

INDIA

Infrastructure Coming of Age



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Contents

Executive summary	05
Higher government capex to drive infrastructure growth	06
Government will lead funding, supported by financial institutions and asset monetization	10
Private investments will boost infrastructure investment cycle	20
Emerging segments in India for attractive investment opportunities	28

Executive summary

Building India

Between fiscals 2024 and 2028, the central government is expected to spend a whopping Rs 88 trillion in capital expenditure on infrastructure, an increase of ~80% compared with ~Rs 49 trillion in the previous five fiscals.

Government capex has historically been the driver of India's infrastructure buildout — soaring ~800% from a relatively modest Rs 1.12 trillion in fiscal 2014 to an estimated Rs 10 trillion in fiscal 2024.

These numbers underscore the government's recognition of infrastructure development as pivotal to economic progress.

Roads, railways and urban infrastructure have continued to lead infrastructure growth, consuming more than two-thirds of the overall capex pie.

India's commitment to capital investment has been substantial in recent years, with gross fixed capital formation (GFCF) increasing 55%. Notably, the share of infrastructure-related GFCF as a percentage of total GFCF has increased from 9.6% in fiscal 2013-17 to 14.1% in fiscal 2018-22.

In years to come, infrastructure investment from the private sector is expected to boost the investment cycle.

After a prolonged period of sluggishness, the capex cycle — especially corporate capex — has seen a resurgence since fiscal 2021, spurred by all that government spend.

The concerted activity will lead to investments in roads and railways almost doubling over the next five years. Road capex, in particular, is expected to increase 1.8 times over the medium term, led by construction of national and state highways.

The power sector will not be far behind. With power demand directly correlated to India's gross domestic product, demand growth is pegged at ~6% until fiscal 2030, higher than the 30-year average of 5.4%.

Focus on transmission and distribution will strengthen the grid energy efficiency and advanced metering infrastructure will reduce losses.

Renewable energy integration will boost growth of the segment, raising its share in total capacity 4x over fiscals 2023-30; its share in the generation mix, though, will grow slower.

Asset monetisation will support funding, given the huge potential presented by a large quantum of monetisable assets, especially roads and renewables, for top private players.

Green bonds support renewable energy projects by providing wider access to domestic and foreign capital. Infrastructure focused Non-banking financial companies (NBFCs) have also raised funds through green bonds.

Among other sectors that have investment potential, warehousing is expected to experience high growth. Simultaneously, the data center industry is expected to log a compound annual growth rate (CAGR) of ~20% between fiscals 2024 and 2028, led by robust investments by Indian and global players. Spending on urban infrastructure is expected to reach Rs 7.4 trillion over fiscals 2024-28, more than double the amount invested in the previous five years, with CAGR of 10-15%, driven by central government schemes.

Higher government capex to drive infrastructure growth

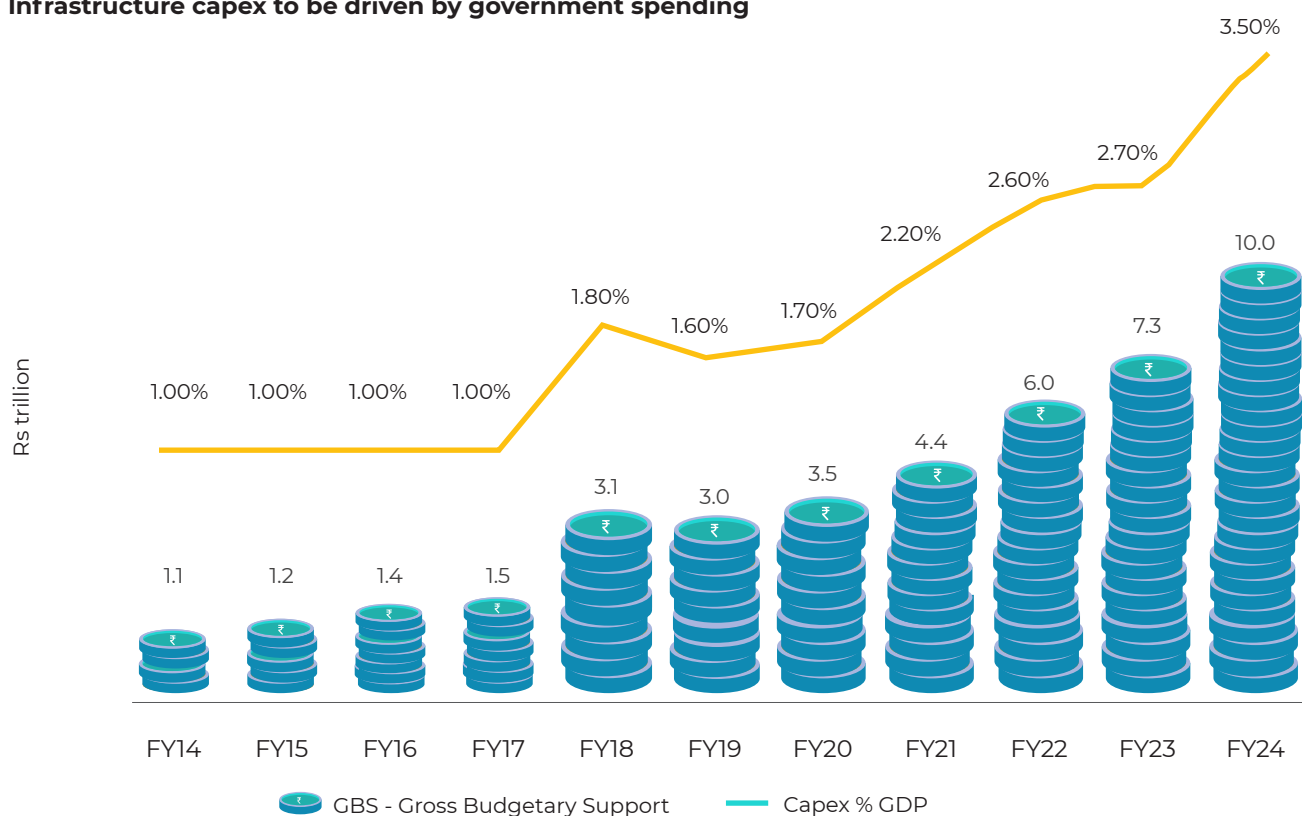
There has been a notable change in the government’s priorities, with a clear emphasis on infrastructure development, as indicated by the increasing trend in capital expenditure. Key sectors such as Roads, Railways, and Power have taken a prominent role in this development and are expected to continue attracting investments in the foreseeable future. Additionally, the infusion of private capital expenditure is anticipated to play a crucial role in augmenting India’s infrastructure, complementing various government initiatives like Gati Shakti and the National Infrastructure Pipeline.

In recent years, the government’s commitment to fostering economic growth through a robust infrastructure backbone has reflected in an increase in its capital expenditure (capex) for infrastructure development from just Rs 1.12 trillion in fiscal 2014 to

an impressive Rs 10 trillion this fiscal, marking a jump of nearly 800%.

More telling has been the increase in capex as a percentage of GDP — more than trebling from a mere 1% in fiscal 2014 to 3.5% this fiscal.

Infrastructure capex to be driven by government spending

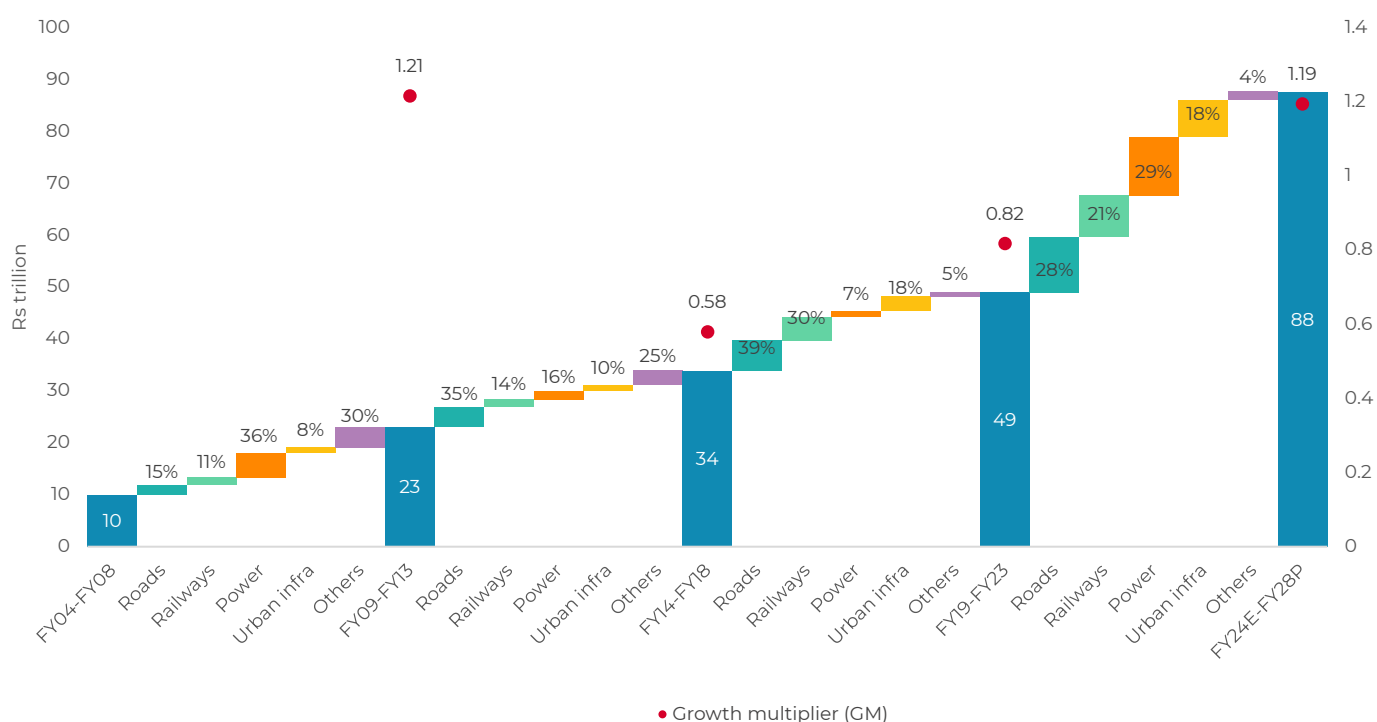


SOURCE: CRISIL MI&A RESEARCH

The Reserve Bank of India's recent study highlights the economic impact of capex, with a significant gross domestic product (GDP) multiplier of 2.45 in the first year and 3.14 in the following year for every rupee spent by the central government. The

traditional growth drivers – roads and railways – have made way for some additions, notable ones being power generation, urban infrastructure, and renewable energy (RE).

Overall infrastructure spends till FY28 is expected to be driven majorly by Roads, Railways & Power



Note - GM is calculated as: (CAGR of 5 years infrastructure spends / CAGR of 5 years current GDP spends)
SOURCE: CRISIL MI&A RESEARCH

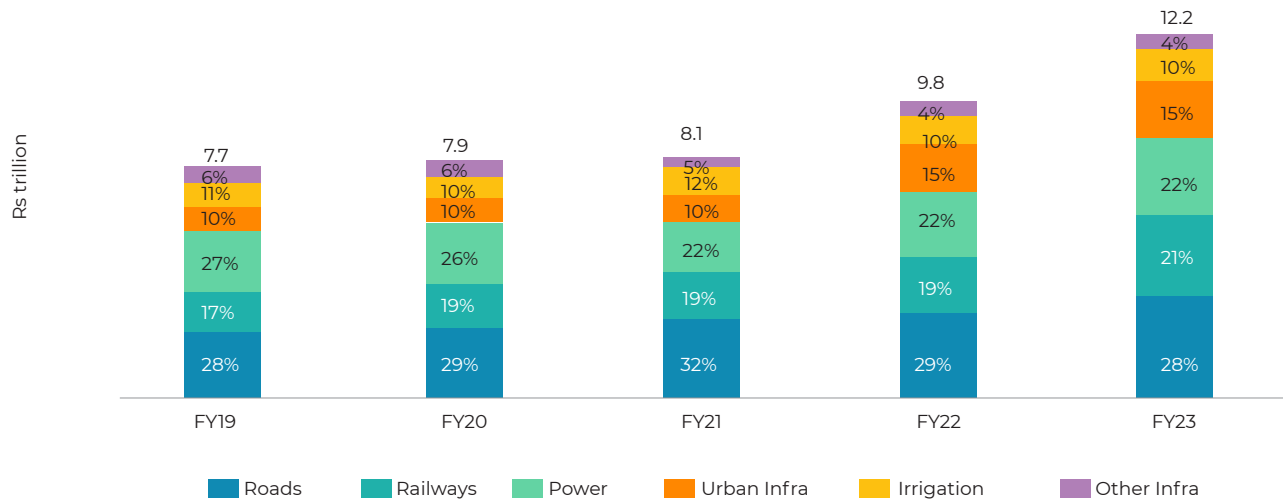
Roads, railways, power and urban infrastructure will lead growth

Infrastructure investments surged from Rs 7.7 trillion in fiscal 2019 to Rs 12.2 trillion in fiscal 2023, at 11% CAGR.

Notably, there has been a shift in investment allocation within the sector. Investments in roads and railways have consistently accounted for 45-50% of total infrastructure investments, emphasising the

importance of transportation for economic growth and connectivity. Urban infrastructure investments increased from 10% in fiscal 2019 to 15% in fiscal 2023, reflecting a growing focus on improving urban living standards and fostering sustainable urban development.

Roads, railways and power lead in infrastructure sector with 71% of capex share in fiscal 2023

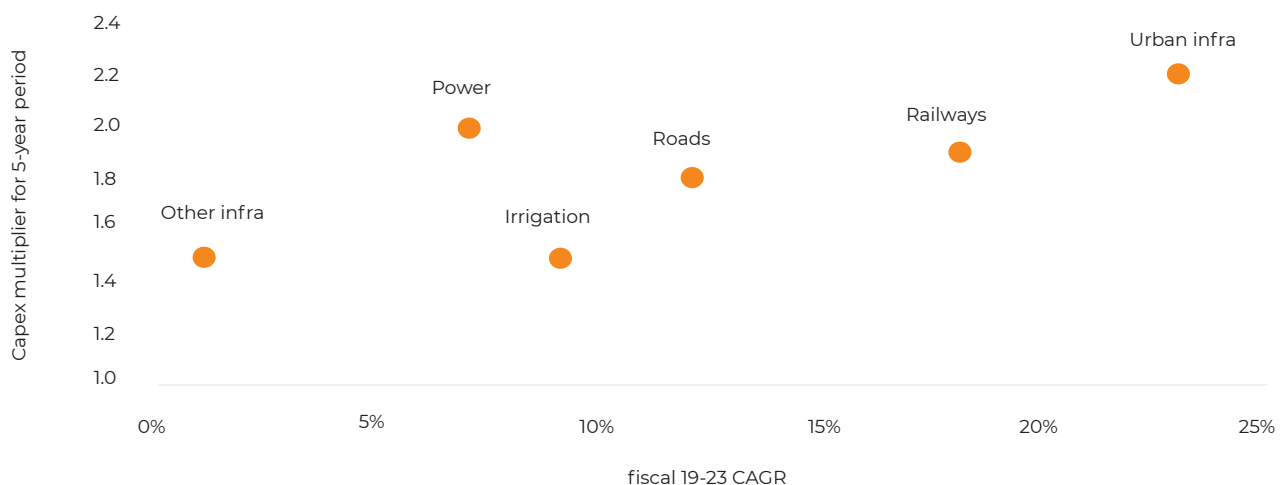


Source: CRISIL MI&A Research

The Indian government has launched initiatives such as the National Infrastructure Pipeline (NIP), National Monetisation Pipeline (NMP), Gati Shakti, Bharatmala and Jal Jeevan Mission to deliver top-tier infrastructure facilities and create a business-friendly environment. Over the next five years, urban infrastructure is projected to have a substantial

investment multiplier of 2.2x, with water supply and sanitation (WSS) accounting for a significant portion of it. Additionally, the roads, railways and power sectors are expected to witness nearly a twofold increase in investments, underlining their continued importance in India's infrastructure development.

Roads & railways & urban infra are leading sectors in infrastructure having CAGR >10% in last 5 years



Source: CRISIL MI&A Research

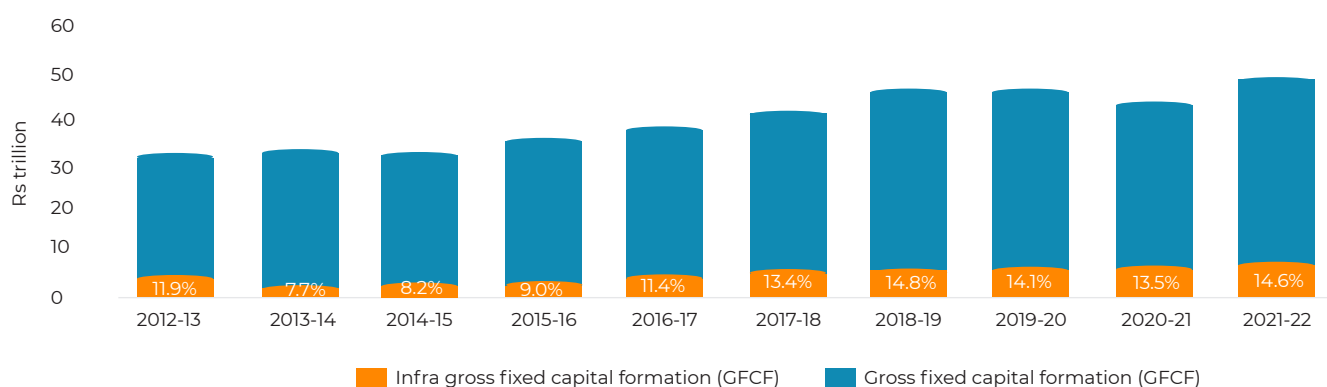
Gross fixed capital formation in infrastructure to increase, private investments to become more attractive

Over the period of fiscal 2013 to fiscal 2022, India demonstrated a substantial commitment to capital investment, with gross fixed capital formation (GFCF) increasing 55%. The share of infrastructure-related GFCF as a percentage of total GFCF increased from 9.6% between fiscals 2013 and 2017 to 14.1% between

fiscals 2018 and 2022. This shift reiterates the strategic emphasis on infrastructure development, highlighting its critical role in improving the nation's physical assets, sustaining economic growth, enhancing living standards and creating a competitive business environment

infrastructure sectors' share in overall GFCF has been on an increasing trend

Infra GFCF as % overall GFCF

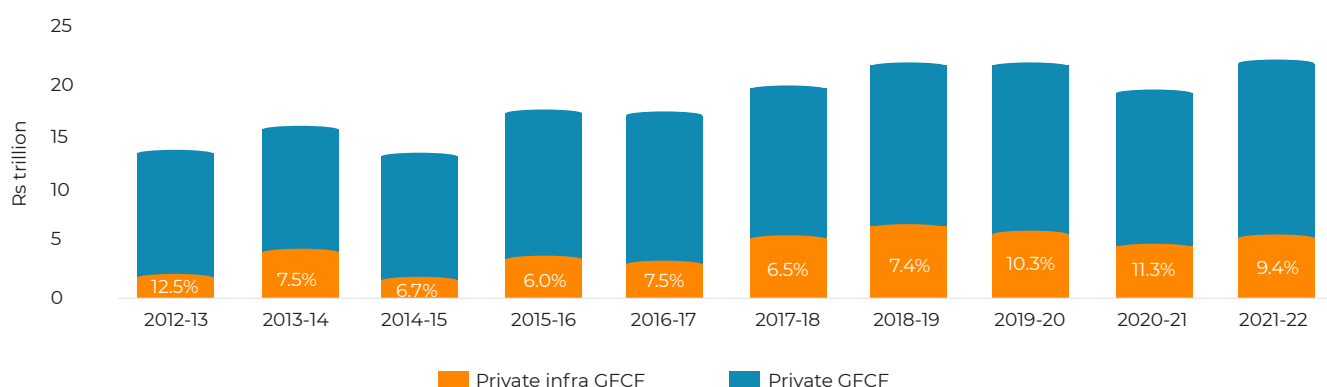


Source: MoSPI, CRISIL MI&A Research

Furthermore, the increase in private corporations' GFCF from Rs 11.4 trillion to 17.6 trillion over the same period is noteworthy. However, the relatively modest growth in private corporations' contributions to infrastructure, from 8% to 9%, suggests untapped potential for greater private sector involvement

in this space. Private companies are increasingly recognising the value and returns of infrastructure investments, and there are opportunities to incentivise and attract more private sector investments in infrastructure.

Share of private infra GFCF has remain muted



Source: MoSPI, CRISIL MI&A Research

Government will lead funding, supported by financial institutions and asset monetization

Capex towards Infrastructure is projected at Rs 88 trillion for next 5 years. The share of private sector in infrastructure investments was 18-22% in last 3 years. Central and state governments have played important role in funding. Central government's infrastructure budgetary allocation more than tripled from Rs 3 trillion in fiscal 2019 to Rs 10 trillion in fiscal 2024. Total Indian green bond issuances were \$21 billion as of February 2023, with the private sector accounting for 84% of total issuances. National Monetisation Pipeline, was drawn up to create revenue sources from unutilised or under-utilised public assets

Key government initiatives for infrastructure development

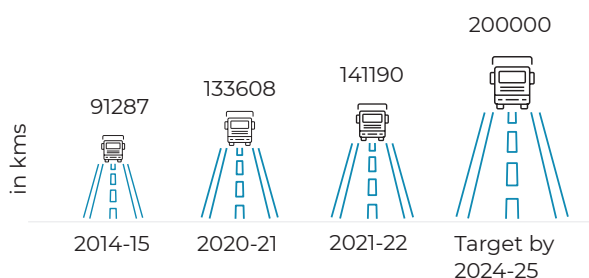
PM Gati Shakti

The PM Gati Shakti initiative is a crucial step in India's pursuit to become a \$5-trillion economy. It aims to benefit various stakeholders, including citizens, industries, farmers and rural communities. Its primary goal is to eliminate bureaucratic barriers and promote a unified approach to project planning

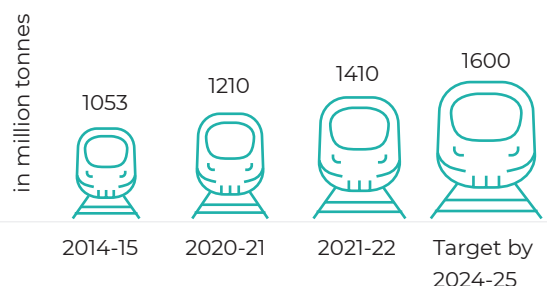
and execution, focusing on improving multi-modal and last-mile connectivity. PM Gati Shakti operates through seven key drivers – roads, railways, airports, ports, mass transport, waterways and logistics infrastructure – to boost comprehensive infrastructure development and national progress.

Ministry-wise targets/achievements under PM Gati Shakti

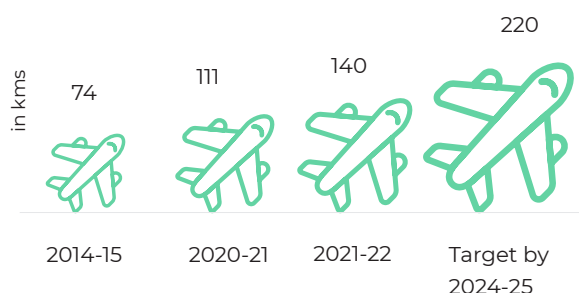
Total length of national highways (km)



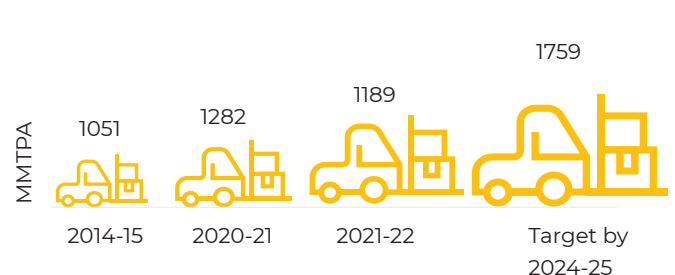
Cargo handled by railways (million tonne)



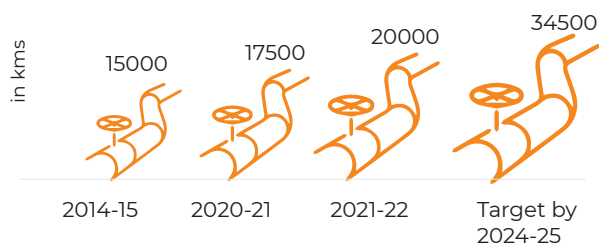
Airports/heliports/water aerodromes



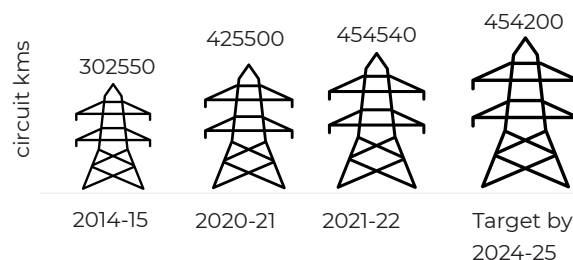
Cargo handled at ports (MMTPA)



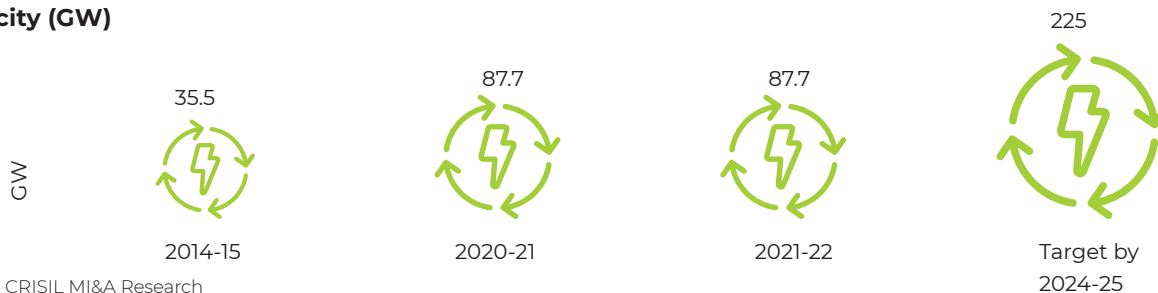
Length (km) of gas pipelines



Power transmission network (circuit km)



RE capacity (GW)



Source: PIB, CRISIL MI&A Research

National Infrastructure Pipeline (NIP)

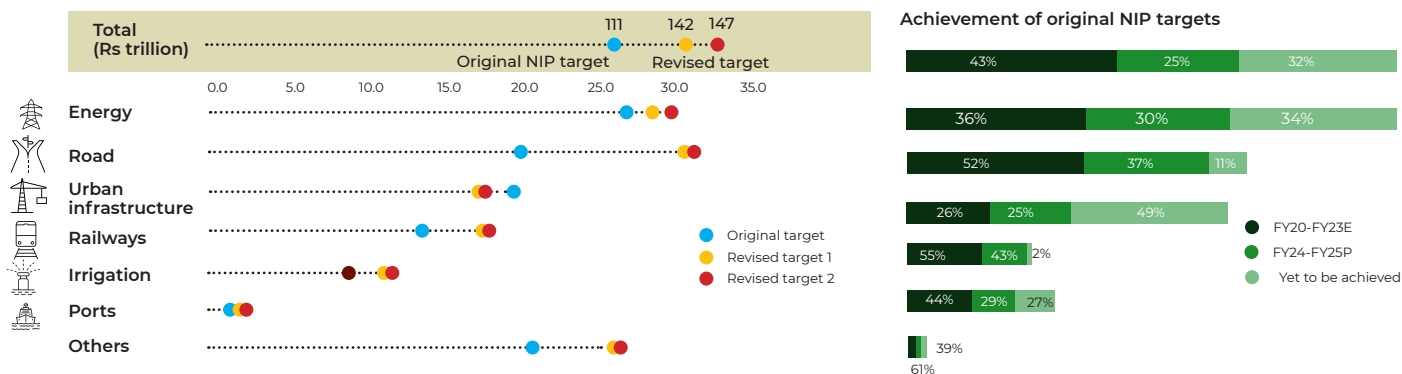
National Infrastructure Pipeline in India is a government initiative aimed at boosting economic growth by investing in infrastructure projects. Announced in 2019, for investing in various sectors such as energy, transportation, water, and social infrastructure.

NIP aims to channel substantial investments amounting to Rs 147 trillion (original target of 111 trillion) into India's infrastructure over five years, to support the nation's goal of becoming a \$5-trillion economy by fiscal 2025. NIP focuses on improving infrastructure on the supply side, with the aim of stimulating economic growth, creating employment and contributing to GDP growth. It emphasises

the importance of integrated logistics and aligning infrastructure development with Sustainable Development Goals.

In the NIP framework, ~81% of total infrastructure investment is allocated to roads, power, railways and urban infrastructure. However, a significant portion of infrastructure development still relies on public funds, with 64% of projects planned under the engineering, procurement and construction (EPC) mode, particularly in railways and roads. The government is expected to play a pivotal role in initiating spending and demonstrating effective project execution.

About half of NIP target projects are under construction



Notes: Project stats as per initial capital outlay target of Rs 111 trillion. LHS: Transport includes roads, railways, metros, ports, and airports. Energy includes thermal, renewables, etc. Water includes irrigation and sanitation. Social includes urban housing, medical and education infrastructure. Others include telecom, cold chains and industrial parks

Source: IIG, CRISIL MI&A Research

NHAI paving the path of growth in roads sector, with its debt to equity lowest in fiscal 2023 (compared to last 5 years)

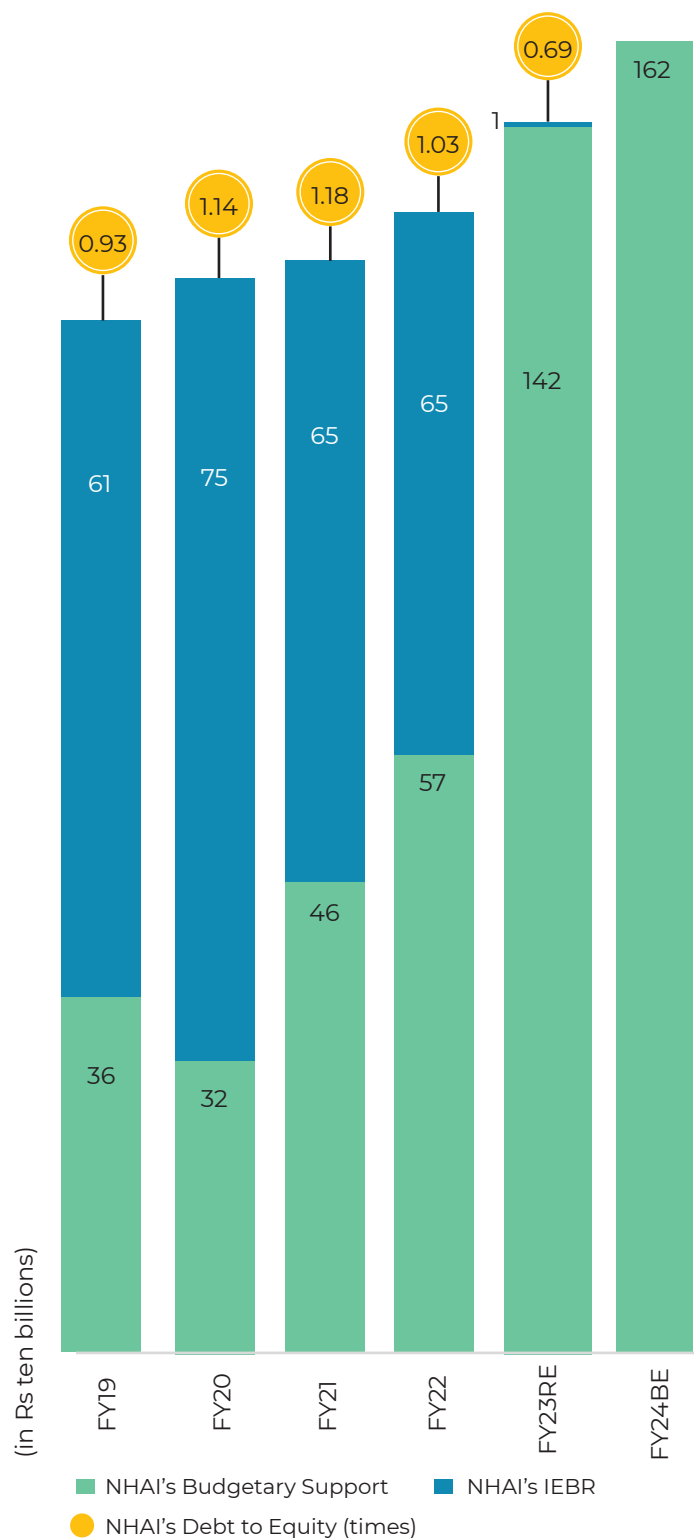
Infrastructure capex, projected at Rs 88 trillion over the next 5 years, presents a huge financing opportunity. While traditional sources such as government funding and financing from financial institutions will continue to play an active role, newer funding sources such as bond markets and infrastructure investment trusts (InvITs) are also expected to contribute significantly in the coming years. Additionally, green and sustainable financing has picked up pace of late. Its momentum is only likely to increase further, as India races to meet its sustainability goals.

So far, the share of private sector in infrastructure investments has been limited to 18-22% in last 3 years, due to skewed risk-sharing between private and public entities. As a result, central and state governments have done the heavy lifting in terms of infrastructure growth and investment through large budgetary allocations for the sector.

Government sources: Historically, both central and state governments have played a near- equal important role in funding infrastructure capital expenditure (capex). This trend was especially pronounced after the Covid-19 pandemic, when they ramped up their spends to revive their economies. The central government's infrastructure budgetary allocation more than tripled from Rs 3 trillion in fiscal 2019 to Rs 10 trillion in fiscal 2024. Furthermore, the share of internal and extra budgetary resources (IEBR) also reduced, implying lesser reliance on market borrowings. This, along with possible repayment of existing debt, augurs well for the financial strength of implementing bodies such as the National Highways Authority of India (NHAI). Notably, NHAI has seen an improvement in its debt-to-equity ratio from 1.18 in fiscal 2021 to 0.69 in fiscal 2023.

Reduction in IEBR has improved NHAI's debt-to-equity ratio, and hence, its financial profile

(Rs ten billions)

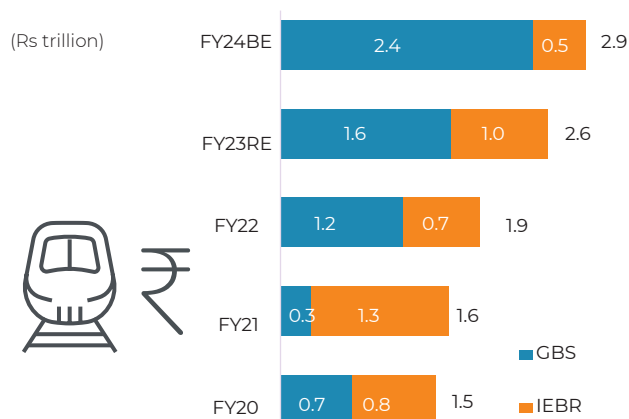


Note: IEBR refers to the resources raised by Public sector undertakings (PSUs) through debt and equity.

*NHAI - National Highways Authority of India

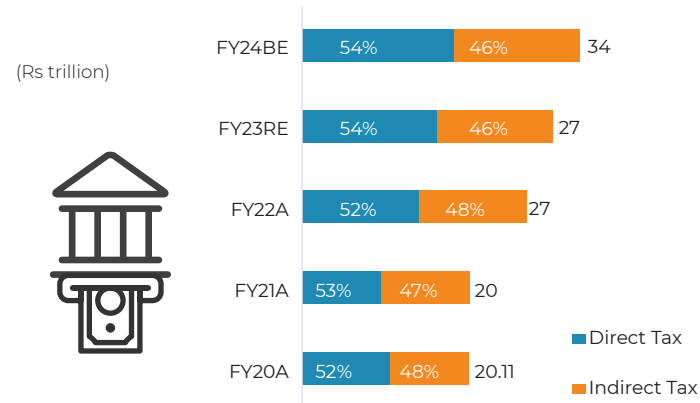
Source: NHAI, CRISIL MI&A Research

Reduction in IEBR has supported the Ministry of Railways' financial profile too by reducing its dependence on external sources



Source: Ministry of Railways, CRISIL MI&A Research

Central government's tax receipts have grown 51% over fiscals 2020 to 2023



NOTE: A-Actuals; RE-Revised estimated; BE-Budgeted estimate
Source: CBDT, budget documents, CRISIL MI&A Research

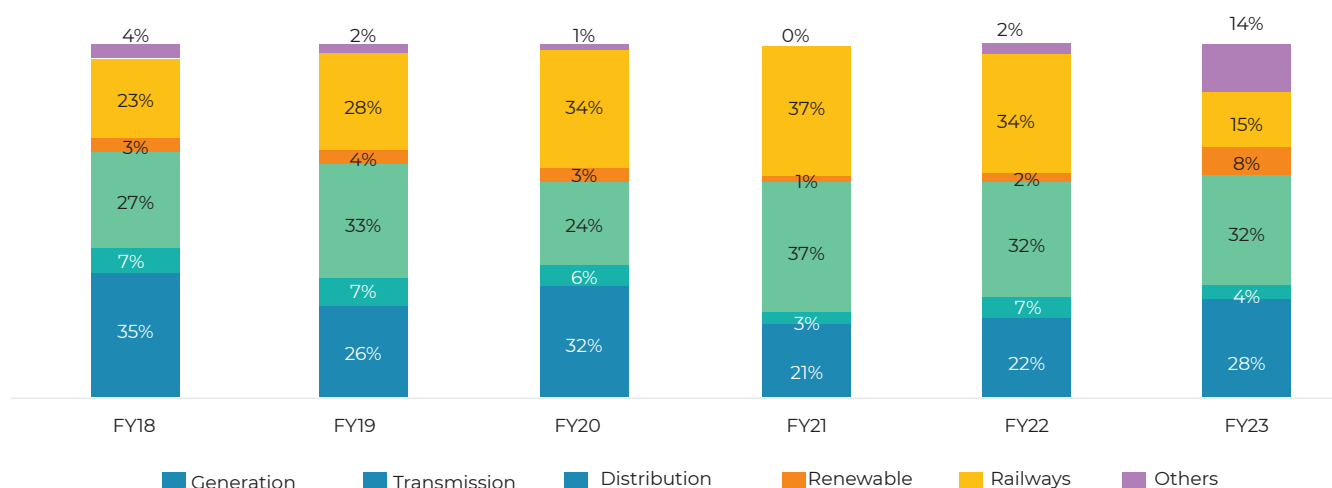
The state's budgetary outlay on infrastructure has logged a CAGR of 9%, rising from Rs 3,020 billion in fiscal 2019 to Rs 4,234 billion in fiscal 2024.

The high funding by central and state governments is supported by increasing tax and revenue receipts. This would provide the government the financial buffer to undertake aggressive infrastructure capital expenditure going forward, too.

Financial institutions: Banks and NBFCs have also played an important role in infrastructure financing over the years, with ~20% of total funding in this space coming from these sources. Despite limited private participation, the infrastructure loan books of both banks and NBFCs have swelled, as these institutions have financed projects in sectors such as power, railways and roads. Public sector NBFCs such as Power Finance Corporation (PFC), Rural Electrification Corporation Limited (REC) and Indian Railway Finance Corporation (IRFC) have played a key role, consistently disbursing substantial amounts to finance projects in power and railway sectors.

Railways and power sector have seen high disbursements from infrastructure financing NBFCs

Disbursement split of top 3 infrastructure finance companies



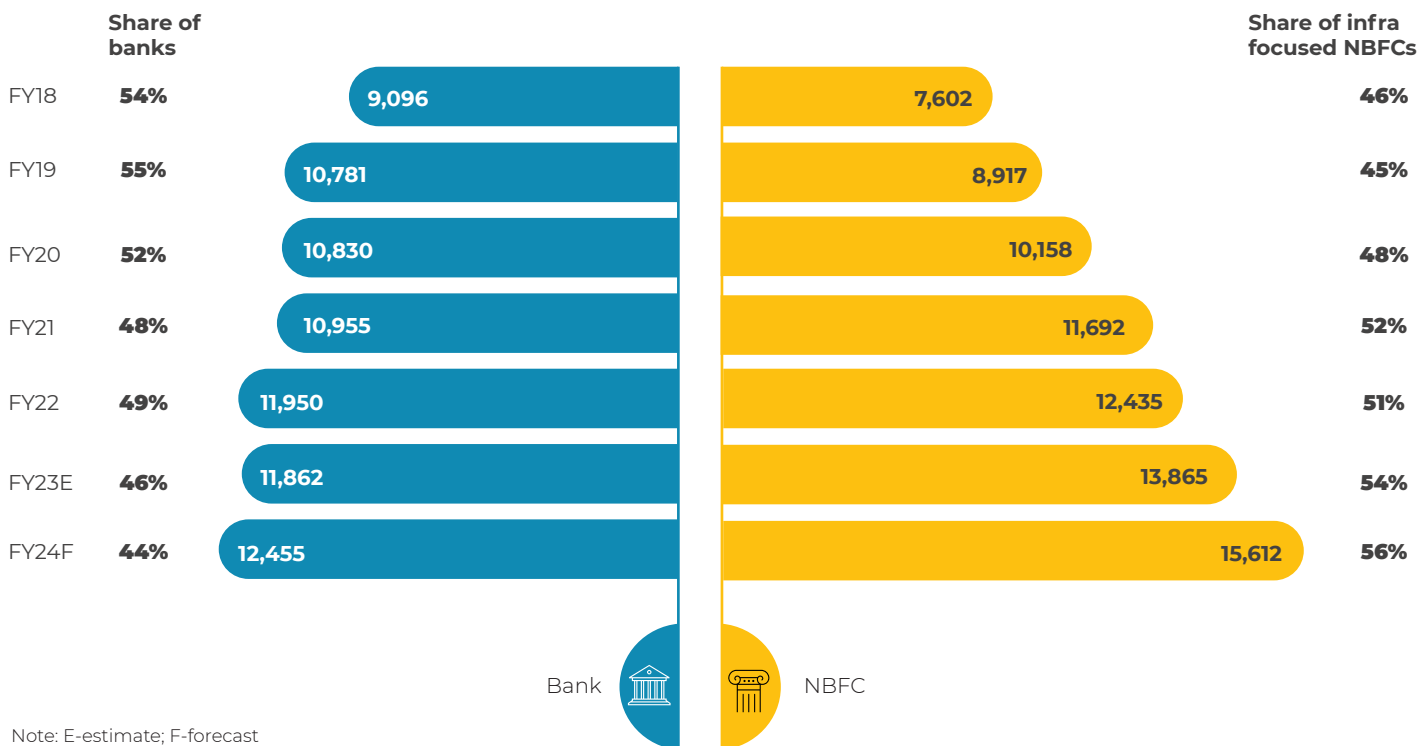
Note: Top 3 infrastructure finance companies include PFC, REC and IRFC; 'Others' include short-term loans
Source: Company reports, CRISIL MI&A Research

Consequently, the share of infra focused NBFCs in total outstanding infrastructure loan book increased

from 46% in fiscal 2018 to 54% in fiscal 2023 and is likely to further go up to 56% this fiscal.

Infra focused NBFCs have been growing faster than banks

(Rs billion)

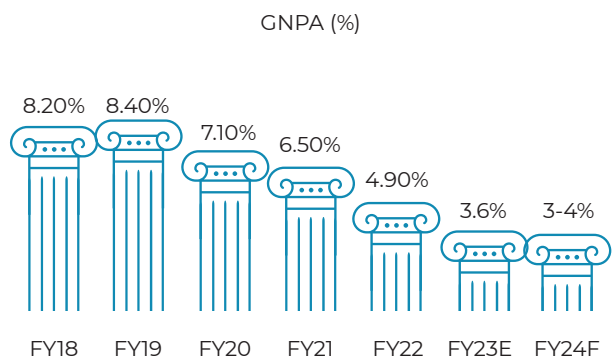


Note: E-estimate; F-forecast
Source: Company reports, CRISIL MI&A Research

Furthermore, the gross non-performing assets (GNPA) level of NBFCs has improved significantly from 8.2% in fiscal 2018 to 3.6% in fiscal 2023, due to resolution of stressed assets. The GNPA of banks

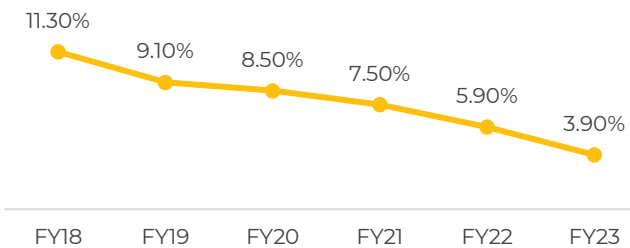
have also shown a similar trend. This augurs well for the sector’s financing as NBFCs would be better placed to extend credit to projects, alleviating the risk of funding crunch.

Infrastructure-focused NBFCs have seen a stark improvement in their GNPA levels



E- Estimated; F- Forecast
Source: RBI, Company reports, CRISIL MI&A Research

Banks GNPA are also at a historical low

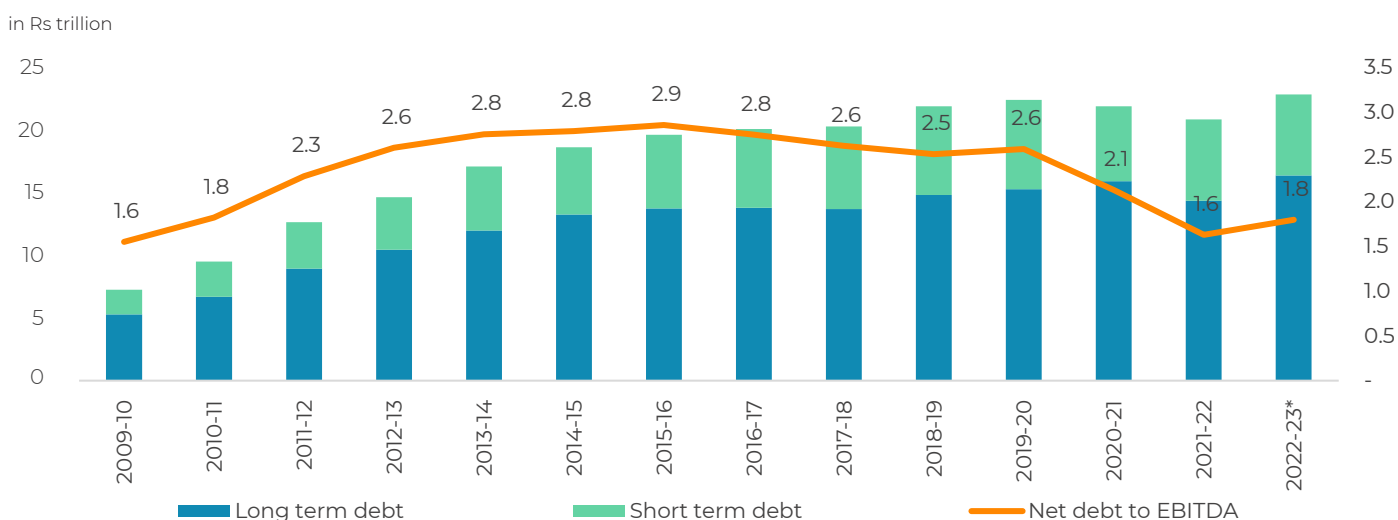


Source: RBI, Company reports, CRISIL MI&A Research

Furthermore, as indicated by the net debt-to-Ebitda (data pertains to financials of ~800 companies; barring BFSI and oil & gas), leverage of players is at

one of its best levels since fiscal 2010, implying ample room for players to undertake incremental debt for infrastructure project execution.

Net debt-to-Ebitda fell to a decadal low in fiscal 2022



Note: Data pertains to financials of ~800 companies (barring BFSI and oil & gas)
Source: CRISIL MI&A Research

In addition, the government has announced the creation of a new development financial institution (DFI) to ease fund flow for infrastructure projects. The National Bank of Financing Infrastructure and Development (NaBFID) has been set up as a corporate body with an authorised share capital of Rs 1 trillion, to directly or indirectly lend, invest or attract

investments for infrastructure projects located entirely or partly in India.

Other sources: Apart from the traditional ones, other funding sources have also started to gain traction. These include issuance of non-convertible debentures (NCDs), raising of equity, internal accruals, and foreign direct investment (FDI).

Other funding sources to play a key role in infrastructure financing

Non-Convertible Debentures (NCD)

- Despite underpenetrated bond market, multiple entities have issued NCDs to raise capital for infra projects.
- This includes private players as well as government entities such as NHA and NTPC.
- Yet the share of NCDs in infrastructure funding remains well below 10%.
- Nonetheless, the significance of NCDs is likely to rise with further bond market penetration

Equity & Internal Accruals

- Growing order books and timely execution of projects have boosted the cash accruals of many infra players.
- Improved financial profiles, have also enabled players to raise equity for funding projects.
- This aids funding in sectors such as roads, where the promoter typically undertakes equity infusion of 15-20% of the total project cost in HAM projects.
- With increasing profitability, players' reliance on these sources for funding is likely to rise.

Foreign Direct Investment (FDI)

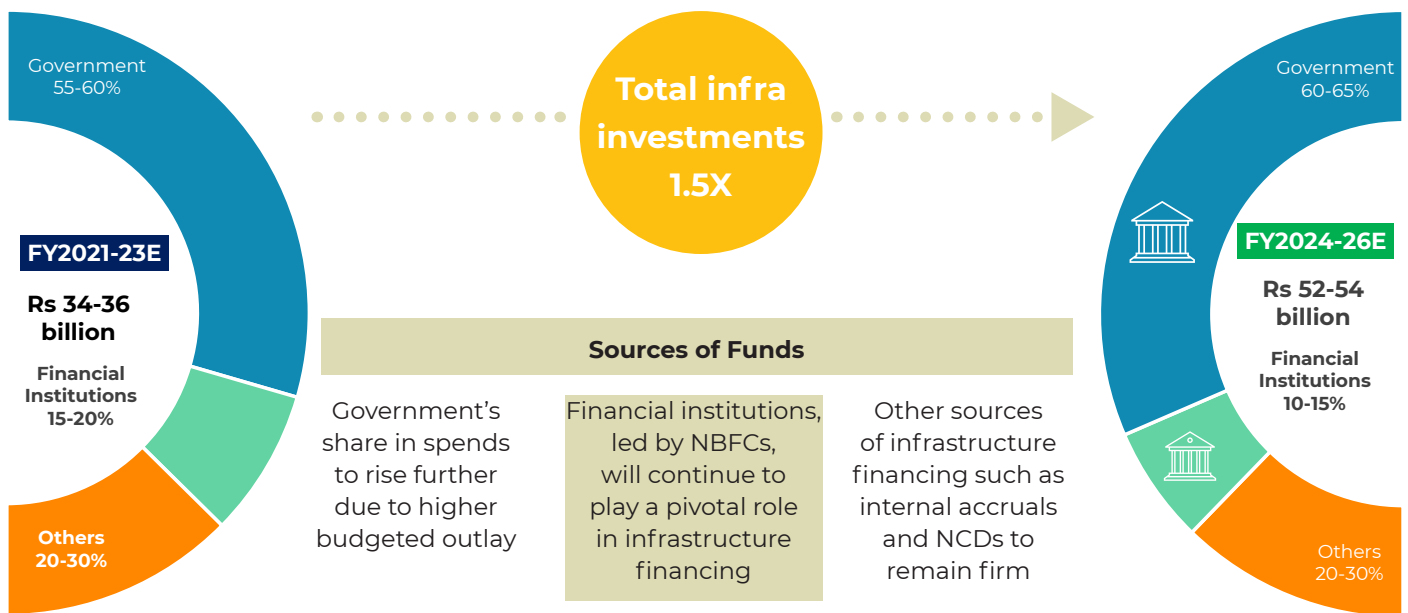
- India's strong fundamentals and promising economic prospects has resulted in the infra sector seeing strong FDI inflows in recent times.
- In 2022, international project finance deals increased by 64%, making India the recipient of the 2nd largest number of international project finance deals globally behind only the USA.
- Given promising economic outlook and robust infrastructure capital expenditure, FDI inflows is likely to remain strong going forward.

Source: CRISIL MI&A Research

Given all of the above, the total infrastructure financing opportunity in India is expected to increase from Rs 34-36 billion in fiscals 2021-23 to Rs 52-54 billion in fiscals 2024-26, implying a jump of ~51%. While all segments of financing have good

growth potential, the government sector is still likely to be the largest source, owing to its high budgetary outlays. We estimate its share is likely to rise from 55-60% to 60-65%.

Infra financing opportunity to grow 1.5x in fiscals 2024-26 over previous three years



Source: Budget documents, company reports, CRISIL MI&A Research

A significant portion of this financing would be towards renewable energy (RE) projects. Green bonds have rapidly become an attractive option for such projects, though it is still in a nascent stages in India.

Green bonds support RE projects by providing wider access to domestic, foreign capital

According to the World Bank, total Indian green bond issuances were \$21 billion as of February 2023, with the private sector accounting for 84% of total issuances. Players such as Greenko, ReNew and Continuum have played an especially active role in the same.

While the private sector has done the heavy lifting so far in this space, recently, Indian government entities have also started issuing green bonds. Notably, India raised ~\$2 billion (Rs 160 billion) in fiscal 2023 through its first ever sovereign green bond issuance.

As India makes strides towards its sustainability targets, the green bonds market is set to grow. This would be further supported by some of its inherent

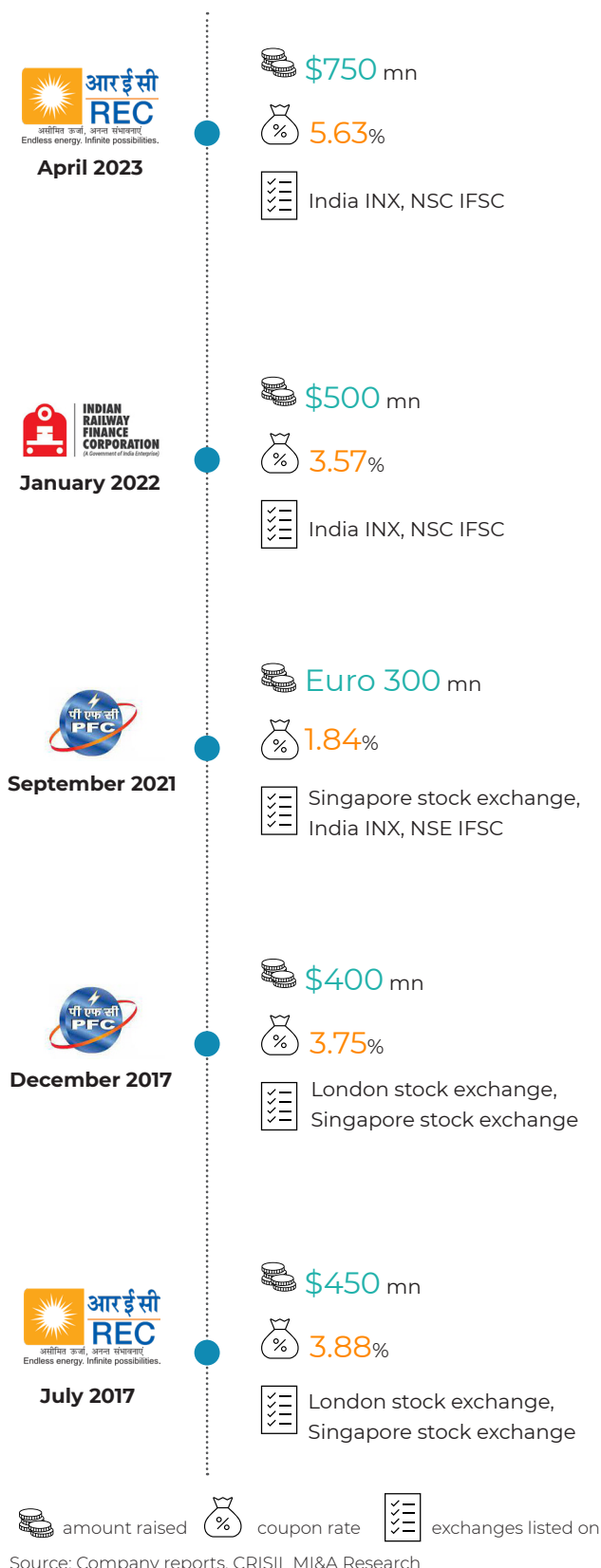
benefits such as:

- Lower capital cost than domestic bank loans, including hedging costs.
- Fixed rate of financing as opposed to floating rate of project loans.
- Diversification of debt profile and refinancing of existing bank debt.
- Freeing up of bank credit for utilisation later/ elsewhere.

Infrastructure focused NBFCs, too, have raised funds through green bonds

Since 2017, India's leading infrastructure-focussed NBFCs — PFC, REC and IRFC — have raised funds by issuing green bonds. Typically, these bonds have been denominated in foreign currencies and have also been listed on overseas bourses. Furthermore, most of these green bonds issued have a tenure of 10 years. However, recently, green bonds with a tenure of 5 years have also been issued.

Leading infrastructure-focused NBFCs have tapped the green bonds market



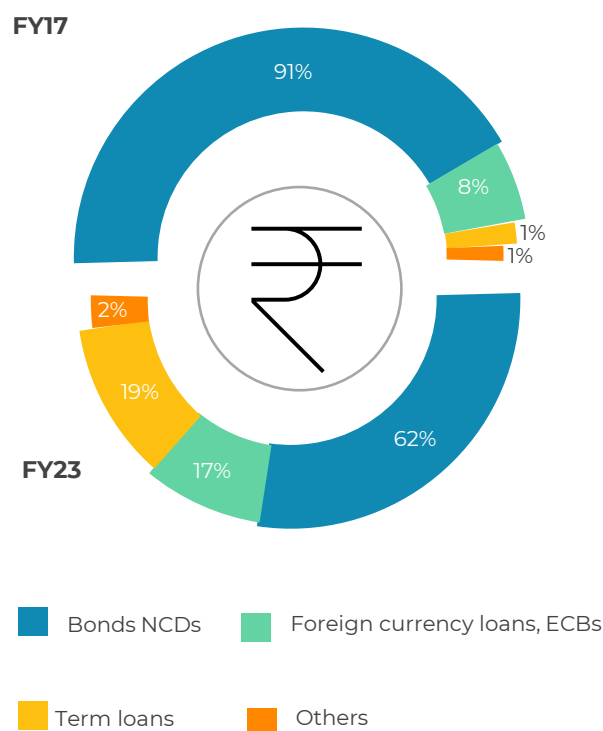
Green bond holdings of PFC and REC

NBFC	Utilisation of green bonds	Share of green bonds in foreign currency notes/ bonds
PFC	Financing of RE projects	16%
REC	Financing solar, wind and renewable purchase obligations (RPO), including refinancing of eligible projects	10%

Source: Company reports, CRISIL MI&A Research

The issuance of green bonds has coincided with the increase in share of foreign currency loans in the borrowing mix, which has gone up from 8% in fiscal 2017 to 17% in fiscal 2023. The share of term loans have gone up from 1% in fiscal 2017 to 18% in fiscal 2023.

Share of foreign currency loans and ECBs on the rise in the borrowing mix of NBFCs



Note: Data is not exhaustive and includes the top two NBFCs; ECB: external commercial borrowings
Source: Company reports, CRISIL MI&A Research

Asset monetisation to support funding with large quantum of monetisable assets

While the infrastructure financing opportunity is sizeable, a large portion of it would continue to be through government sources. That said, despite rising revenue and tax receipts, the government's ability to fund infrastructure capex would remain a critical factor. Against this backdrop, asset monetisation could assume a significant role as it

can prop up the government's funding ability.

A Rs 6 trillion (\$ 75 billion) asset monetisation blueprint, the National Monetisation Pipeline (NMP), was drawn up to create revenue sources from unutilised or under-utilised public assets. Sectors such as mining, power and roads have witnessed successful cases of monetisation over the past few years, while those such as railways are yet to catch up. Overall, execution of asset monetisation has been patchy so far, with stark variations across sectors.

Asset monetisation execution patchy last fiscal but may aid capitalisation overall

Sector	FY22 monetization (Rs bn)	Achievement	FY23 monetization (Rs bn)	Achievement	Overall target (Rs bn)	YTD achievement in overall NMP targets
Roads	230	77%	161	49%	1602	24%
Railways	8	4%	18	3%	1525	2%
Power	95	125%	160	105%	850	30%
Mining	580	17.26x	600	2.81x	287	4.11x
	913		939		4264	38%

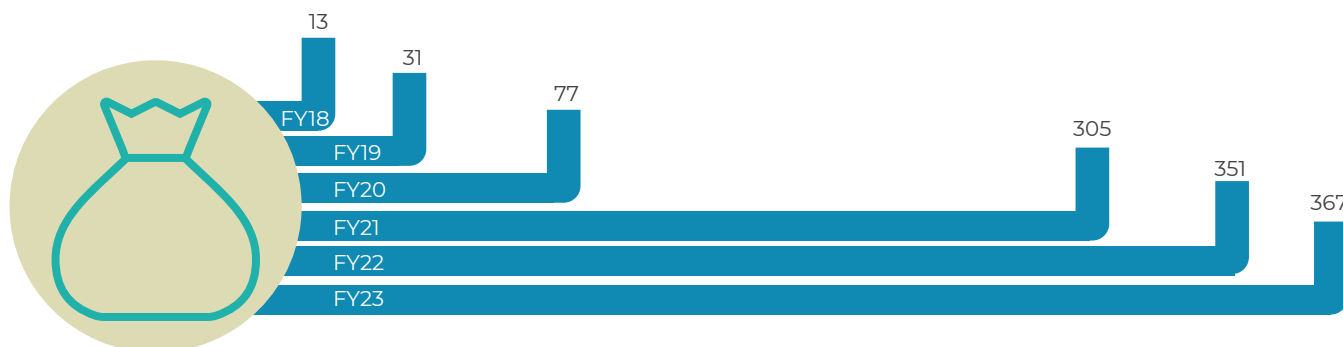
Note: Data is updated as of March 2023
Source: Industry, CRISIL MI&A Research

While still nascent, InvITs have fast become the preferred investment vehicle for monetisation of assets. InvITs are quasi-equity which amalgamate the benefits of debt and equity, providing opportunities

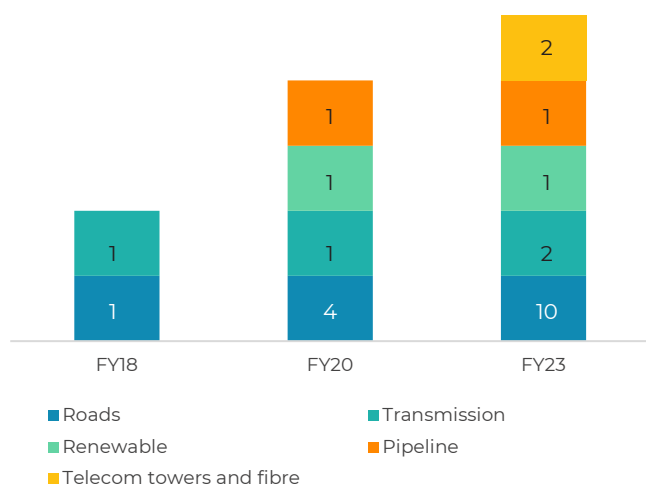
for capital gains as well as steady cash flows over long periods of time. Given the favourable risk-return profile of the asset class, it has appealed to domestic and international investors, alike.

InvITs in India have seen a sharp growth in AUM

(Rs ten billions)



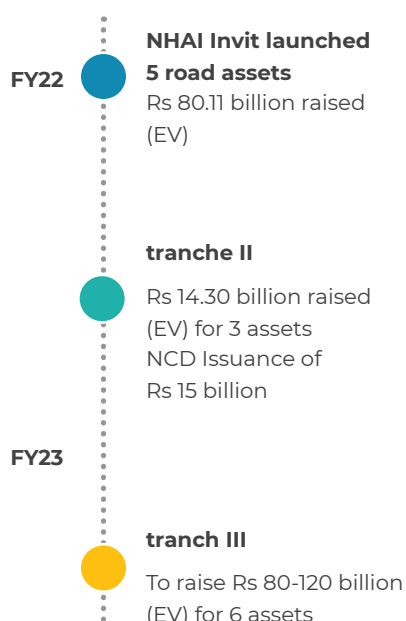
Newer sectors are being encompassed by InvITs



Note: Numbers in box represent total active InvITs in respective fiscal

The NHAJ successfully launched its own InvIT in fiscal 2022 and raised Rs 109.41 billion by end-fiscal 2023. It aims to raise another Rs 80-120 billion this fiscal. Contrarily, some toll-operate-transfer (TOT) bids, another mode of monetisation of road assets, have seen mixed success. While some TOT bundles have witnessed healthy participation others have been lacklustre, leading to their cancellation.

NHAJ InvIT has gained good traction so far



Source: NHAJ, CRISIL MI&A Research

Despite mixed success so far, the sheer quantum of monetisable infrastructure assets translates to a huge potential for asset monetisation. Private players too have explored the option of InvITs for monetising assets to deleverage their balance sheets and free up cash flows to meet equity commitments in HAM projects, or execute other projects. In this regard, roads and renewable sectors present a sizeable opportunity. This is significant as these two sectors together account for 44% of the NMP targets.

Roads and renewables present massive monetisation potential for top private players



Source: Company reports, CRISIL MI&A Research

Private investments will boost infrastructure investment cycle

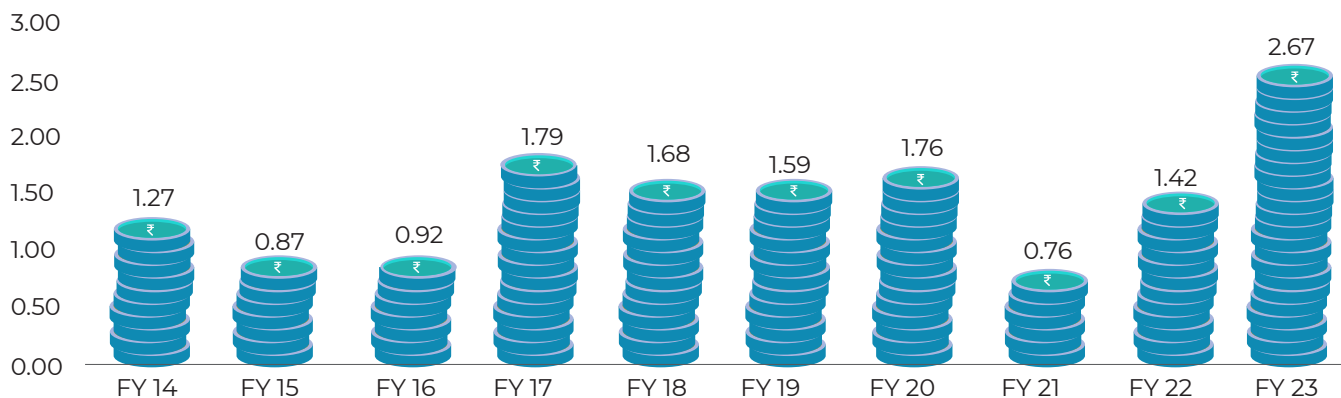
Private sector investments accelerated from fiscal 2017, particularly for the construction of roads and bridges. Banks and financial institutes provided substantial support, amounting to Rs 2.67 trillion. In comparison to previous period an increase in investments of 80% is observed in road sector. Improved energy efficiency and less losses are achieved through the use of sophisticated metering infrastructure. India's energy infrastructure is being strengthened and renewable sources are being integrated through initiatives like the Revamped Distribution Sector Scheme and the Green Energy Corridor.

Private investments will boost infrastructure investment cycle

Following a prolonged period of sluggish investments during fiscals 2013 - 2016 the capex cycle picked up pace between fiscals 2017 and 2020, particularly by the private sector. In fiscal year 2021, once again investments experienced a decrease due to the impact of the pandemic. However, starting from fiscal 2022, there has been a noticeable resurgence in private sector investments within this industry.

Last fiscal, banks and financial institutions (FIs) extended support to 547 projects, valued at Rs 2.67 trillion. This is a significant departure from fiscal 2022, when 401 projects valued at Rs 1.42 trillion received similar backing.

Project sanctioned by banks and financial institutes (FI) have witnessed a decadal high in fiscal 2023

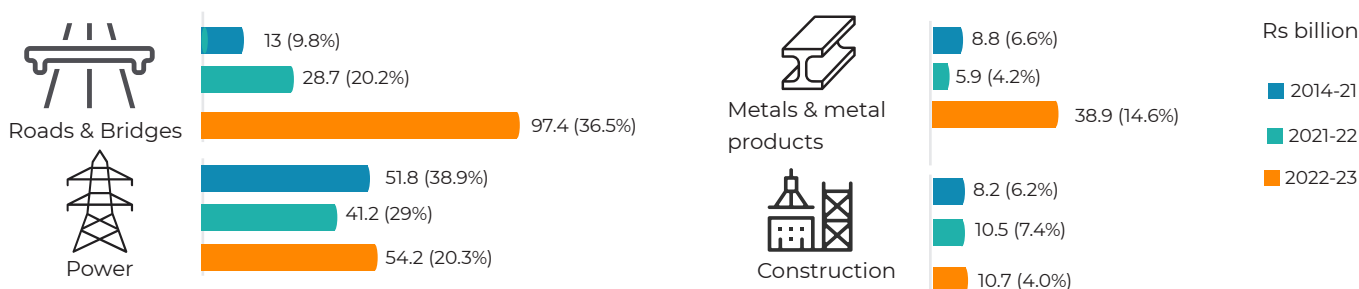


Source: RBI, CRISIL MI&A Research

Of the total projects, the infrastructure sector accounted for a substantial 60% share, led by roads

and bridges, largely bolstered by the Bharatmala initiative.

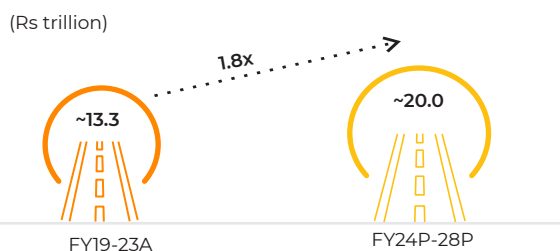
Private capex sanctioned by banks and FIs have seen a higher investments towards roads & bridges in fiscal 2023



Note – The figures enclosed in parentheses () represent the percentage of the total private capital expenditure sanctioned by banks and financial institutions (FIs) for the specified time period. Additionally, for the time frame spanning 2014 to 2021, the private capital expenditure is calculated as the average annual private capex over that period
Source: RBI, CRISIL MI&A Research

Investments in roads and railways to almost double over next 5 years

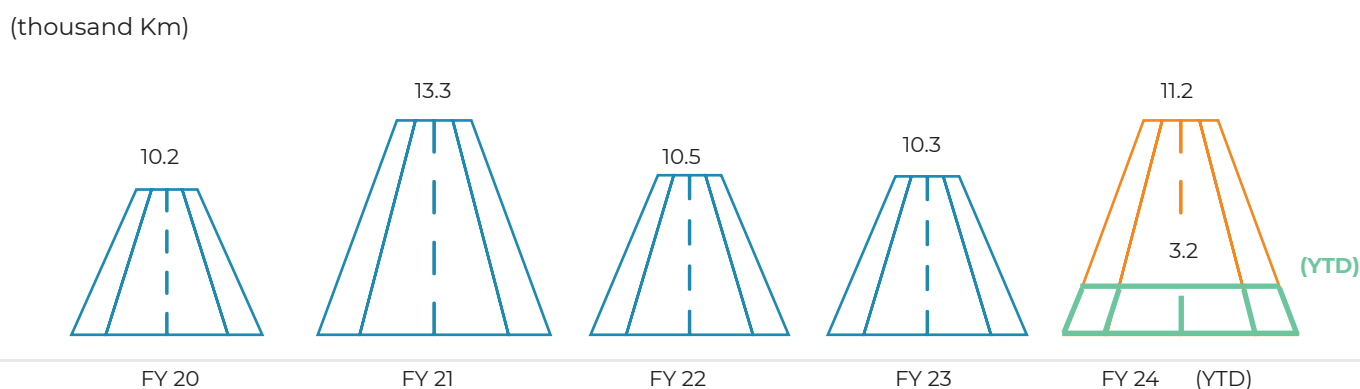
Road capex to increase 1.8x in medium term, led by national/state highway construction



Source: CRISIL MI&A Research

Projections indicate a significant 80% increase in capex in the roads sector between fiscals 2024-28 and fiscals 2019-23, surpassing the Rs 20 trillion mark. Funding sources are expected to include the central government (60-65%), state governments (25-30%) and the private sector (10-15%).

Pace of road construction to continue at steady pace



Note – The data indicates total annual construction of National Highway in 000' kms
Source: MoRTH, CRISIL MI&A Research

Road construction is progressing steadily and is expected to return to the fiscal 2021 levels. The government aims to increase the current

construction rate of 28 km per day to 50 km per day soon.

Shift in model has helped hedge project risks in roads sector

EPC (Engineering, Procurement, and Construction): Government handles the entire project process, from design to construction. Government fully funds the project; bears risks of delays and cost overruns.

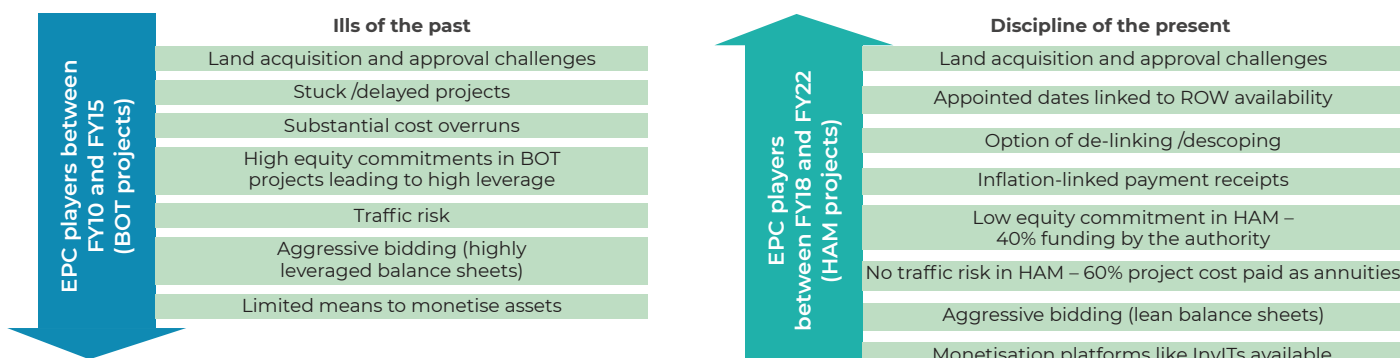
HAM (Hybrid Annuity Model): Government provides 40% grant, developer arranges 60% funding; shared construction and maintenance responsibilities. Partial grant from government; developer funds the rest, shares revenue and traffic risks with the government

BOT (Build-Operate-Transfer): Private entity builds, operates, and maintains project; transfers ownership to government after concession period. Private investment, revenue from tolls; private entity bears construction, operation, and revenue risks.

The shift in the roads sector model from built-operate-toll (BOT) to hybrid annuity model (HAM) has helped hedge multiple risks associated with

execution and boosted implementation. Table below reflects the transformation in execution due to the model shift.

Discipline of HAM have over come the risks of BOT projects



Policy changes to mitigate risks further

Government measures to address competition

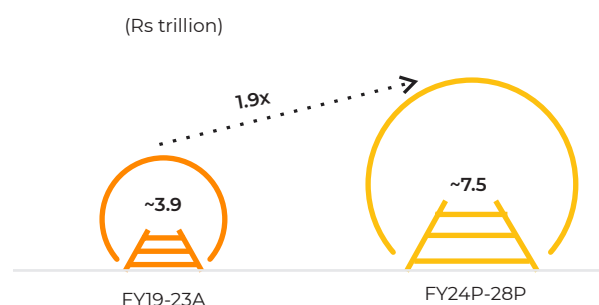
- ✓ Operation and maintenance (O&M) bids removed as award criteria. Norms made similar to engineering, procurement, and construction (EPC) bids
- ✓ Additional performance security for abnormally low bids below 20% bid discount
- ✓ Adjustment made in net worth calculation by deducting the balance equity commitment in projects
- ✓ A minimum credit rating requirement of 'BBB' for bidders. If the rating is below this threshold, a comfort letter is needed from banks/financial institutions

Railway capex to almost double in medium term

Projections indicate a substantial 90% increase in capex for the railway sector, from ~Rs 3.9 trillion between fiscals 2019 and 2023 to ~Rs 7.5 trillion between fiscals 2024 and 2028. The central government is expected to finance 80-85% of this expenditure, emphasising its commitment to upgrading railway infrastructure and connectivity. The private sector is expected to contribute 15-20%, showcasing the potential for public-private partnerships (PPPs) and private investment in the development of India's railway sector.

Full operationalisation of the dedicated freight corridors in June 2024 will drive investments in the Indian railways sector over the next five years, with total opportunity projected at ~Rs 1.25 trillion.

Capex in railways to be led by high-speed rail and station redevelopment



Source: CRISIL MI&A Research

Dedicated freight corridor (DFC) have a total opportunity of Rs 1.24 trillion

Land acquisition EDFC: 100% ^ WDFC: 100% ^ PPP: 99%^	Commissioned length: EDFC: 100% WDFC - 52%	Financial Progress EDFC: 86% WDFC: 92%
Progress of works: Track linking - ~99% OHE wiring - ~ 83%	Target completion date (in phases) June 2024	

^ As of September 2023

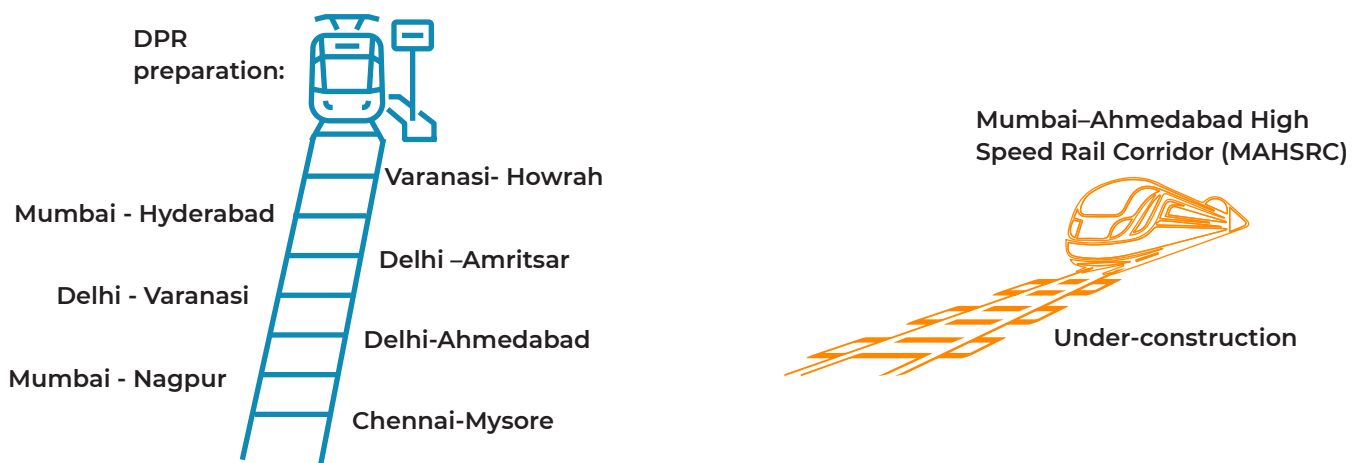
Note: EDFC - Eastern dedicated freight corridor
 WDFC - Western dedicated freight corridor
 PPP - Public private partnership

CRISIL MI&A Research

High-speed rail projects are becoming attractive opportunities in the infrastructure sector. The Mumbai-Ahmedabad High-Speed Rail project, initially challenged by land acquisition issues, has made significant progress by securing nearly 99.5%

of the needed land, paving the way for accelerated construction. Other high-speed rail projects are in the detailed project report (DPR) preparation stage, indicating a growing focus on advancing such projects in the near future.

High-speed rail to have opportunity for infrastructure players



Source - CRISIL MI&A Research

The Amrit Bharat Station Scheme is also gaining prominence as a prospect for stakeholders in the infrastructure sector. This initiative entails revitalisation of over 1,300 railway stations, enhancing

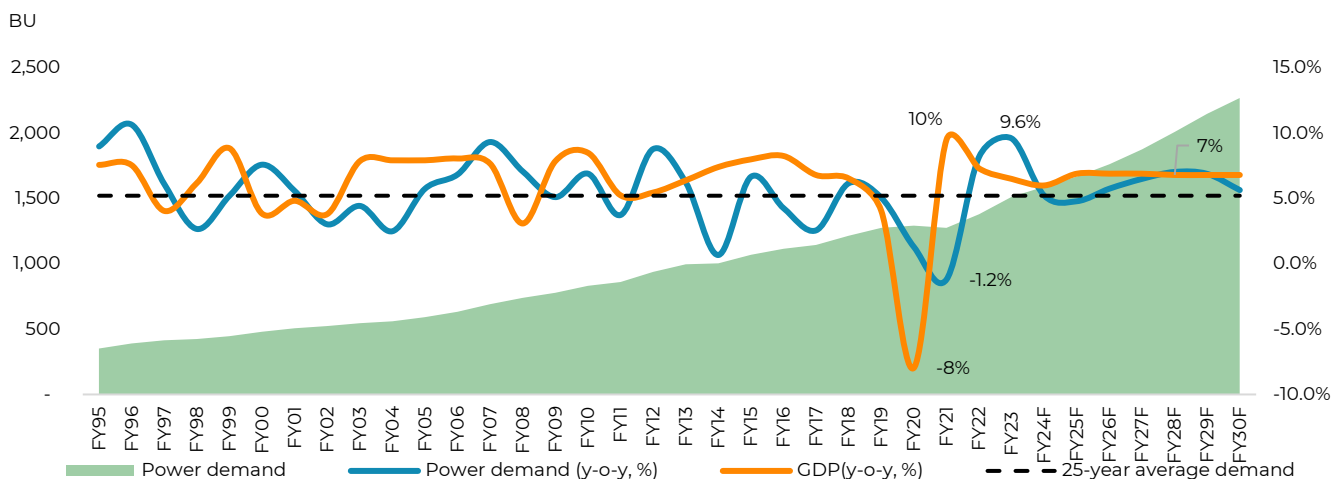
these with improved and contemporary amenities for passengers. The comprehensive redevelopment potential for these stations is projected at ~Rs 250 billion.

Power demand growth pegged at ~6% until fiscal 2030, open multiple opportunities for private players

Private investments in India's power sector have been instrumental in addressing the country's energy needs, particularly in power generation and renewable energy. The sector offers ample opportunities for both domestic and foreign investors as India aims to modernize and expand its energy infrastructure.

India's power demand and GDP growth have shown a strong correlation of 0.93. Between fiscals 2002 and 2009, power demand increased at an average rate of 5.5% and GDP grew 6.8%. Between fiscals 2009 and 2016, these figures were 5.3% and 7.1%, respectively. However, between fiscals 2016 and 2023, both power demand and GDP growth softened to 4.5% and 5.1%, respectively, because of the pandemic.

On average, power demand has remained nearly 1% lower than GDP

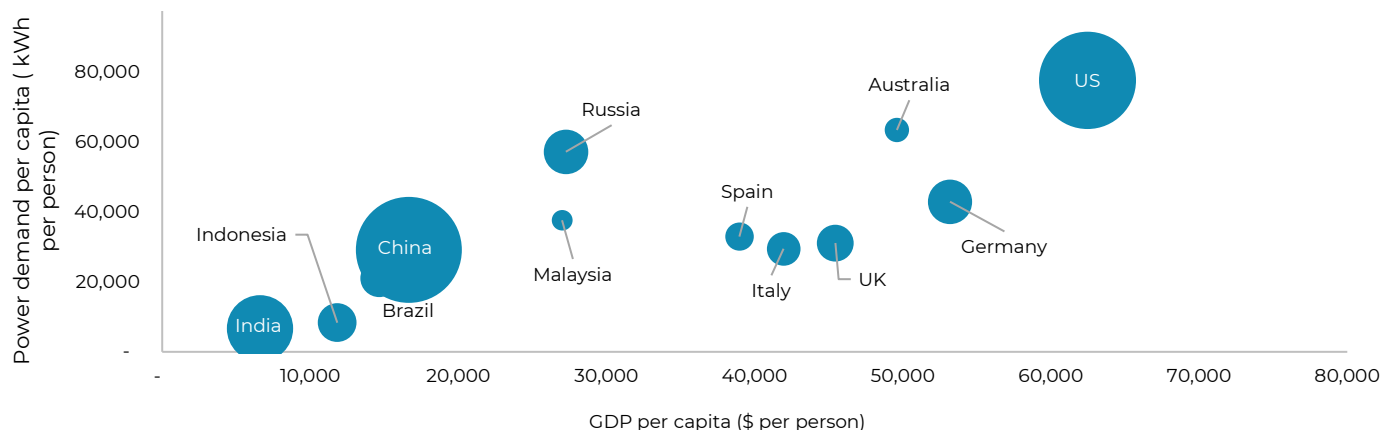


Source: World Economic Forum, CEA, CRISIL MI&A Research, BP statistics

India's power intensity, a measure of power used to generate GDP, decreased from 0.18 kWh/\$ in 2000 to 0.14 kWh/\$ in 2020, reflecting improved energy

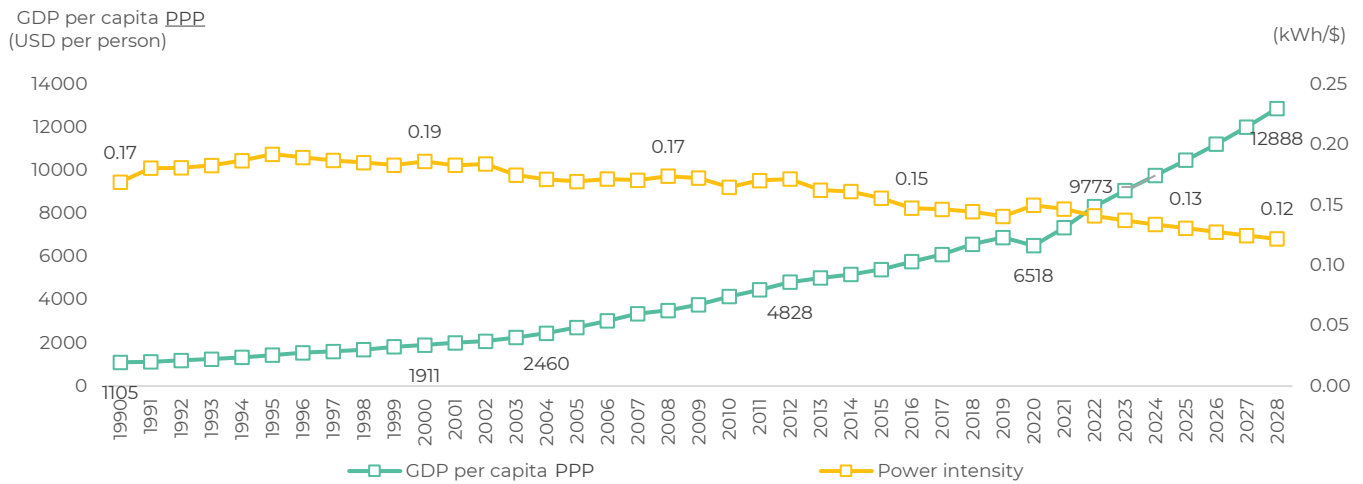
efficiency. The US showed a similar trend, while China and Indonesia experienced slower decline due to higher manufacturing and mining activities.

India's power demand per capita is significantly lower than developed countries, implying room for growth in future



Note: Size of the bubble denotes power demand in respective countries
Source: World Economic Forum, CEA, CRISIL MI&A Research, BP Statistical Review

India's power intensity to fall with increase in GDP per capita



Source: World Economic Forum, CEA, CRISIL MI&A Research, BP Statistical Review

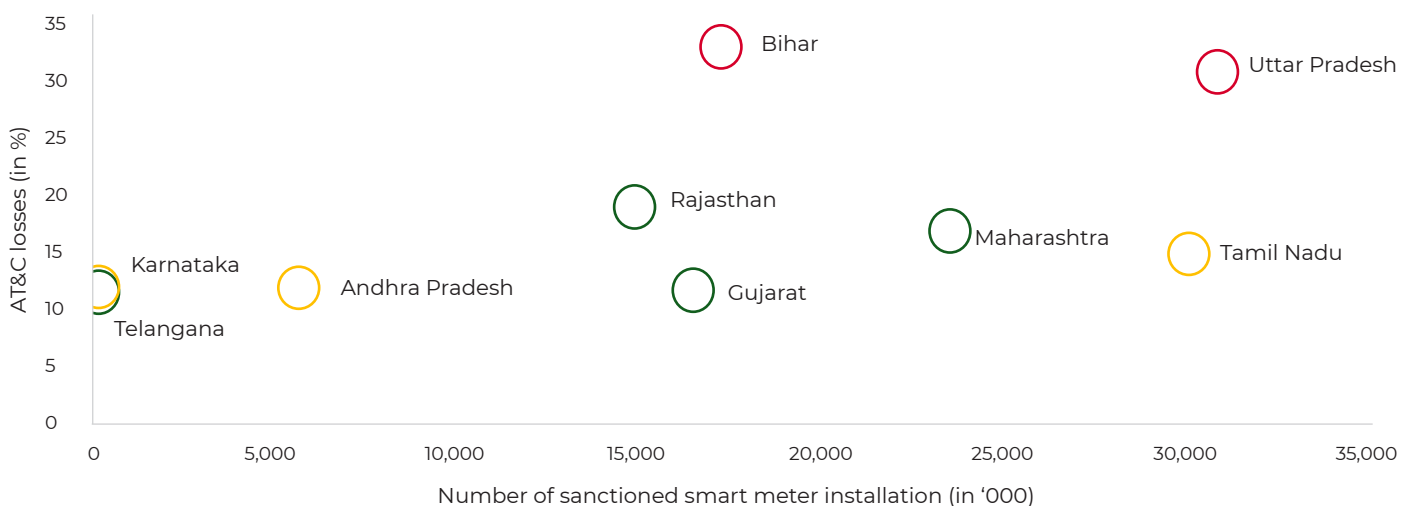
Role of advanced metering infrastructure in reducing losses

The main objective of advanced metering infrastructure is to establish two-way communication between smart energy meters and a central system. This enables capabilities such as time-of-day tariffs, encouraging electricity usage during off-peak hours to improve grid efficiency and security. Prepaid meters, another component, promote bill payment before consumption, mitigating non-payment issues and strengthening

distribution companies' (discoms) financial conditions.

Current aggregate technical and commercial (AT&C) losses in India have improved in last few years. AT&C losses currently are at 16.4% in fiscal 2022, this was at 22.32% and 23.72% in year 2022 & 2017 respectively. The government has approved the installation of 229.9 million smart meters, with over 55 million already awarded for deployment.

Uttar Pradesh and Tamil Nadu are leading in smart meter installation



Green: 20% or less residential consumers; yellow: more than 20% but less than 40% residential; red: More than 40% residential consumers
Source: Company reports, CRISIL MI&A Research

Focus on T&D to strengthen grid energy efficiency, RE integration to support

The central government is implementing two key initiatives to strengthen the energy system, integrate RE sources and reduce losses: Green Energy Corridor (GEC) at the transmission level and the Revamped Distribution Sector Scheme (RDSS) at the distribution level.

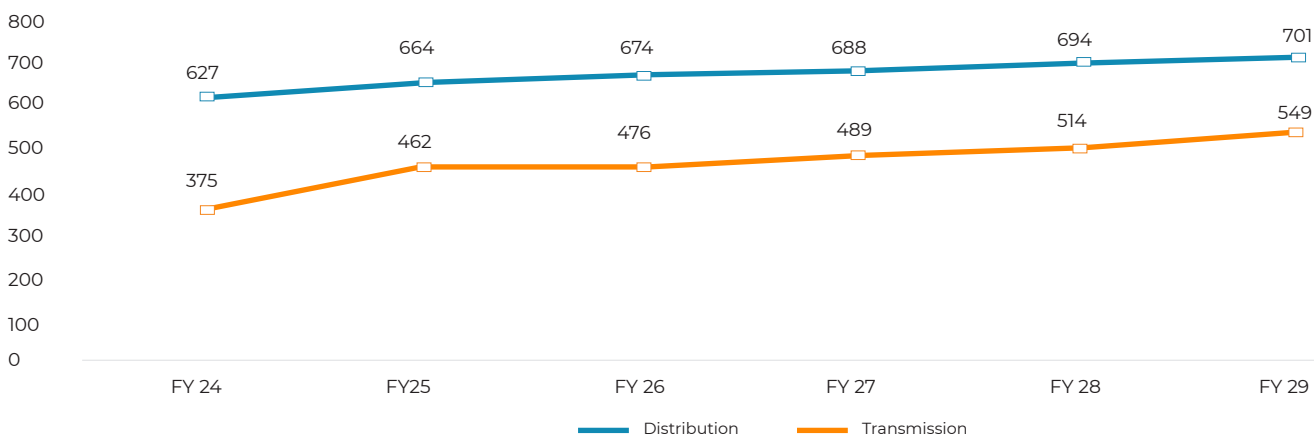
In the transmission sector, the government plans to add 16.6k circuit km of transmission lines and 78k megavolt-ampere of transformation capacity this fiscal to support the growing adoption of non-fossil energy and the target of 500 GW of RE by fiscal 2030. Investments of ~Rs 2.9 trillion are expected in the transmission sector between fiscals 2024 and 2029, with contributions from the central, state and private sectors.

GEC, implemented in two phases, focuses on increasing evacuation and transformation capacity near RE sites to distribute RE power across the country.

The RDSS aims to reduce losses at the distribution level, enhance discoms' financial strength, and modernise the existing infrastructure, with smart meters as a central component. The scheme has a projected outlay of Rs 3 trillion, and the central government is expected to provide ~Rs 0.97 trillion. It aims to reduce AT&C losses from 16.44% in fiscal 2022 to 12-15% in 2025 at the pan-India level. These initiatives are vital for integrating RE sources and enhancing the efficiency of India's energy infrastructure.

Projected investments in T&D till fiscal 2029

(Rs Billion)



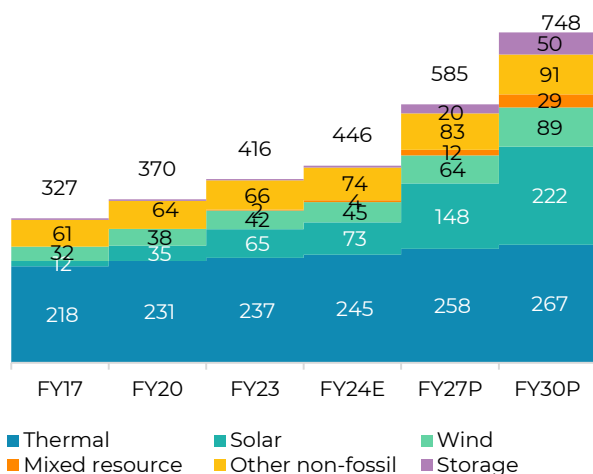
Source: CRISIL MI&A Research

RE share in total capacity to grow 4x over fiscal 2023-30

- India's commitments made at COP 26 and COP 27 include reducing the emission intensity of its GDP by 45% from the fiscal 2005 level, achieving 50% of its cumulative electric power installed capacity from non-fossil-based energy by fiscal 2030, and reaching Net Zero emissions by fiscal 2070.
- Between fiscals 2023 and 2030, India's total installed capacity is expected to grow significantly from 416 GW to 748 GW, with non-fossil fuel sources constituting ~90% of the additional capacity.
- RE capacity, excluding hydro, is projected to reach 52% of the total installed capacity by fiscal 2030. Solar and wind energy will make up majority of these additions.
- To address the intermittency challenges associated with renewables, there will be a focus on integrating storage elements such as pumped storage plants (PSP) and battery energy storage systems (BESS), as well as deploying hybrid systems, round-the-clock (RTC) and peak power supply solutions.
- Although non-fossil fuel sources will see substantial growth in installed capacity, their share in the generation mix will increase more slowly due to lower capacity utilisation factors (CUF) of renewable sources. Despite growth of non-fossil sources, fossil fuels will continue to be a prominent power source, accounting for 55% of the generation mix by fiscal 2030, with coal plants maintaining load factor above 60% to meet rising demand.

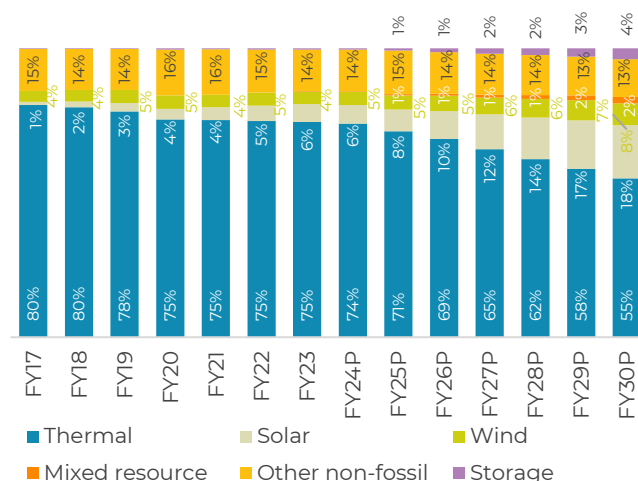
Energy storage installed capacity to reach 50 GW by fiscal 2030 to support renewable sources

RE and storage to dominate capacity addition until fiscal 2030



Source: CRISIL MI&A Research

Driven by robust additions, solar to account for the largest share in energy among RE technologies



Hedging of risks through contractual measures and agreements has encouraged private sector participation

Strengths:

- Payment security mechanisms, such as tripartite agreements, improve credit ratings for renewable energy projects by enhancing payment certainty from state discoms; Solar Energy Corporation of India (SECI) rating increased from AA- to AA+ after becoming a beneficiary in 2017, reducing risk premiums and lowering lending rates for such projects
- Introduction of a payment security fund has served as a capital reserve, offering interest-free capital to its beneficiaries in the event of payment defaults by any discom, usually amounting to three months of energy sale payments to the discom
- During a raw material upcycle, variable costs increase for conventional fuels, and if the discom rejects the power, the generator receives mandatory fixed charges
- Deemed generation clauses ensure payments to the generator when discoms curtail power for reasons other than grid security, highlighting the obligation of discoms to pay for the scheduled capacity of the renewable energy project

Further policy interventions can help speed up private investments

Coal 	<ul style="list-style-type: none"> • Mandatory coal washing for power plants and reinstating ash content restrictions, alongside financial incentives for using washed coal, can enhance Indian coal quality and adoption in the power sector. • Encouraging rail and conveyor belt transport, with additional railway lines and the First Mile Connectivity (FMC) initiative, is vital for reducing road transportation in mining areas and improving mechanized coal transport.
Energy storage 	<ul style="list-style-type: none"> • The government should offer initial financial support for battery storage plant installation to kickstart sector investment, exemplified by the recent announcement of Rs 37.6 billion for 4 MWh of battery storage BESS projects. • India should prioritize building domestic capacity for battery raw material processing and establish strategic partnerships with resource-rich nations to address supply chain vulnerabilities.
Smart meters 	<ul style="list-style-type: none"> • Discoms should gradually phase out paper bills while continuing to provide them for the time being. • Discoms must ensure timely notifications and a seamless recharge process for prepaid customers. • Discoms should assist consumers in utilizing the payment flexibility feature offered by prepaid meters.
Renewable energy 	<ul style="list-style-type: none"> • The VGF scheme until 2030 aims to facilitate private investment in capital-intensive floating solar projects, reducing reliance on land, conserving water, and potentially mitigating tariff differentials for tender-issuing entities. • The introduction of a VGF for offshore wind in India depends on technological progress and could be supported by renewable purchase obligations, similar to the Contract for Difference scheme and feed-in tariffs that boosted the sector in the UK and China. • Policies around uniformity in land acquisition is required to make solve the legal battles between land owners and developers. • Renewable energy (RE) power projects face the risk of price upcycles. Since power is purchased at a single-part tariff, there is less scope for renegotiation of tariffs. Further, RE plants do not receive fixed charges even though a back-down is entirely arbitrary, illegal, and unjustified in both facts and law

Emerging segments in India for attractive investment opportunities



Warehousing

Top 8 Indian cities to log 10-15% CAGR between fiscals 2024 and 2028

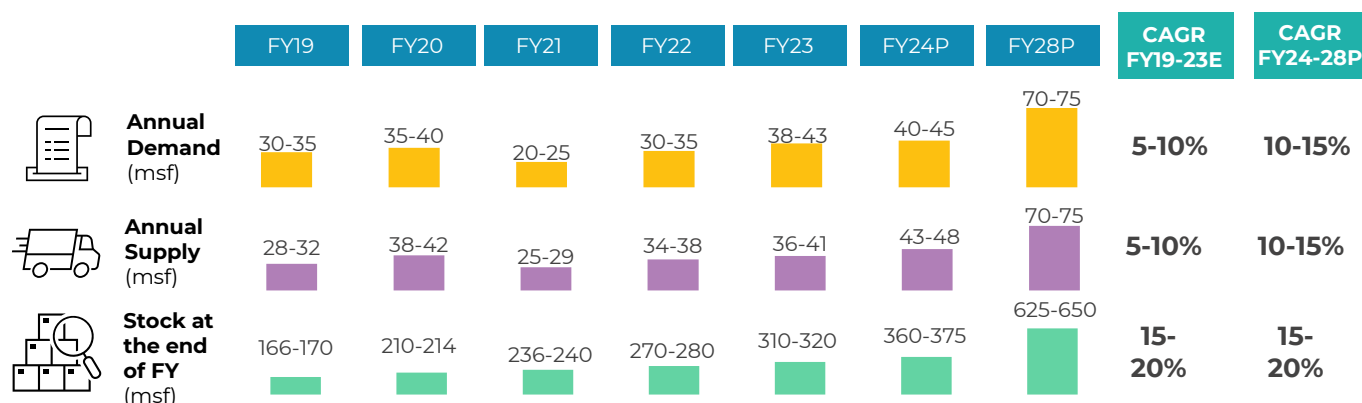
E-commerce, third-party logistics to drive up industrial warehousing demand in next 5 years, aided by increased digital penetration

Demand for industrial warehousing is expected to continue its growth trajectory. The segment had bounced back strongly in fiscal 2022 after the pandemic blow and logged steady growth the following year. Growth in incremental demand normalised in fiscal 2023, and there was net absorption of 38-43 million sq ft (msf) during the year, mirroring the normalisation in growth rates across end-user industries.

This fiscal, industrial warehousing demand is expected to grow 5-10% owing to high-base effect and a slowdown in the e-commerce segment, although demand from the third-party logistics (3PL) segment is expected to be robust.

Between fiscals 2024 and 2028, both annual demand and supply of Grade A and B warehouses in the top 8 Indian cities are expected to log a compound annual growth rate (CAGR) of 10-15%.

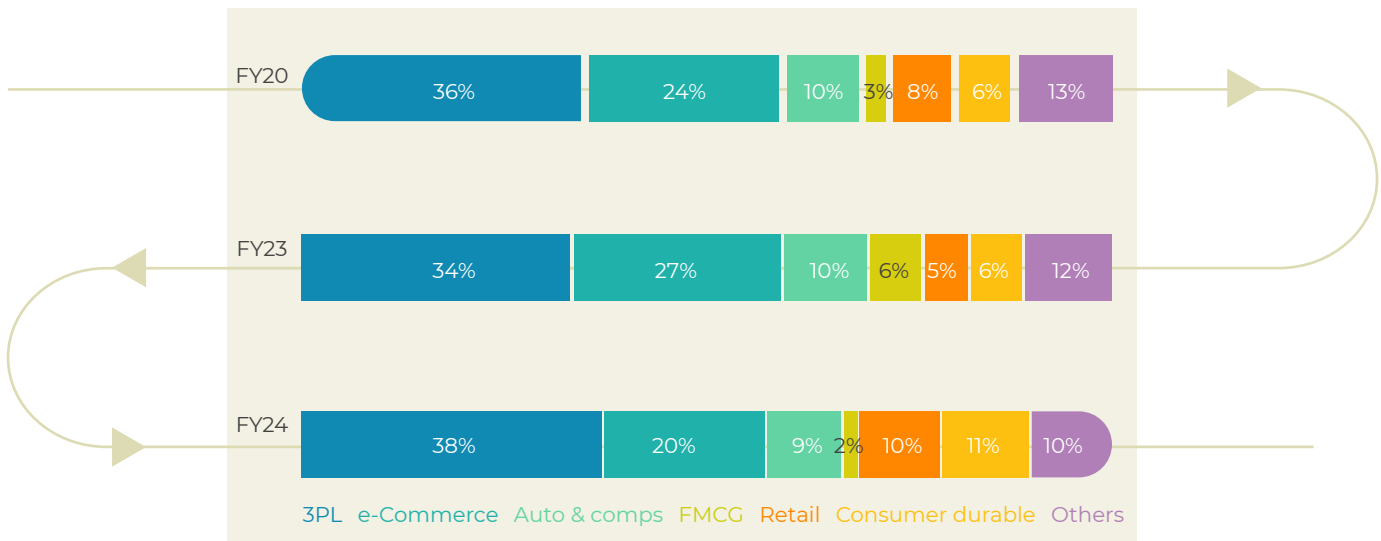
Industrial warehousing demand to remain flat in FY24



Source: CRISIL MI&A Research

- Demand from third-party logistics (3PL) has increased as sectors such as electronics and white goods, retail, and fast-moving consumer goods (FMCG) are leveraging 3PL services. Moreover, large- and medium-scale manufacturing companies are outsourcing a portion of their inventory management to 3PL service providers to optimise costs.
- As e-commerce companies aim for faster delivery of products, having warehousing spaces near major cities is paramount. The e-commerce industry is poised for robust growth in the coming years, and its share in overall warehousing demand is expected to increase significantly.

Annual warehousing demand led by e-commerce and 3PL, to contribute 55-60%.



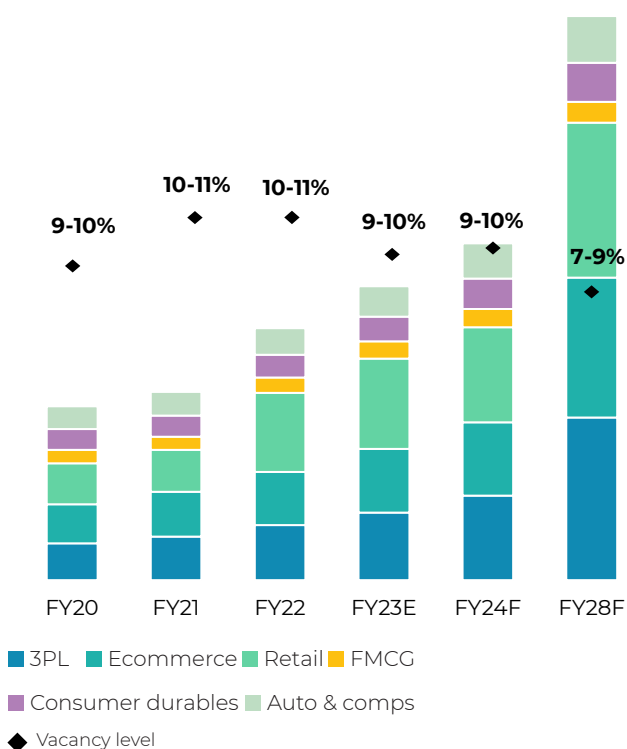
Source: CRISIL MI&A Research

Advancements in technology, particularly automation, are pushing up the demand for end-to-end logistics services. As a result, the Indian warehousing segment is witnessing a favourable structural shift with the rise in demand for modern

warehousing. 3PL and e-commerce players have gained a significant share in the occupied stock over the past five years, and they are expected to be key drivers of future growth in the organised warehousing sector.

Tech-led value-added services to help 3PL players gain further market share from captive warehouses over the long term.

Mumbai and New Delhi account for ~60% of Grade A and B warehousing stock



	Warehousing Stock (msf)	FY24E Rentals (Rs. Per sf / month)
Mumbai	105-125	20-26
NCR	55-65	21-28
Pune	20-30	25-30
Hyderabad	13-17	18-22
Kolkata	22-27	20-26
Bangalore	23-27	23-29
Chennai	20-23	19-25
Ahmedabad	14-19	16-21

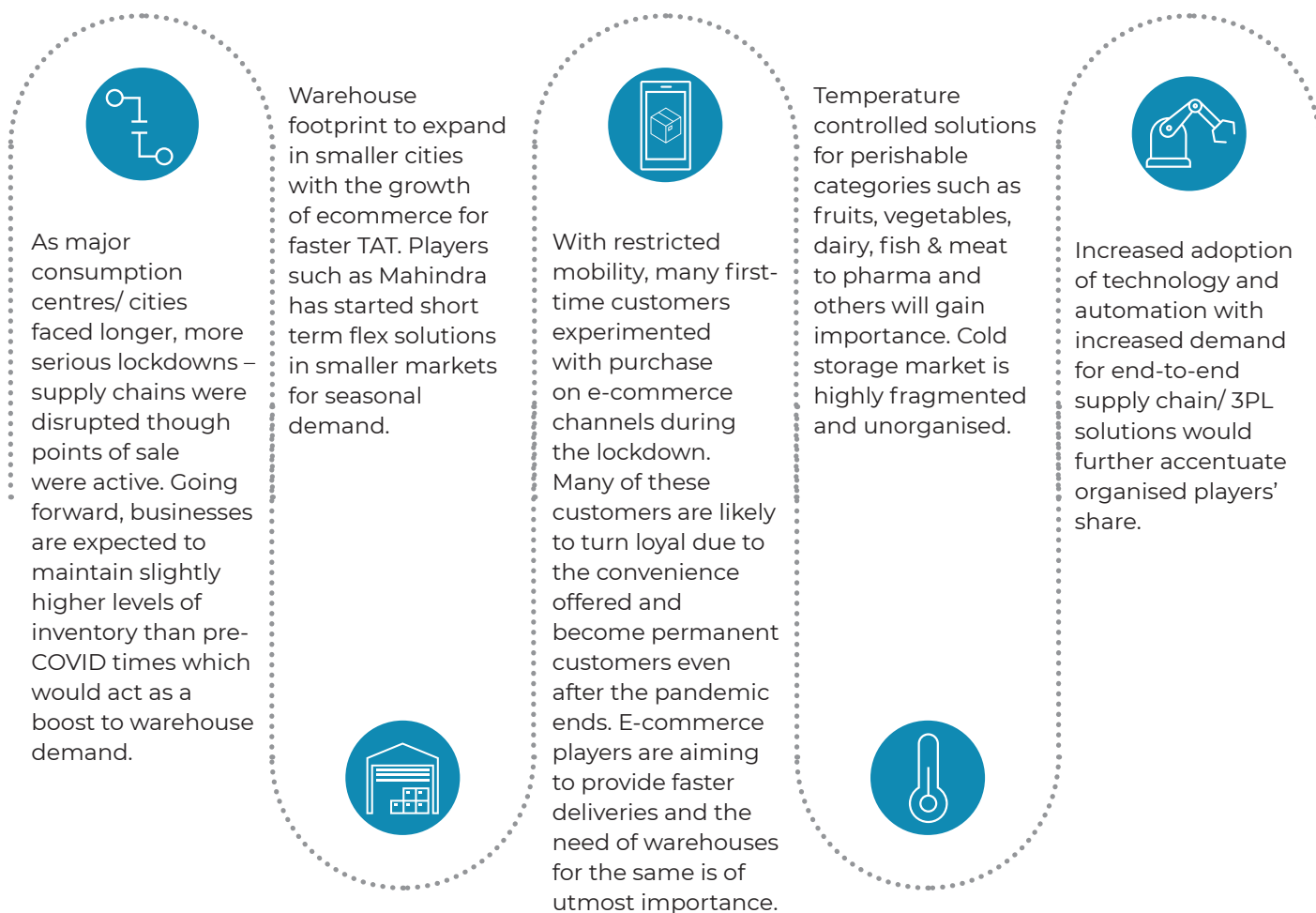
E-commerce and logistics companies leading the top 8 cities of India



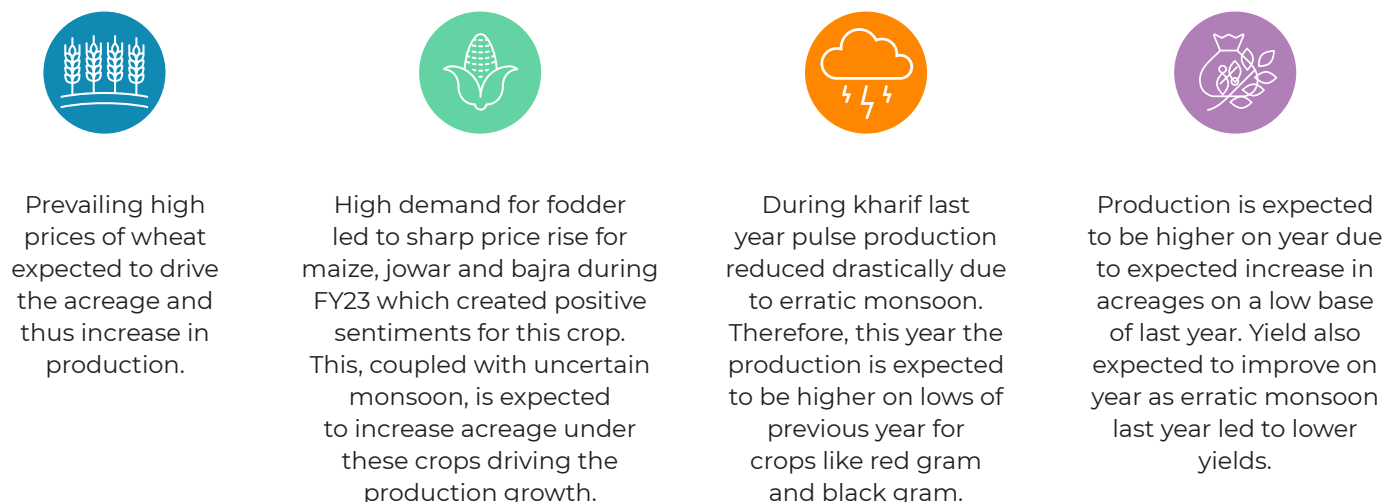
Other rapidly emerging locations for warehousing

<p>Ambala-Rajpura: Gateway to Punjab and serves key markets in Punjab & J&K. Also in close proximity to Chandigarh, Patiala, Ludhiana & Zirakpur</p>	<p>Jaipur, Vadodara & Indore: Tier 1 consumption centres for the e-commerce as well as manufacturing segments</p>	<p>Guwahati, Lucknow, Siliguri, Bhubaneshwar: Serve northern and eastern belts esp for the FMCG & e-commerce markets</p>	<p>Vizag & Kochi: close proximity to ports and key highways: cater to both manufacturing and FMCG/FMCD demand</p>
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There are several trends and themes in the warehousing sector, which are as follows



Higher production to augur well for agricultural warehousing demand





Data centres

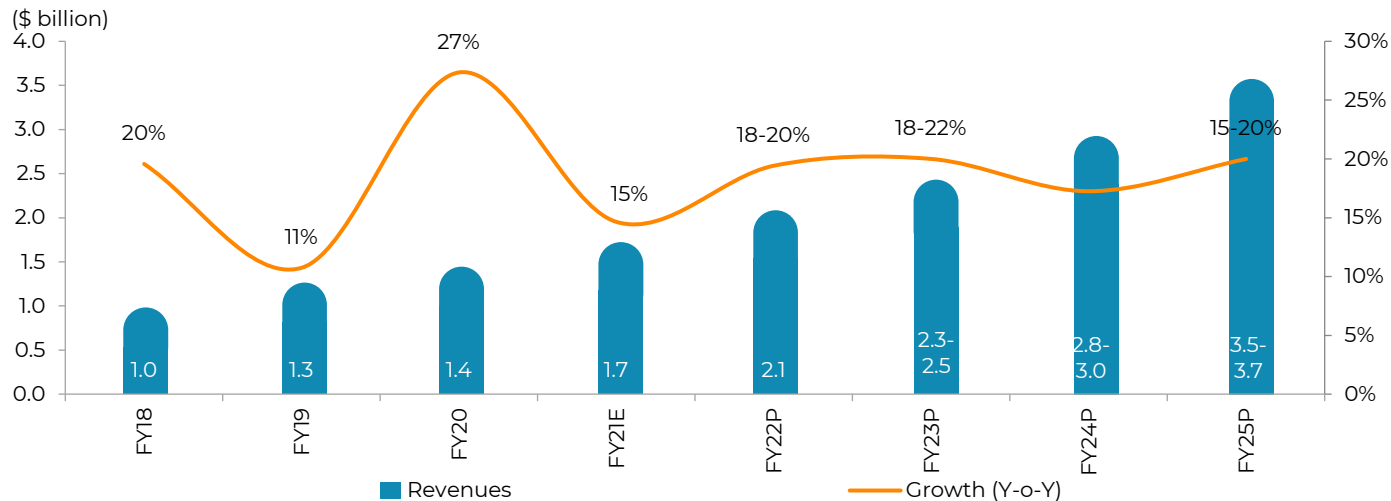
Evolving digital landscape positions India as a data centre hub

The industry is expected to log a ~20% CAGR between fiscals 2024 and 2028, led by robust investments by Indian and global players.

The Indian data centre industry is at an inflection point, driven by accelerated digitisation and rapid cloud adoption. As part of their digitisation strategies, industries are shifting their IT infrastructure to the cloud to enhance user experience and reduce costs. The industry expanded at a CAGR of 19-21% between fiscals 2018 and 2022, to reach ~\$2.1 billion in fiscal 2022. This growth was

supported by the Digital India initiative, and growth of sectors such as e-commerce, banking, financial services and insurance (BFSI), technology and media. The launch of 5G services is expected to boost the demand for data and storage capacities across sectors. Government norms on data localisation, and digital initiatives will add to the buzz.

Internet of Things, cloud and big data analytics drive industry growth

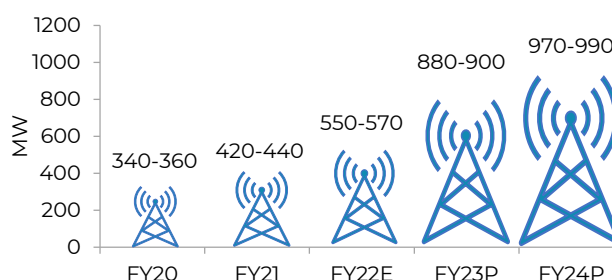


Source: Industry, CRISIL MI&A Research

Power capacity addition to support digital revolution

India currently hosts about 164 data centres across nine cities. The total installed capacity was estimated to 550-570 MW for fiscal 2023. The challenges posed by the Covid-19 pandemic accelerated the need for digital transformation across industries, making it a necessity rather than an option. This led to a surge in demand for hybrid cloud models and colocation services. The rise in data consumption increased the demand for data storage, transforming the data centre industry into a large and strategically important segment.

Capacity to reach 970-990 MW by FY24 led by investments from players across the globe



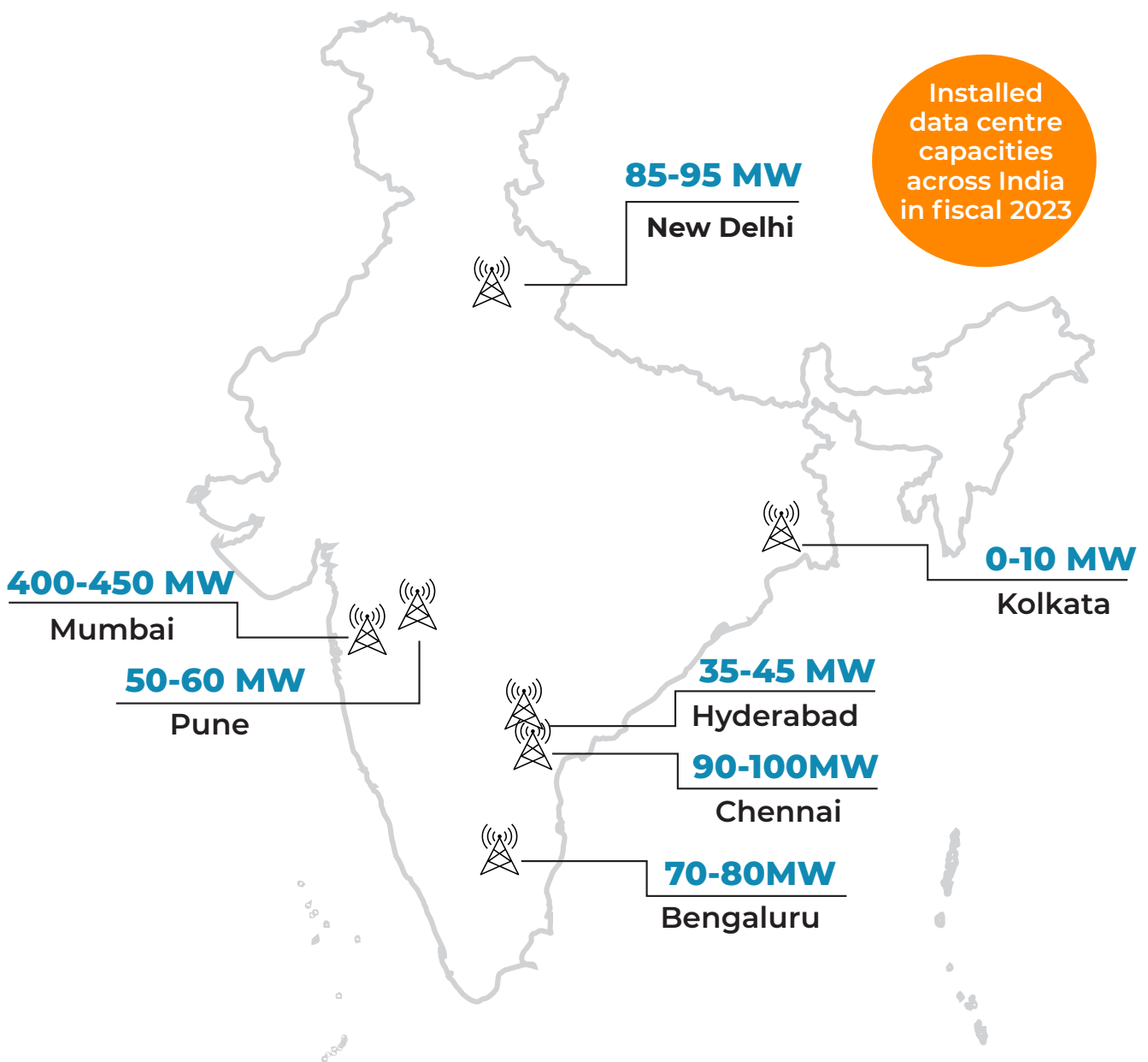
Current installed capacity (MW) in selected key cities in India.

Cable landing stations and government incentives give Maharashtra an edge over other states.

In India, data centres are buoyant in major cities

such as Mumbai, Chennai, Bengaluru, Hyderabad, Pune and Delhi. Mumbai accounts for ~50% of the installed data centre capacity, benefitting from the presence of undersea cable landing stations, its proximity to corporate houses and well-distributed fibre connectivity.

Mumbai leading in data centers capacities in India with 400-450 MW in fiscal 2023



Source: Industry, CRISIL MI&A Research

Overview of key business models in the Indian data centre industry

	Captive	Colocation	Hosting
Business model	Built-to-suit - consumer to design and customize a data center facility to meet its requirements	Subscription – consumer can rent space for servers and other computing hardware	Pay-per-use - consumer pay for the servers and storage, only while it is actually executing
Pros	Complete control over choice of hardware, software and security No vendor lock-ins	Capex savings due to direct leasing of rack space	No capex on IT hardware or software. Hyper-scalability of infra, based on demand
Cons	High capex, along with maintenance and security costs	Capex on servers. Hiring and training of staff required to manage systems	Inability to deploy customised solutions

Key growth drivers and trends for the data centre industry in India

1. Data Protection Bill

The central government’s data centre policy is focused on infrastructure status for data centres, improving the ease of doing business. Declaration of data centres under the Essential Services Maintenance Act, 1968, ensuring reliable power, internet connectivity and business continuity.

2. Rising internet subscriber base

With the launch of 5G services by telecom players, users will get access to higher-quality content such as Full HD videos. Edge data centres will act as intermediaries between large volumes of data and data processing.

3. Rising cloud adoption

Government initiatives to accelerate the delivery of e-services and partnerships with cloud service providers are driving increased cloud adoption among enterprises. The Indian public cloud services market is estimated to have reached \$5 billion in fiscal 2023.

4. Big data and IoT

Analytics has been driving demand for more bandwidth, and reliable and scalable data centres.

The number of IoT devices is expected to reach ~75 million by fiscal 2025, and the big data analytics market is anticipated to be worth \$68 billion.

Challenges faced by the industry

1. Data privacy

As data centres store sensitive and confidential client data, data leaks or thefts could be extremely costly. Thus, risk mitigation and ensuring cyber and physical protection of stored data are primary concerns for every data centre.

2. Power management

To reduce unplanned downtime in data centres, proper planning, analysis of power requirements, and implementation of a reliable power backup system are essential. Unplanned downtimes impact the reliability of a data centre.

3. Capacity planning

To deliver optimal performance, a data centre should be operating at its desired capacity. This can be achieved through the use of data centre infrastructure management (DCIM) tools, which can identify computational, storage and cooling requirements.



Urban infrastructure

Urban infrastructure spending to reach Rs 7.4 trillion over fiscals 2024-28

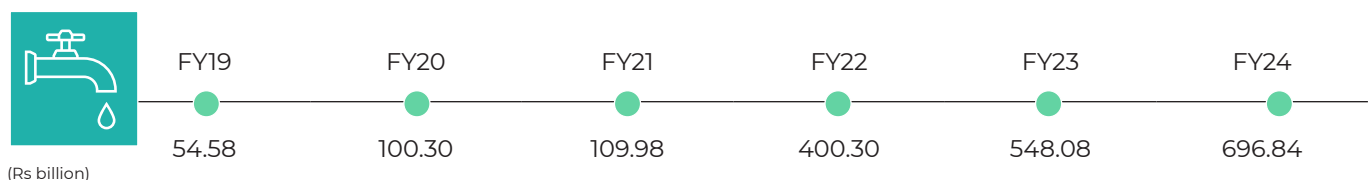
More than double the amount invested in the previous five years, driven by central government schemes.

Investments in urban infrastructure are expected to continue rising in the medium term, led by increasing urbanisation; government schemes such as Atal Mission for Rejuvenation and Urban Transformation (AMRUT), Swachh Bharat Mission, Clean Ganga and Jal Jeevan Mission; water supply and sanitation (WSS) projects; and construction and expansion of metro rail networks in major Indian cities.

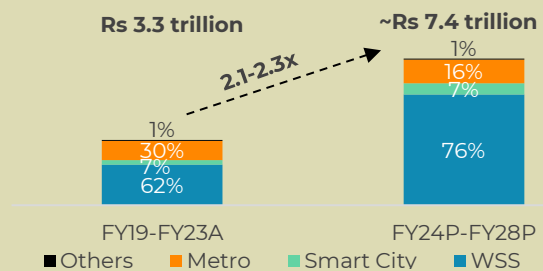
Investments in urban infrastructure are expected to rise 31-33% this fiscal, led by investments in WSS projects under schemes such as Swachh Bharat Mission, Jal Jeevan Mission and AMRUT; and deferred investments in metro projects, a bulk of which were under implementation and have achieved financial closure. This follows a 20-21% on-year rise in urban infrastructure investments last fiscal, attributable to increased investments in WSS projects, government focus on urban infrastructure, introduction of the Smart Cities Mission, and rise in execution of metro projects across 27 cities.

1. Jal Jeevan Mission

The Jal Jeevan Mission aims to ensure every rural household in India has access to safe and sufficient

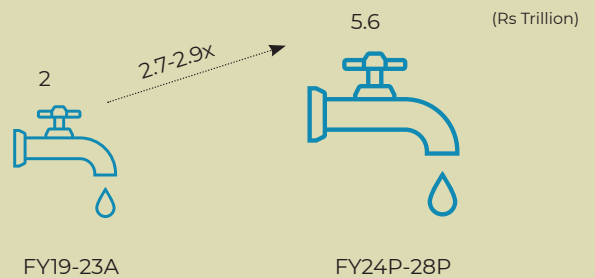


Water supply & sanitation (WSS) investments to account to ~75% of urban infrastructure spend in the next 5 years



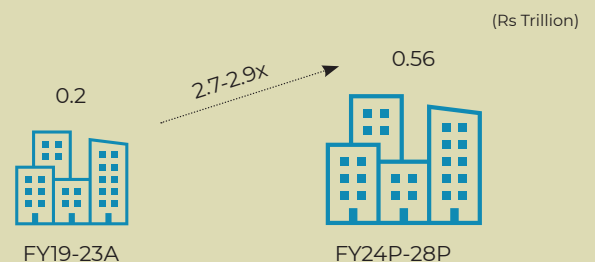
Source: CRISIL MI&A Research

Investments in WSS to rise 200% over the next 5 fiscals lead by the centers focus on jal jeevan mission



Source: CRISIL MI&A Research

Smart City investments to be more than double, attributable to delayed investments and boosted by utility during the pandemic



Source: CRISIL MI&A Research

drinking water by 2024, achieved through individual tap connections. Disbursements under the scheme by the central government in Rs billion are as below:

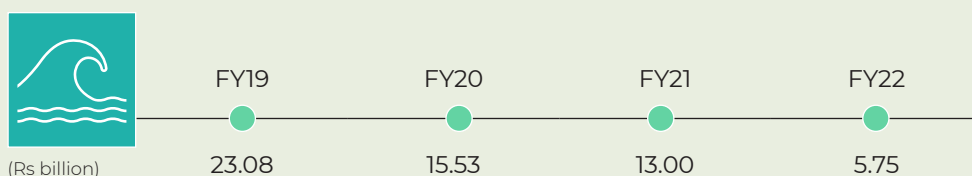
2. Namami Gange Programme

It is an integrated conservation mission approved as a 'flagship programme' by the Union Government in June 2014. With a budget outlay of Rs 20,000 crore, the programme aims to accomplish the twin objectives of effective abatement of pollution, and conservation and rejuvenation of national river the Ganga. The other key objectives of the programme include:

- Building robust sewage treatment infrastructure

- River front development
- River surface cleaning
- Industrial effluent monitoring
- Afforestation
- Improving biodiversity
- Increasing public awareness

Disbursements under the programme by the central government in Rs billion are as below:

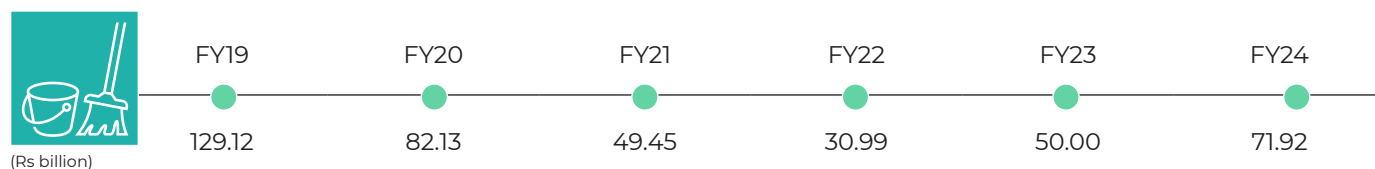


3. Swachh Bharat Mission

Swachh Bharat Mission was launched by the Prime Minister of India on October 2, 2014, with the aim of accelerating efforts to achieve universal sanitation coverage and highlighting the importance of sanitation. To achieve sustained open-defecation-free behaviours, ensure inclusivity, and make solid

and liquid waste management facilities accessible, the mission is transitioning to its Phase II, known as ODF-Plus.

Disbursements under the scheme by the central government have seen 44% growth in fiscal 24 (year-on-year)



4. AMRUT

AMRUT was launched on June 25, 2015, in 500 selected cities and towns across India. The mission aims to develop basic infrastructure in sectors such as water supply, sewerage and septage management, stormwater drainage, green spaces and parks, and non-motorised urban transport. The mission aims to make cities 'water secure' through projects related to functional water tap connections, water source conservation, rejuvenation of water bodies and wells, recycle/reuse of treated wastewater, and rainwater harvesting. The total indicative outlay for AMRUT 2.0 is Rs 2.99 trillion, including a central share of Rs 767.6 billion over five years.

5. Pradhan Mantri Krishi Sinchayee Yojana (PMKSY)

The primary goal of PMKSY is to achieve convergence of investments in irrigation at the field level. This includes expanding the cultivable area under assured irrigation, improving on-farm water use efficiency to minimise water wastage, promoting the adoption of precision irrigation and other water-saving technologies (to achieve more crop per drop), increasing aquifer recharge, and introducing sustainable water conservation practices. The scheme was launched by the Department of Agriculture & Cooperation, Ministry of Agriculture, in January 2006, as a centrally sponsored scheme on micro irrigation.

Notes

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