ltd	Koppal, Karnataka	385000
BF 34	SAIL - Visveswaraya Iron And Steel Ltd	Shimoga, Karnataka	118000
BF 35	SLR Metaliks Ltd	Bellary, Karnataka	240000
BF 36	Evonith Metallics Ltd	Wardha, Maharashtra	600000
BF 37	SAIL - Rourkela Steel Plant	Rourkela, Odisha	4400000
BF 38	Tata Steel Ltd	Kalinganagar, Odisha	3000000
BF 39	VISA Steel Ltd	Jajpur, Odisha	225000
BF 40	JSW Steel Ltd	Salem, Tamil Nadu	1000000
BF 41	Ankit Metal And Power Ltd.	Bankura, West Bengal	12325

BF 42	Electrosteel Castings Limited	Khardah, West Bengal	425000
BF 43	Jai Balaji Industries Ltd (Unit III)	Bardhaman, West Bengal	428750
BF 44	KIC Metaliks Ltd.	Bardhaman, West Bengal	265000
BF 45	Tata Metaliks Ltd	Kharagpur, West Bengal	600000
BF 46	Neo Metaliks Ltd	Durgapur, West Bengal	188000
BF 47	SAIL - Durgapur Steel Plant	Durgapur, West Bengal	1802000
BF 48	SAIL - IISCO Steel Plant	Burnpur, West Bengal	2500000
BF 49	Suraj Products Ltd	Sundergarh, Odisha	60000
BF 50	Ispat Damodar Ltd	Purulia, West Bengal	60000

Source: JPC, CRISIL MI&A Research

14.4 List of GGBS manufacturers in India

GGBS Sr. no.	Player name	Location
GGBS 1	JSW Cement Ltd	Vijaynagar, Karnataka
GGBS 2	JSW Cement Ltd	Dolvi, Maharashtra
GGBS 3	JSW Cement Ltd	Nandyal, Andhra Pradesh
GGBS 4	JSW Cement Ltd	Salem, Tamilnadu
GGBS 5	JSW Cement Ltd	Jajpur, Odisha
GGBS 6	JSW Cement Ltd	Salboni, West Bengal
GGBS 7	Sri Balaha Chemicals Pvt Ltd	Hindupur, Andhra Pradesh
GGBS 8	Sagar Cements Limited	Vishakhapatnam, Andhra Pradesh
GGBS 9	My Home Industries Pvt Ltd	Vishakhapatnam, Andhra Pradesh
GGBS 10	Chettinad Cement Corporation Pvt Ltd	Vijaywada, Andhra Pradesh
GGBS 11	Ultrafine Minerals & Admixtures	Nagpur, Maharashtra
GGBS 12	Suyog Elements India Pvt Ltd	Bharuch, Gujrat
GGBS 13	Pyramid Industries	Rajkot, Gujrat
GGBS 14	STP & Sons	Nagpur, Maharashtra

Source: Industry, CRISIL MI&A Research

14.5 Use of GGBS in overseas projects

Name of the project	Country	GGBS used
Spinnaker Tower	UK	50%
Wales Millennium Center	UK	55%
Persistence Works	UK	-
Clyde Wind Farm	UK	16,000 Tonnes

Blackpool Sea Defense	UK	50%
Second Severn Crossing road bridge	UK	70%
Liquefied natural gas (LNG) storage tanks at Milford Haven	UK	65%
The Welcome Trust Millennium Building	UK	70%
Queen Elizabeth II Bridge	UK	70%
Twenty Two Building	UK	68%
ORTUS Centre	UK	50%
20 Fenchurch St - Walkie Talkie	UK	50%
Clackmannanshire Bridge	UK	70%

Source: Industry, CRISIL MI&A Research

According to U.S. Geological Survey report, production (sales) of GGBS in the United States is estimated at 16 million metric tonnes in 2021, 2022 and 2023. The country imported 2.1, 1.7 and 2.1 million metric tonnes of GGBS in 2021, 2022 and 2023, respectively, for domestic consumption. The report also states that with 40% share, Japan is the leading GGBS exporter to the United States, during 2019-2022. Over the same duration, China, Brazil and Canada's share in total imports of GGBS stood at 23%, 18% and 7%, respectively.

14.6 GGBS manufacturers: Overseas

Name	Location
Heidelberg Materials UK (earlier known as Hanson UK)	UK
Boral Limited	Australia
Lafarge Emirates Cement LLC	UAE
Readymix Gulf LLC	UAE
Aggregate Industries	UK
JFE Mineral & Alloy Company Ltd	Japan
LKAB Minerals	Sweden

Source: Industry, CRISIL MI&A Research