National Bank for Financing Infrastructure and Development

ICRA

Catalysing Infrastructure Investment & Innovation: Towards Viksit Bharat 2047

Building the Foundations for a Modern, Inclusive and Sustainable India

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Foreword

Mr. Rajkiran Rai G.

Managing Director

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There are very few parallels to the Indian growth story in history- from being the largest economy of the world till the seventeenth century to one of the poorest nations by the middle of twentieth century and then to become the fourth largest economy today. In the first quarter of the twenty-first century, India's nominal gross domestic product (GDP) rose 9X to surpass the $4-trillion landmark. Consequently, India has pulled millions out of poverty, being at the verge of eradicating absolute poverty. The honourable Prime Minister has set the ball rolling for India to become 'Viksit Bharat' by 2047. This means a transition from a lower-to-middle income economy today (about $2,700 per capita) to a high-income economy (>$13,400 per capita). We need to replicate the success of our past quarter century to make this transition happen. Developmental experience of the world, however, warns of the challenges in the transition to a developed economy-only a few have made it successfully in the past 30 years.

India's growth story has benefitted from its democratic polity, youthful demography, fast paced urbanisation, technological deepening and infrastructure enabling efficient movement of goods and services, both internally and across borders, along with energy security and communication. Infrastructure is key to sustaining the growth over a long horizon.

It is my privilege to introduce this comprehensive knowledge paper, prepared in collaboration with ICRA, titled Catalysing Infrastructure Investment & Innovation: Towards Viksit Bharat 2047. This document provides a thorough examination of India's infrastructure journey, highlighting both achievements and the strategic imperatives ahead.

The report traces the remarkable progress in infrastructure spending over the past two decades, analysing pan-India trends and the evolving sub-sectoral mix across transport, energy, urban development, water, digital networks and social infrastructure. It offers valuable insights into state-level dynamics, including cumulative spending patterns and comparative analyses across major states, revealing the diverse needs and opportunities within our federal structure. A key highlight is the exploration of the Special Purpose Vehicles (SPVs) and Public-Private Partnerships (PPPs), detailing their interconnections with Central schemes and state budgets. These mechanisms have been instrumental in driving efficiency and scaling projects, but the paper underscores the need for further enhancements to maximise their impact.

Drawing on historical data, the report delves into equity and debt financing trends, presents sector-wise investment projections and a gap analysis, illustrating the disparity between current trajectories and the requirements for Viksit Bharat. To address this, it advocates for unlocking private capital through blended finance, viability gap funding and enhanced PPP frameworks, while attracting long-term investors such as pension funds, sovereign wealth funds and insurance companies.

Policy and regulatory reforms are positioned as essential enablers, including improvements in land acquisition, dispute resolution and contract enforcement. It also explores innovative financing mechanisms, such as green bonds, sustainability-linked instruments, municipal bonds, pooled financing, asset monetisation and the application of fintech and tokenisation. These tools not only expand funding sources but also align infrastructure with environmental and social goals.

At the National Bank for Financing Infrastructure and Development, we are committed to our catalytic role in this transformation—de-risking projects, building bankable pipelines and mobilising capital to support inclusive growth. The insights from this report will inspire actionable strategies to overcome challenges and seize opportunities.

Let us collectively harness this momentum to build an infrastructure ecosystem that is resilient, innovative and equitable, paving the way for a prosperous India by 2047.

Foreword

Mr. K. Ravichandran

Executive Vice President & Chief Rating Officer

ICRA Limited

India's infrastructure development is pivotal to its economic growth and vision of becoming a developed nation by 2047. The country has made significant progress in sectors such as transport, energy, urban development, and digital connectivity, yet certain challenges persist in availability of low-cost & long-tenured financing, timely execution, and sustainable solution. Strategic investments, policy reforms, and innovative financing mechanisms are essential to bridge the infrastructure gap and realise the vision of Viksit Bharat 2047.

Infrastructure development in transport, energy, water, digital connectivity, and social assets drives GDP growth, employment, and competitiveness, so crucial for India's vast and diverse economy. The Vision 2047 infrastructure stands on key pillars like universal connectivity, sustainable urbanisation, clean energy transition, inclusive development, and technological leadership, aiming for a developed, inclusive, and sustainable India.

Infrastructure spending in India has grown exponentially, with capital outlay rising from Rs. 2.0 trillion in FY2015 to Rs. 11.2 trillion in FY2026 (as per Budget Estimates or BE) —a spectacular ~6x growth in a 12-year horizon. Also, it has evolved from fragmented, sector-specific allocations to a more integrated and outcome-oriented approach. The Government's flagship programmes such as the National Infrastructure Pipeline (NIP) and the PM Gati Shakti have laid the foundation for coordinated planning across sectors, including transport, energy, logistics, and urban development.

Over the years other than budgetary allocation, the funding for the capital expenditure (capex) on infrastructure has been complemented by the increased role of the NBFCs, Infrastructure Debt Funds, and institutional investors, coupled with conventional bank lending. Private equity (PE), Infrastructure Investment Trusts (InVITs), and foreign direct investments (FDI) have also been key contributors, with reforms enabling greater participation from domestic and foreign investors, although challenges remain in regulatory consistency for certain modes of investment.

Going forward massive investments are the need of the hour across roads, railways, power, telecom and urban infrastructure, among others, to meet the demands of Viksit Bharat 2047. The report highlights expected investment requirement in key infrastructure verticals. Moreover, given the steady increase in urbanisation in India, the report highlights the significant investment potential in Indian urban infrastructure space.

Other than Central and state government funding modes, which remain constrained by fiscal targets, unlocking private capital through blended finance, viability gap funding, enhanced public-private-partnership (PPP) frameworks, and attracting long-term institutional investors like pension and sovereign wealth funds will be critical. ICRA's study also underpins that structural reforms in land acquisition, dispute resolution, contract enforcement, digital platforms for transparency, green bonds, municipal bonds, asset monetisation, and fintech innovations are critical to create a resilient and inclusive infrastructure financing ecosystem.

Executive Summary

India's infrastructure development has been a defining feature of its economic narrative over the past decade. As the world's most populous country and one of the fastest-growing major economies, India has recognised infrastructure as a critical enabler of inclusive growth, competitiveness, and sustainability. The Government of India's (GoI) proactive approach, marked by ambitious programmes and institutional reforms, has laid the foundation for a modern, connected, and resilient India.

The country has made significant strides in building physical and digital assets; initiatives such as the National Infrastructure Pipeline (NIP) with an initially projected investment of Rs. 111 trillion, and the PM Gati Shakti Master Plan have laid the foundation for integrated and coordinated infrastructure development across sectors. These efforts are aimed at improving transparency, reducing project delays, and fostering inter-ministerial collaboration, enabling a more strategic approach to nation building. To give a few statistics, as of FY2024, the Central government's budget allocation for infrastructure spending reached Rs. 10 trillion, with capital expenditure in roads alone rising 5.7 times[1] (including private investment) since FY2014 to Rs. 3.01 trillion. The pace of highway construction increased from 12.1 km/day in FY2015 to 33.8 km/day in FY2024, and four-lane national highway (NH) stretches grew 2.6 times to 48,422 km. Urban and rural infrastructure have both seen notable improvements. The Smart Cities Mission has completed 94%[2] of 8,067 cross-sectoral projects, with about Rs. 47,385 crore disbursed by the GoI as of March 2025. Along with initiatives like Atal Mission for Rejuvenation and Urban Transformation (AMRUT), the PM Awas Yojna (PMAY) and the Jal Jeevan Mission, have enhanced access to housing, water, sanitation, and mobility. In rural areas, programmes like PM Gram Sadak Yojana (PMGSY) and BharatNet have expanded connectivity, helping bridge the urban-rural divide. India's digital infrastructure has also emerged as a global benchmark, with Aadhaar, UPI, and the Digital India initiative transforming service delivery and financial inclusion.

Despite these achievements, several challenges remain. Urban infrastructure continues to lag population growth, leading to congestion, pollution, and housing shortages. Financing is a major constraint, with infrastructure investment needs estimated at over $8 trillion by 2047 from key segments. Public resources need to be augmented by private sector participation, however, challenges like regulatory risk and long project gestation periods persist. Execution bottlenecks such as land acquisition delays and environmental clearances further hinder progress. Additionally, climate vulnerability is a growing concern, with infrastructure increasingly exposed to extreme weather events and lacking adequate resilience measures.

At the same time, India is well-positioned to capitalise on emerging opportunities. The global shift toward green infrastructure aligns with India's net-zero commitment by 2070, creating avenues for investment in renewable energy, electric mobility, and sustainable construction. The expansion of digital infrastructure, including 5G, data centres, and AI, offers the potential to revolutionise logistics, urban management, and public service delivery. Regional connectivity is improving through initiatives like Bharatmala, Sagarmala, and Dedicated Freight Corridors (DFCs), which are enhancing logistics efficiency and unlocking economic potential. Liberalised FDI norms and asset monetisation programmes are also opening new channels for private investment.

To realise the vision of Viksit Bharat 2047, infrastructure must be reimagined as a catalyst for transformation. This requires integrated planning, innovative financing, and a strong focus on sustainability and resilience. Platforms like Gati Shakti can support data-driven decision making, while blended finance models and green bonds can unlock private capital. Climate risk assessments, low-carbon technologies, and nature-based solutions must become standard practice. Strengthening governance, empowering urban local bodies, and leveraging technology for real-time monitoring and predictive maintenance will be essential. By making strategic choices today, India can build infrastructure that supports economic growth, enhances quality of life, and ensures environmental stewardship—paving the way for a truly developed and inclusive nation by 2047.

[1] *https://www.pib.gov.in/FactsheetDetails.aspx?Id=149113*
[2] *https://www.pib.gov.in/PressNoteDetails.aspx?NoteId=154736&ModuleId=3*

Introduction

Importance of Infrastructure in Economic Development

Infrastructure forms the backbone of economic development, serving as the foundation upon which nations build prosperity and improve quality of life. In India's context, infrastructure development—spanning transport, energy, water, digital connectivity, and social assets—has a multiplier effect on GDP growth, employment generation, and overall competitiveness. Well-planned infrastructure lowers the cost of doing business, stimulates investment, enhances productivity, and unlocks new economic corridors.

A modern and reliable infrastructure ecosystem is especially critical for a country as vast and diverse as India, where connectivity, logistics, and energy access remain central to unleashing the full potential of both urban and rural regions. The Government of India's continued focus on infrastructure, as seen in the NIP and PM Gati Shakti, underlines its importance as a principal driver of national progress and global ambition.

Role of Infrastructure in Achieving the Viksit Bharat 2047 Vision

Viksit Bharat 2047 envisions India as a developed, inclusive, and sustainable nation by its 100th year of independence. Achieving this milestone requires transformative changes in the scale, quality, and reach of national infrastructure. Infrastructure will serve not just as a facilitator of economic growth, but as a catalyst for social transformation—enabling access to education, healthcare, sanitation, mobility, and digital empowerment for all citizens.

The vision of Viksit Bharat 2047 rests on several infrastructure-driven pillars:

- **Universal Connectivity:** Seamless and affordable physical and digital connectivity across rural and urban India.
- **Sustainable Urbanisation:** Green and smart cities that provide liveable, resilient, and efficient services.
- **Clean Energy Transition:** Acceleration towards renewable energy sources, energy security, and climate resilience.
- Inclusive Development: Infrastructure that bridges existing divides and delivers services equitably to all sections of society.
- **Technological Leadership:** Adoption of cutting-edge technologies to drive efficiency, transparency, and innovation in infrastructure planning, delivery, and management.

In this context, infrastructure emerges as both the canvas and the catalyst for realising the Viksit Bharat 2047 vision—empowering India to leapfrog developmental barriers and shape a future-ready nation.

Objectives of the Report

This report aims to:

- Provide a comprehensive review of India's infrastructure journey—including significant achievements, persistent challenges, and emerging trends.
- Highlight the significant infrastructure funding needs across key sectors and funding opportunities for banks, Development Finance Institutions (DFIs), and private capital, among others.
- Recommend strategic imperatives and possible actionable to align infrastructure development with the Viksit Bharat 2047 vision.
- Summarise possible learnings from infrastructure financing models and policy steps followed by other countries on an infra-led growth trajectory.

By offering actionable insights and a roadmap for the future, this report seeks to inform policymakers, investors, entrepreneurs, and citizens alike, contributing meaningfully to the discourse on India's development trajectory as it approaches its century milestone of independence.

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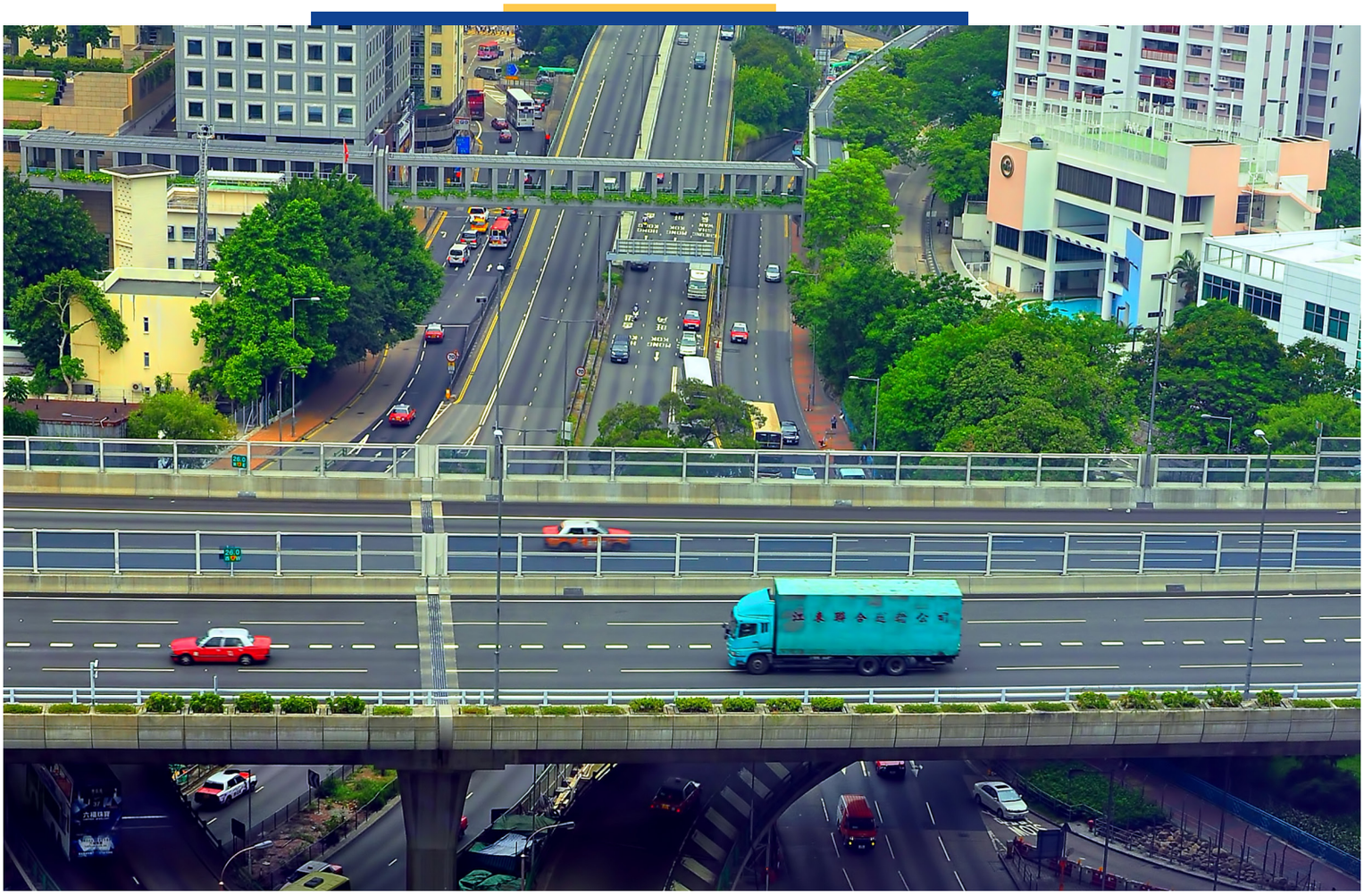
Infrastructure Landscape in India

Pan-India Infrastructure Development Trends: A Decadal Analysis

Over the past decade, India has witnessed a transformative shift in its infrastructure landscape, driven by sustained public investment, policy reforms, and strategic prioritisation. As one of the fastest-growing major economies globally, India's infrastructure push has been central to its economic ascent, culminating in its recent overtaking of Japan to become the world's fourth-largest economy by nominal GDP.

Infrastructure spending in India has grown exponentially, with capital outlay rising from Rs. 2.0 trillion in FY2015 to Rs. 11.2 trillion in FY2026 (BE) —an increase of nearly 600%. Also, it has evolved from fragmented, sector-specific allocations to a more integrated and outcome-oriented approach. The Government's flagship programmes such as the NIP and PM Gati Shakti have laid the foundation for coordinated planning across sectors including transport, energy, logistics, and urban development. These initiatives aim to mobilise investments exceeding Rs. 100 trillion over a multi-year horizon, with a focus on improving connectivity, reducing logistics costs, and enhancing productivity.

One of the most notable achievements has been in **highway construction**. India has consistently expanded its national highway network, with annual construction reaching record levels. The implementation of the Bharatmala Pariyojana (starting in 2017) accelerated the development of economic corridors, border roads, and expressways. Between FY2014 and FY2024, the pace of highway construction more than doubled (from 12.1 km/day in



FY2015 to 33.8 km/day in FY2024)[3], with over 12,000 km built annually in peak years. This expansion has significantly improved inter-state connectivity and reduced travel time.

In the **railway sector**, modernisation has gained momentum through electrification, station redevelopment, and the introduction of semi-high-speed trains like the Vande Bharat Express. The push for 100% electrification of broad-gauge routes and the adoption of digital technologies for operations and safety have marked a shift toward sustainability and efficiency. Freight corridors and multimodal logistics parks are being developed to enhance cargo movement and reduce dependence on road transport.

Energy infrastructure has also undergone a paradigm shift. India has emerged as a global leader in renewable energy capacity addition, with solar and wind installations growing rapidly. The country's installed renewable energy capacity crossed 237.5 GW as of July 2025[4] , hitting the 50% non-fossil installed capacity milestone ahead of 2030 clean energy target, supported by policy incentives and international partnerships. Simultaneously, the expansion of transmission networks and rural electrification programmes have improved energy access and reliability.

In **logistics and urban infrastructure**, the focus has been on integrated development. The rollout of smart cities, metro rail projects, and urban mobility solutions has improved liveability in major urban centres. The logistics sector has benefited from the implementation of Goods and Services tax (GST), digitisation, and infrastructure upgrades, contributing to India's improved ranking in the World Bank's Logistics Performance Index (from 44 in 2018 to 38 in 2023[5]). The LEADS 2024 report[6] introduced sustainability metrics and recognised top-performing states like Gujarat, Karnataka, and Maharashtra.

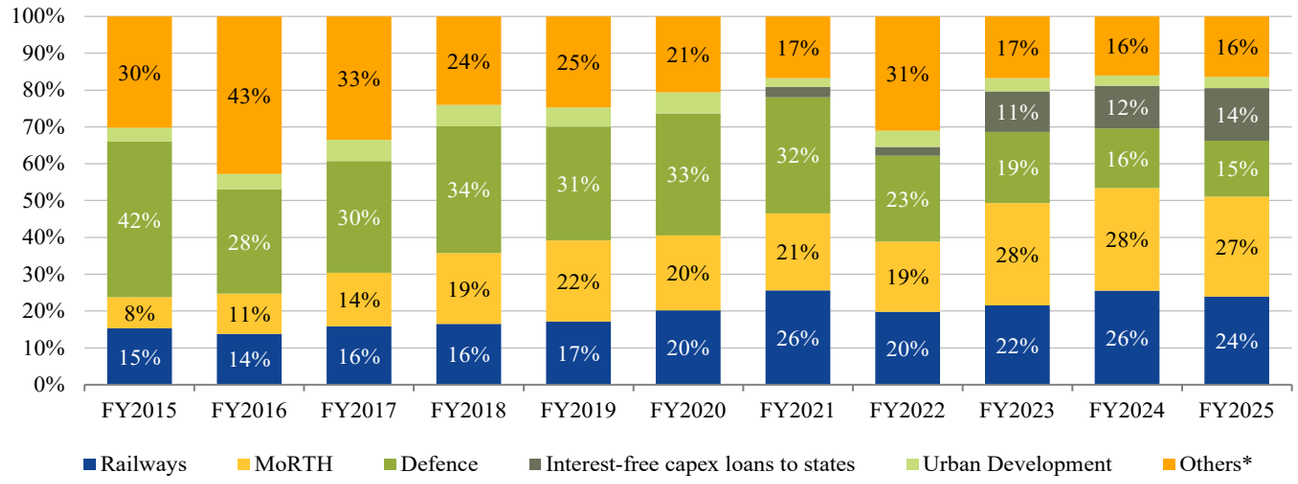
Despite these gains, challenges remain in terms of financing, land acquisition, and project execution. Private sector participation, though improving, still lags expectations. However, the Government's emphasis on public-private partnerships (PPPs), asset monetisation, and institutional reforms is gradually addressing these bottlenecks. As infrastructure continues to be a key driver of economic expansion, sustained investment and policy coherence will be critical to maintaining momentum.

Sectoral mix of Government's capex focus

Historically, sectors like defence, railways, and roads have constituted a large proportion of the GoI's capital expenditure. While the capital outlay towards defence formed a substantial 42% of the total capex in FY2015, its share moderated to about 15% in FY2025, even as it remains elevated in absolute terms (Rs. 0.8 trillion in FY2015 over Rs. 1.6 trillion in FY2025). On the other hand, the share of infrastructure-oriented sectors such as railways (24% in FY2025 from 15% in FY2015) and roads (Ministry of Road Transport and Highways (MoRTH); 27% in FY2025 from 8% in FY2015) have risen sharply over the past 10 years, reflecting a shift in the GoI's focus on infrastructure development. Moreover, the allocation towards urban development (including metro projects) has risen at a CAGR of about 16% during FY2015-FY2025, with its share remaining at almost 3-4% during this period. Together, these three segments accounted for nearly 55% of the GoI's capex in FY2025 as against just about 26% in FY2015.

[3] *https://www.pib.gov.in/PressReleasePage.aspx?PRID=2098788*
[4] *https://mnre.gov.in/en/physical-progress/*
[5] *https://www.pib.gov.in/PressReleasePage.aspx?PRID=2090056*
[6] *https://www.pib.gov.in/PressReleasePage.aspx?PRID=2090056*

Exhibit: Composition of GoI's capex



*Note: *Other sectors excluding those mentioned above; Source: Union Budget; CGA, Ministry of Finance, GoI; ICRA Research*

Despite the decadal shift, the allocation for these sectors has remained somewhat stagnant over the past two years by the Ministry of Railways (at Rs. 2.4-2.5 trillion in FY2024-FY2025), MoRTH (at Rs. 2.6-2.9 trillion), and the Ministry of Housing and Urban Development (at Rs. 0.3 trillion), which may partly reflect execution bottlenecks and cautious budgeting.

Moreover, the GoI had introduced the "Special Assistance as Loan to States for Capital Expenditure" or the 50-year interest-free capex loan scheme for the state governments in FY2021, to support their spending on infrastructure development as well as sector-specific projects. The allocation under this scheme rose from just Rs. 0.12 trillion in FY2021 to a substantial Rs. 1.50 trillion in FY2025, with its share in aggregate capex jumping from about 3% to almost 14% during this period.

Seven states made up 62% of total state capex in FY2025 PA

Among India's 28 states, there is sizeable diversity in terms of the absolute size of the capex, the pace of its YoY growth as well as the magnitude of their spending relative to the size of their respective gross state domestic product (GSDP). In FY2025 (as per Preliminary Actuals or PA), Uttar Pradesh incurred a capex of Rs. 1.2 trillion, contributing 14% to the total capex of Rs. 8.3 trillion in that fiscal. The capex of Gujarat, Karnataka, Madhya Pradesh, Maharashtra, Odisha and Tamil Nadu was in the range of Rs. 400 billion to Rs. 1.0 trillion, aggregating to Rs. 4.0 trillion in FY2025 PA. Together, these seven states accounted for 62% of the total state capex of FY2025 PA, indicating a fair extent of concentration in spending. The data on capital spending in FY2015 reveals similar concentration patterns.

The trends in the capital expenditure by a state government relative to the size of its economy, and to total spending, is a useful way of gauging its performance on productive spending compared to assessing it on an absolute basis. A higher proportion of the permitted annual borrowing limit of a state, if consistently utilised for capital expenditure, would be key in pushing the long-term growth of the state higher. While the combined capex of 28 state governments improved to 2.6% of GSDP in FY2025 PA from 2.3% in FY2022, there were wide state-wise variations.

Exhibit: State-wise share of capital expenditure in FY2020

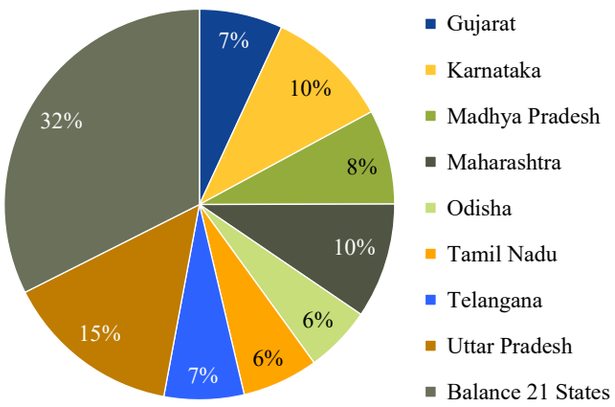
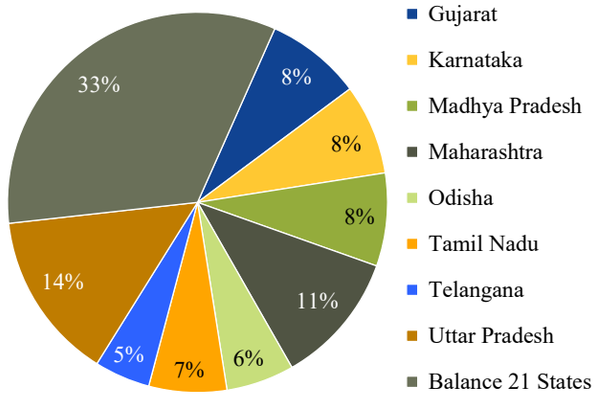


Exhibit: State-wise share of capital expenditure in FY2025 PA

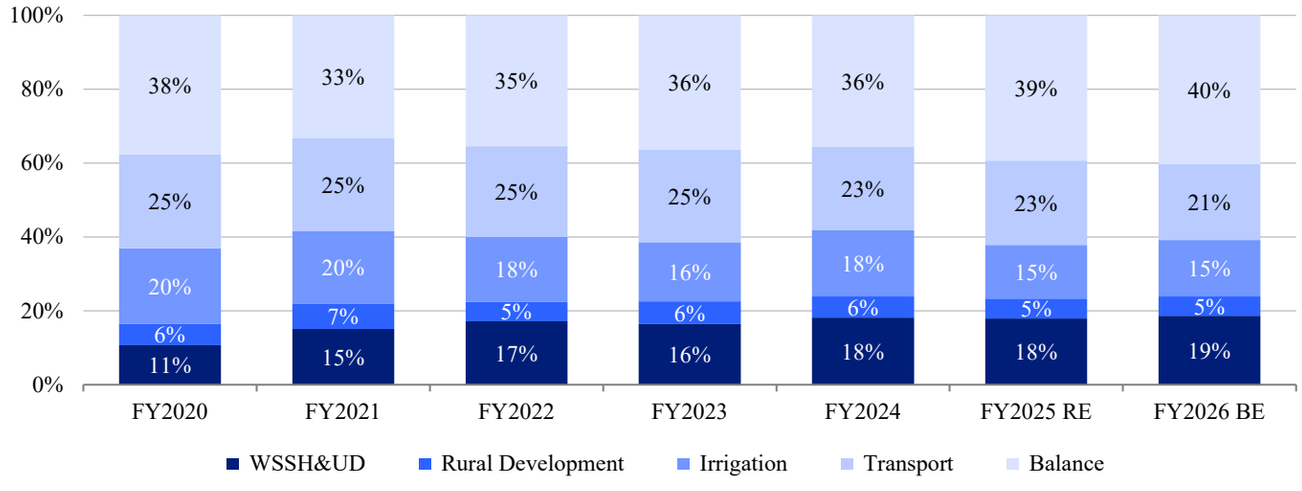


Source: ICRA Research, CAG, State Budgets

State capex priorities: Urban services, transport, irrigation and rural growth

Trends in sector-wise capital spending reveals that such spending has been dominated by, water supply, sanitation, housing and urban development (WSSH&UD), transport, irrigation and rural development. During the FY2022-FY2025 revised estimates (RE), the share of these four sectors accounted for 60-65% of the total capital expenditure. This was not materially different from the trends during FY2015-2020, with FY2021 being an aberration, when the share of these four-heads had increased to 67%. However, within these sectors, the spending had tilted towards WSSH&UD during FY2022-FY2025 from the pre-Covid period (FY2015-FY2020) with some reduction in irrigation and rural development sectors.

Exhibit: Composition of capital outlay



Source: ICRA Research, CAG, State Budgets

Role of Public Private Partnerships (PPPs)

India's infrastructure development strategy has increasingly incorporated Special Purpose Vehicles (SPVs) and Public-Private Partnerships (PPPs) with centrally sponsored schemes and state-level budgetary frameworks to optimise capital mobilisation and execution efficiency while leveraging private sector capabilities. These mechanisms have played a significant role in enabling large-scale investments across transport, energy, urban infrastructure, and logistics spaces.

Special Purpose Vehicles (SPVs) are structured entities created to manage specific infrastructure projects, allowing for financial ring-fencing and operational autonomy. In India, SPVs have been widely adopted under several Central Government programmes such as the Smart Cities Mission, where over 100 cities established SPVs to implement urban infrastructure projects. As of May 2025, approximately 94%[7] of the 8,067 multi-sectoral sanctioned projects with a total investment value of Rs. 1.64 trillion were completed with about Rs. 47,385 crore (99.44% of the budgeted amount) being disbursed by the GoI. SPVs are also central to the National Monetization Pipeline (NMP) and Gati Shakti Master Plan, facilitating asset monetisation and integrated infrastructure planning. States often create sector-specific SPVs (e.g., transport, water, energy) to channel budgetary allocations and attract private investment under centrally guided frameworks. These SPVs operate with financial autonomy, allowing cities to raise funds independently and align with both Central grants and state co-financing; they enable improved accountability and, thus enhance investor confidence by separating project risks from parent government entities.

Public-Private Partnerships (PPPs) have been central to India's infrastructure strategy since the early 2000s. As of 2024, India had over 9,200 PPP projects across various stages, with cumulative investments exceeding Rs. 6.8 lakh crore[8]. The road sector remains dominant, with over 5,000 km of highways under PPP models like Build-Operate-Transfer (BOT) and Hybrid Annuity Mode (HAM), followed by renewable energy and electricity transmission.

[7] *Press Note Details: Press Information Bureau*
[8] *Public Private Partnerships in India*

India's PPP Success Stories: Catalysing Infrastructure through Collaborative Innovation

Delhi Airport Modernisation (2010-2022):
Led by GMR Group, this PPP transformed the airport into a global hub, handling over 65 million passengers annually.

Investment size:
~Rs. 12,500 crore

Mumbai Trans Harbour Link (2016-2024):
India's longest sea bridge (21.8 km) connecting Mumbai to Navi Mumbai. Executed under a PPP model with support from JICA and private contractors.

Investment size:
~Rs. 17,850 crore

Hyderabad Metro Rail (Phase 1; 2012-2020):
Developed by Larsen & Toubro under a PPP concession, the metro spans over 70 km and serves more than 4.5 lakh daily commuters.

Investment size:
~Rs. 17,000-18,800

Rewa Ultra Mega Solar Park (2015-2020):
One of India's largest solar parks with 750 MW capacity; PPP between Rewa Ultra Mega Solar Ltd. (SPV) and private developers.

Investment size:
~Rs. 4, 500 crore

Source: ICRA Research

SPVs and PPPs have contributed significantly to India's infrastructure development by enabling capital mobilisation, improving execution efficiency, and fostering innovation. While sectoral outcomes vary, the overall impact reflects enhanced service delivery, job creation, and improved asset performance. Continued refinement of regulatory frameworks and risk-sharing models will be essential to sustain momentum and attract long-term private investment across sectors.

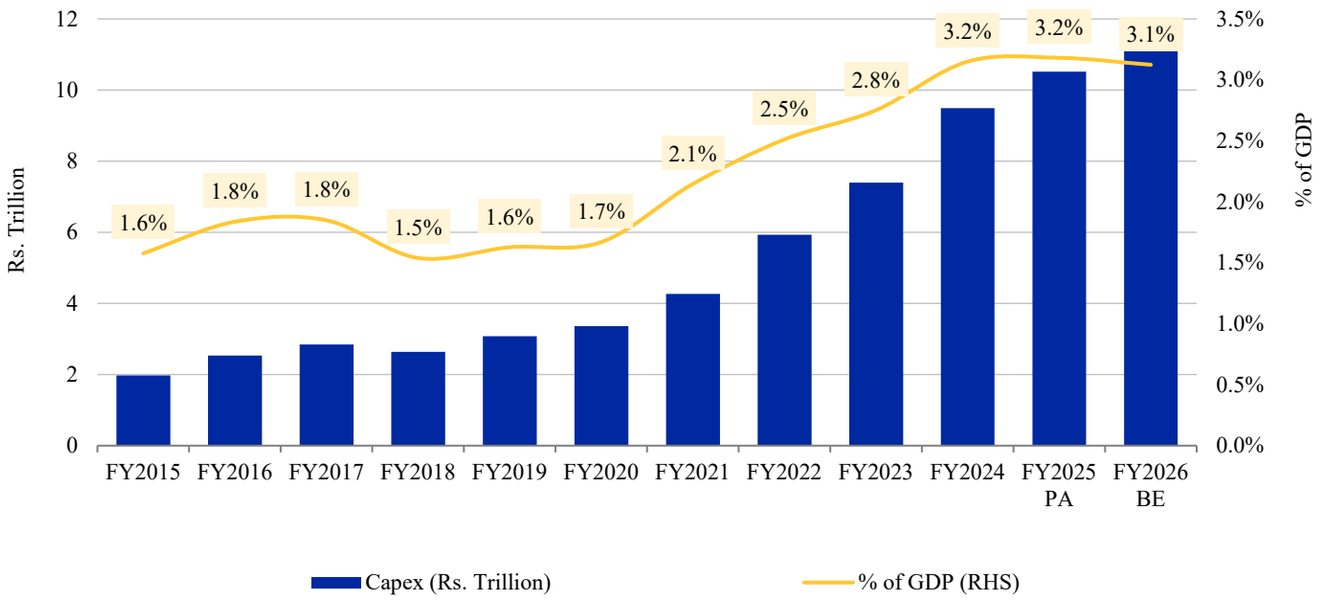
Infrastructure Financing in India: Historical Landscape

Equity Financing

Government capital expenditure

Central Government: Over the past decade, the GoI has been continuously increasing allocations towards the key infra sectors such as roads, highways, railways, and urban infrastructure. The GoI's gross capital spending rose sharply to Rs. 10.5 trillion in FY2025 from a low Rs. 2.0 trillion in FY2015, reflecting a healthy CAGR of 18.3% during this period. Moreover, as a percentage of GDP, the gross capex rose from an average of 1.7% during FY2015-FY2020 to 2.5% during FY2021-FY2023, and further to 3.2% during FY2024-FY2025, reflecting the strong push towards infrastructure development and asset creation.

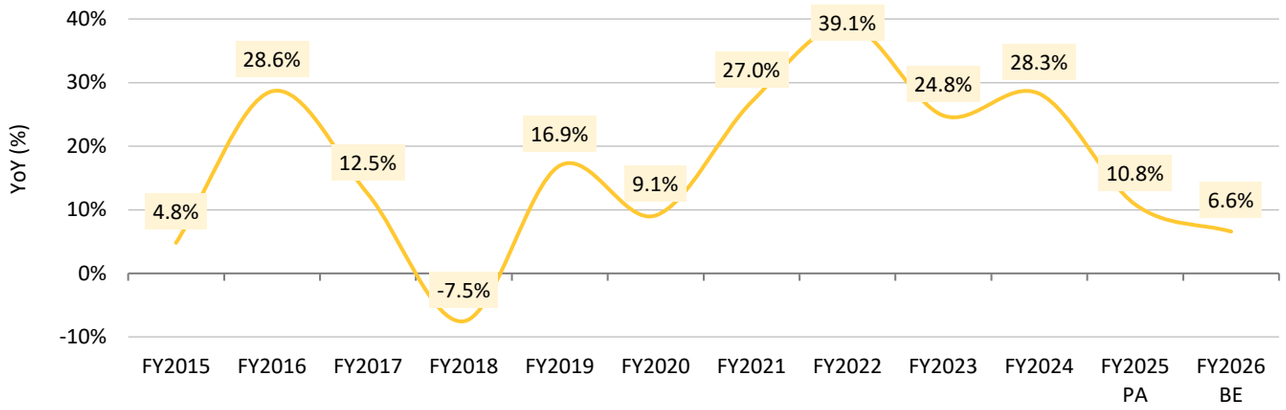
Exhibit: Trends in GoI's capital expenditure over last decade



Note: ICRA's nominal GDP projection of 8.5% for FY2026 has been used; Source: Union Budget; CGA, Ministry of Finance, GoI; ICRA Research

Notably, the pace of year-on-year (YoY) expansion in the GoI's capex had exceeded about 20% in each of the years during the post-Covid period of FY2021-FY2024 (average: +29.8%), before moderating somewhat to 10.8% in FY2025, dampened by the General Elections. This sustained high growth in capex aims to boost productivity, generate employment opportunities, and attract private investment.

Exhibit: Trends in GoI's capex – YoY growth



Source: Union Budget; CGA, Ministry of Finance, GoI; ICRA Research

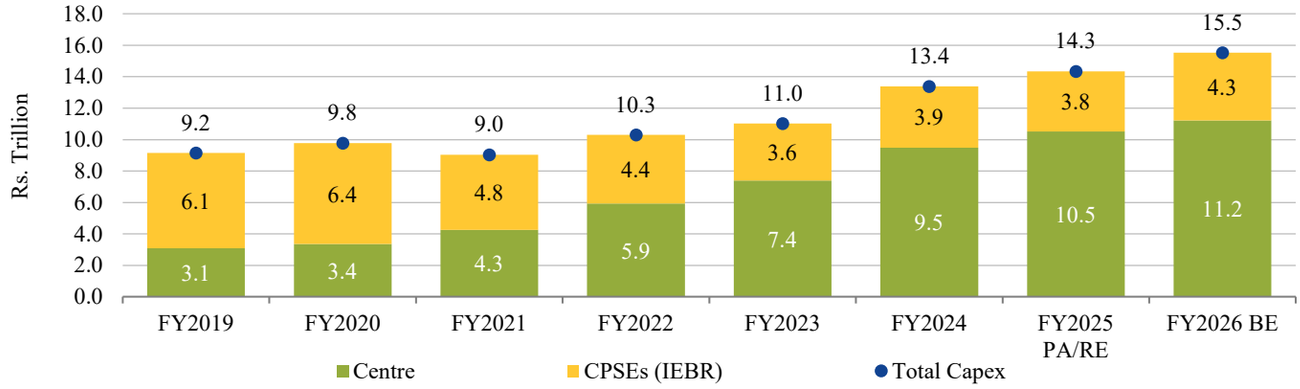
Additionally, as a percentage of total expenditure, the GoI's capital spending has surged to 22.6% in FY2025 from 11.8% in FY2015, depicting an improvement in the quality of spending. After averaging at 12.9% during FY2015-FY2021, capex as a percentage of total expenditure rose to an average of 16.6% during FY2022-FY2023, and further to 22.0% during FY2024-FY2025. This shift from revenue spending to capital spending reflects a change in fiscal policy strategy.

Recent years have seen a drop in CPSEs' IEBR capital outlay due to increased capex on-budgeting

In addition to the on-budget capex, the Central Public Sector Enterprises (CPSEs) also use Internal and Extra Budgetary Resources (IEBRs) to finance their capital spending, which is off-budget and does not directly impact the GoI's fiscal position. The CPSE's IEBR should be considered along with the GoI's on-budget capex to capture a broader picture.

The IEBR component has risen to Rs. 3.8 trillion in FY2025 from Rs. 2.3 trillion in FY2015, implying a relatively muted CAGR of about 5% during the past decade, driven by the Ministry of Petroleum and Natural Gas, Housing and Urban Affairs, and the Department of Food and Public Distribution, even as the Ministry of Railways saw a decline in the IEBR component during this period.

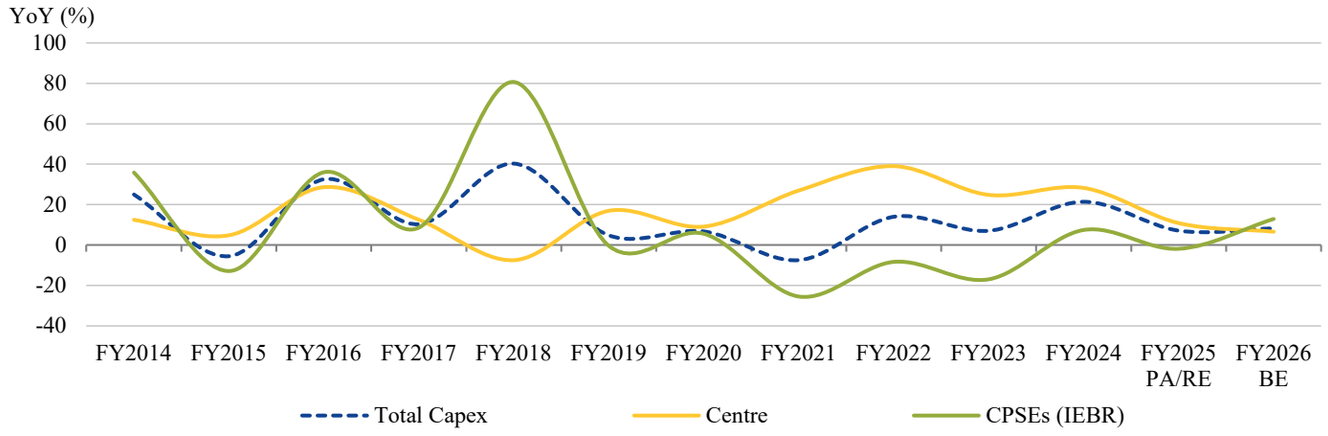
Exhibit: Capex by Centre and CPSEs (IEBR)



Note: PA data has been used for Centre, and RE for CPSE since that is unavailable; Source: Union Budget; CGA, Ministry of Finance, GoI; ICRA Research

There has been a moderation in the mobilisation of IEBR by the CPSEs over the past few years amid rising debt burdens and shift to on-budget financing by the GoI. For instance, after surging during FY2015-FY2020 (CAGR: +23%), the IEBR portion of the capital outlay by CPSEs declined by about 10% during FY2021-FY2025. Thereafter, it continued to contract by almost 4% during FY2023-FY2025. Additionally, as a percentage of GDP, the IEBR rose from 1.8% in FY2015 to 3.6% in FY2018, before easing to 1.2% in FY2025.

Exhibit: Annual growth trends in capex by Centre and CPSEs (IEBR)



Note: PA data has been used for Centre, and RE for CPSE since that is unavailable; Source: Union Budget; CGA, Ministry of Finance, GoI; ICRA Research

Assessing the sectoral trend, the IEBR component of the Ministry of Road Transport and Highways (MoRTH) had surged by a CAGR of about 53% during FY2015-FY2022, amid a steep rise in the National Highway Authority of India's (NHAI's) borrowing. Consequently, the spending by the NHAI was brought on-budget to restrict further debt build up and completely subsumed within the GoI's own budget. Thereby nil allocation was made under the IEBR component for MoRTH during FY2023-FY2025. Likewise, the IEBR for the Ministry of Railways has seen a decline over the past five years (CAGR: -35%).

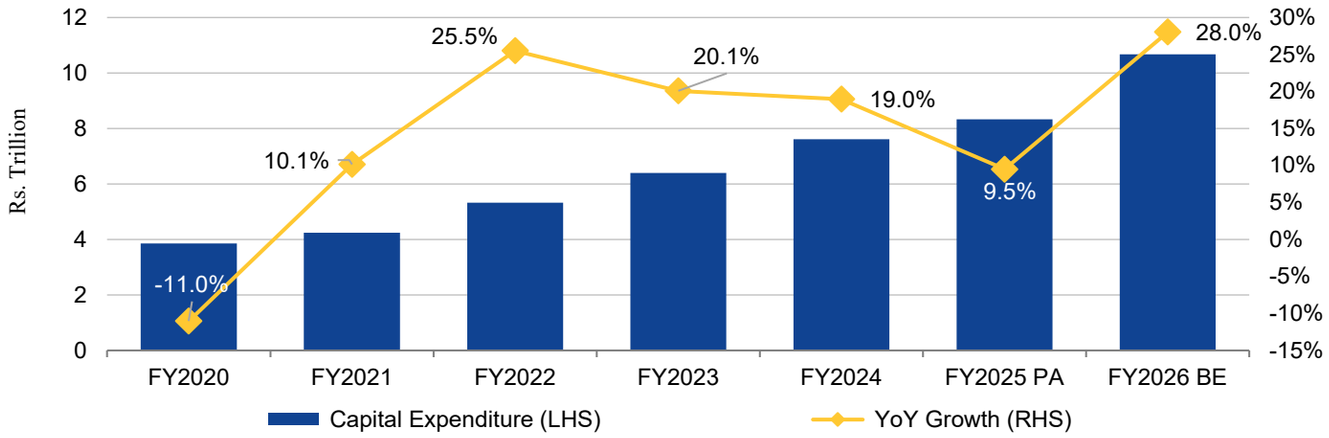
Overall, the combined capital expenditure, which includes the budgetary capex and the IEBR of CPSEs, has recorded a healthy CAGR of 12.6% during FY2015-FY2025, rising to Rs. 14.0 trillion (4.2% of GDP) in FY2025 from Rs. 4.3 trillion (3.4% of GDP) in FY2015.

State-level Trends

Capital spending by state governments doubled to Rs. 8.3 trillion in FY2025 from pre-Covid levels

Capital spending by state governments plays a vital role in boosting the overall growth of India. The share of states in total capital outlay (excluding defence spending plus state's capex) exceeds 50%. During FY2015-FY2019, the combined capital spending of 28 states increased by a moderately healthy CAGR of 13%. However, the economic slowdown in FY2020 and the Covid-19 pandemic in FY2021 restricted the capital spending of states to Rs. 3.9-4.2 trillion, below the Rs. 4.3 trillion seen in FY2019.

Exhibit: Trends of capital expenditure of 28 states



Source: ICRA Research, CAG; State Budgets

Support from the GoI to the states under the 'Financial Assistance to States for Capital Investments' scheme (herein referred as capex loans scheme) wherein the GoI has been providing 50-year interest-free loans to the states, has helped to boost their capital spending from FY2022, among other factors. The combined capital expenditure of the 28 states increased by a healthy 19-26% during FY2022-FY2024. With incremental spending of Rs. 1.0-1.2 trillion during FY2022-FY2024, the total capital spending of 28 states touched Rs. 7.6 trillion in FY2024.

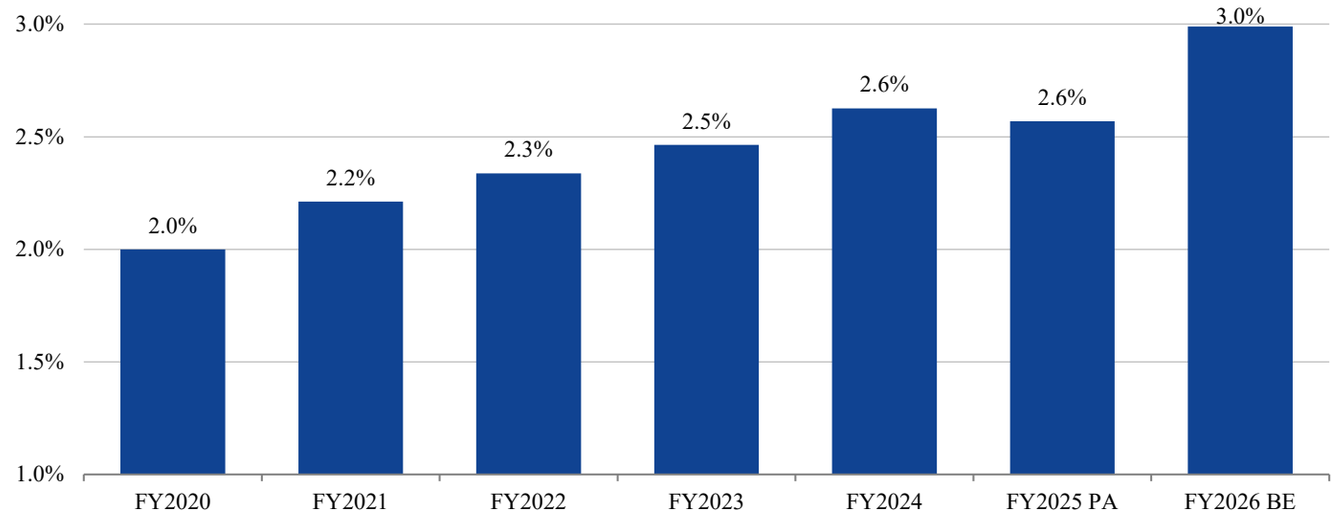
As per the FY2025 PA, 28 state governments incurred capital expenditure of Rs. 8.3 trillion. This was twice the amount expended in the pre-Covid fiscal of FY2020. After three successive years of double-digit YoY expansion in capex during FY2022-FY2024, the growth moderated to 10% in FY2025 PA. Parliamentary elections in the initial months of FY2025 and the subsequent excessive monsoon rainfall in certain states lulled the pace of capex in H1 FY2025. Overall, the capex of 28 state governments reported an impressive CAGR of 16% during FY2022-FY2025 PA. In the Budget Estimates (BE) of FY2026, the 28 state governments have indicated sizable capital spending of Rs. 10.7 trillion.

Notably, the spending ability of the state governments in a fiscal is effectively constrained by the borrowing limits affixed by the GoI based on the recommendations of the successive Finance Commissions (FC). At present, the borrowing limits of the states are governed by the recommendations of the 15th FC (award period FY2022-FY2026). The 15th FC had recommended a step-down in the net borrowing limit (NBC) of the states from 4% of GSDP in FY2022 to 3.5% in FY2023 and to 3.0% of GSDP each during FY2024-FY2026. The NBC includes borrowings from the market through issuance of state government securities (SGS), loans from the Centre, borrowing through financial institutions, and external agencies, etc.

Over and above these limits, the 15th FC had recommended an additional borrowing of 0.5% of GSDP for the states, for each year during FY2022-FY2025, linked to the completion of the prescribed power sector reforms. In the FY2026 Union Budget, the GoI extended this additional borrowing facility to states for FY2026 as well. Moreover, the capex loans provided by the GoI to the state governments is also over and above the NBC of the states. While market borrowing remained the key source of funding the capex, the disbursal of over Rs. 3.1 trillion by the GoI to the states as capex loans during FY2022-FY2025 spurred their capital spending. Such loans were availed by most of the state governments during this period. On the other hand, a select number of states borrowed Rs. 1.3 trillion by completing the prescribed power sector reforms during FY2022-FY2025.

Aided by additional funds under the capex loans and power sector reform linked borrowings, the states' total capital expenditure improved to 2.6% of GSDP in FY2025 PA from 2.3% of GSDP in FY2022.

Exhibit: Capital expenditure as a proportion of GSDP of 28 states



Source: ICRA Research, National Statistics Office (NSO); CAG; State Budgets

Private equity and institutional investors

India's infrastructure financing journey has witnessed a gradual but significant shift in the role of private equity (PE) and institutional investors over the past two decades. Traditionally, infrastructure development was dominated by public sector investment and bank lending. However, the early 2000s marked a turning point, with the Government actively promoting PPPs and liberalising FDI norms to attract private capital.

Between 2007 and 2012, private investment in infrastructure rose sharply, contributing nearly 2.7% to GDP, up from 1.1% in the previous five-year period. This surge was driven by increased participation from domestic and global PE funds, sovereign wealth funds, and pension funds, particularly in sectors like roads, power, and telecom. However, post-2012, private investment slowed due to regulatory bottlenecks, land acquisition delays, and stress build-up in balance sheets of developers and banks.

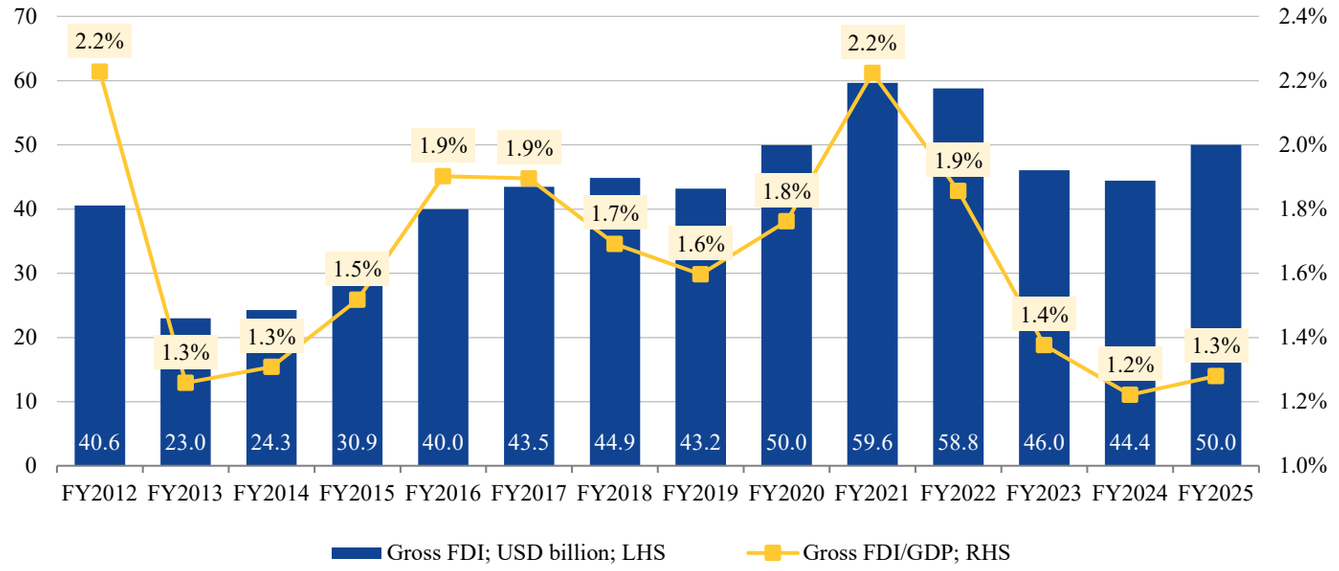
The landscape began maturing in the late 2010s, with the introduction of InvITs and Infrastructure Debt Funds (IDFs), which offered institutional investors access to operational assets with stable returns. As of March 2025, InvITs had mobilised over Rs. 7 trillon in assets under management (AUM) (1000% growth in last five years and 16.5% YoY over March 2024), with foreign investors playing a key role.

Private equity's role has evolved from greenfield risk-taking to investing in brownfield assets and refinancing opportunities. Institutional investors now prefer structured vehicles and regulated platforms, supported by improved credit ratings and policy reforms. While challenges remain—such as regulatory inconsistencies and project execution risks—the historical trend reflects a growing confidence in India's infrastructure sector. Going forward, PE and institutional capital are expected to play a pivotal role in bridging India's infrastructure financing gap and supporting its transition to a $30 trillion economy.

Foreign direct investment (FDI) trends

FDI plays a pivotal role in developing the economic landscape of the country and supporting growth. This includes investment in infrastructure development via providing capital, expertise and technology, while aiding in bridging the gap between domestic funding and country's financing needs to build infrastructure. The historical data reveals that gross FDI equity inflows into India witnessed a steady increase between FY2014 and FY2021, barring FY2019, after displaying a volatile trend during FY2008-FY2013. Gross FDI-equity inflows as a proportion of nominal GDP increased from 1.3% in FY2013 to 2.2% in FY2021, with inflows touching an all-time high of $59.6 billion in FY2021. During this period, such inflows registered a healthy CAGR of 13%. Subsequently, the gross FDI/GDP ratio in the equity segment moderated consistently in the post-Covid era, to 1.2% in FY2024, before displaying a slight uptick to 1.3% in FY2025.

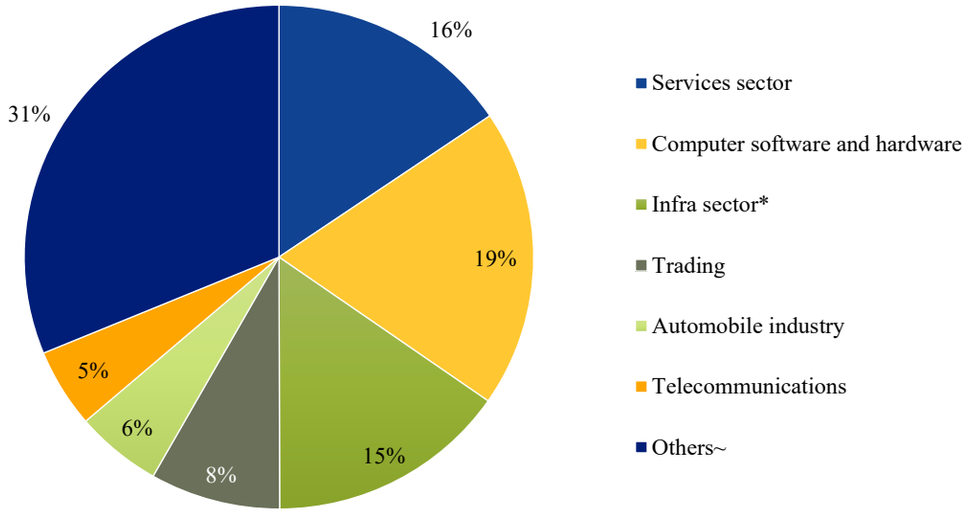
Exhibit: Trend in gross FDI – equity inflows into India



Note: ICRA has used equity inflows (70% of overall flows) for analysis since sectoral data for overall FDI is not available
Source: ICRA Research, Reserve Bank of India, Department of Promotion of Industry and Internal Trade (DPIIT), GoI

On an aggregate basis, gross FDI-equity inflows stood at $511 billion between FY2015 and FY2025. Computer software and hardware accounted for the largest share of 19% in aggregate FDI equity inflows, followed by the services sector at 16%. ICRA assessed the total investment in infrastructure space, and the data for eight sectors revealed that combined FDI inflows into infrastructure sector amounted to $78 billion, with a reasonable share of 15% during this period. In addition, the share of trading, automobile and telecommunication sectors stood at 8%, 5% and 5%, respectively.

Exhibit: Sector-wise trend in India's gross FDI-equity inflows during FY2015-FY2025



**Infra sector includes construction activity and development, air and sea transport, ports, railway components, non-conventional energy and electricity energy; ~Others include cement, hotels, chemicals, etc. Source: ICRA Research*

The Government has undertaken a series of policies and institutional reforms to enhance FDI flows into infrastructure financing. Key measures include permitting 100% FDI under the automatic route in several infrastructure sub-sectors, thereby reducing procedural delays. The establishment of National Bank for Financing Infrastructure and Development, hereafter referred as NIDB, aims to provide long-term financing support, while instruments like InvITs and Alternative Investment Funds (AIFs) are promoted to attract institutional investors. Regulatory simplifications, such as the Jan Vishwas Act, and increased sectoral FDI caps further support investor participation.

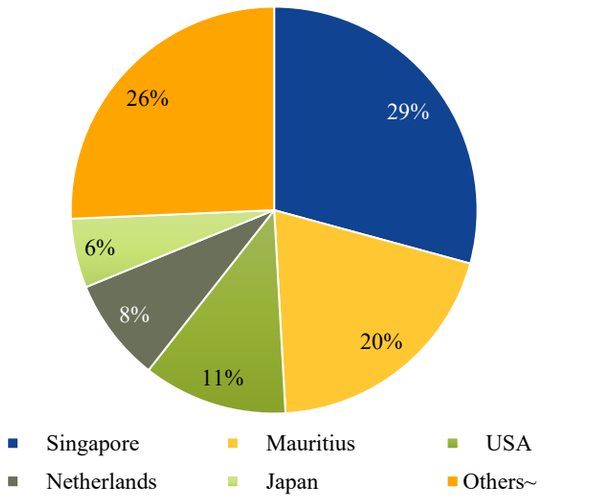
Exhibit: Sector-wise FDI cap and entry route

Infrastructure Sector	FDI Cap	Entry Route
Roads, Highways, Bridges	100%	Automatic
Railways (including infrastructure)	100%	Automatic
Ports and Shipping	100%	Automatic
Airports (Greenfield and Brownfield)	100%	Automatic
Construction Development (townships, etc.)	100%	Automatic
Industrial Parks	100%	Automatic
Power (including renewable energy)	100%	Automatic
Power Exchanges	49%	Automatic
Telecom Infrastructure	100%	Up to 49% Automatic; beyond 49% Government route
Petroleum & Natural Gas (infrastructure)	100%	Automatic
Mining (including coal and non-metal ores)	100%	Automatic
Civil Aviation (Air Transport Services)	100%	Up to 49% Automatic; beyond 49% Government route
Warehousing and Logistics	100%	Automatic

Source: ICRA Research, Sectoral ministries/departments, Department for Promotion of Industry and Internal Trade (DPIIT)

Regarding the origins of investments in India, Singapore led with 29% of FDI during FY2015-FY2025, followed by Mauritius (20%), the US (11%), the Netherlands (8%), and Japan (6%). Based on the state-wise data, compiled by the Department for Promotion of Industry and Internal Trade (DPIIT) from October 2019 to March 2025, Maharashtra received the highest gross FDI equity inflows of about $89 billion, equivalent to 31% of the overall inflows during this period. Moreover, the share of states including Karnataka, Gujarat and Delhi was reasonable at 20%, 16% and 13%, respectively, while it was relatively lower in the case of Tamil Nadu (5%), Haryana (5%) and Telangana (4%). In addition, the share of FDI equity flows to Rajasthan, Jharkhand and Uttar Pradesh in the overall mix was quite muted at 1% each.

Exhibit: Country-wise trend in India's gross FDI-equity inflows during FY2015-FY2025



Note: Other countries are the UAE, UK, Canada, Germany, Cyprus, etc; Source: ICRA Research*

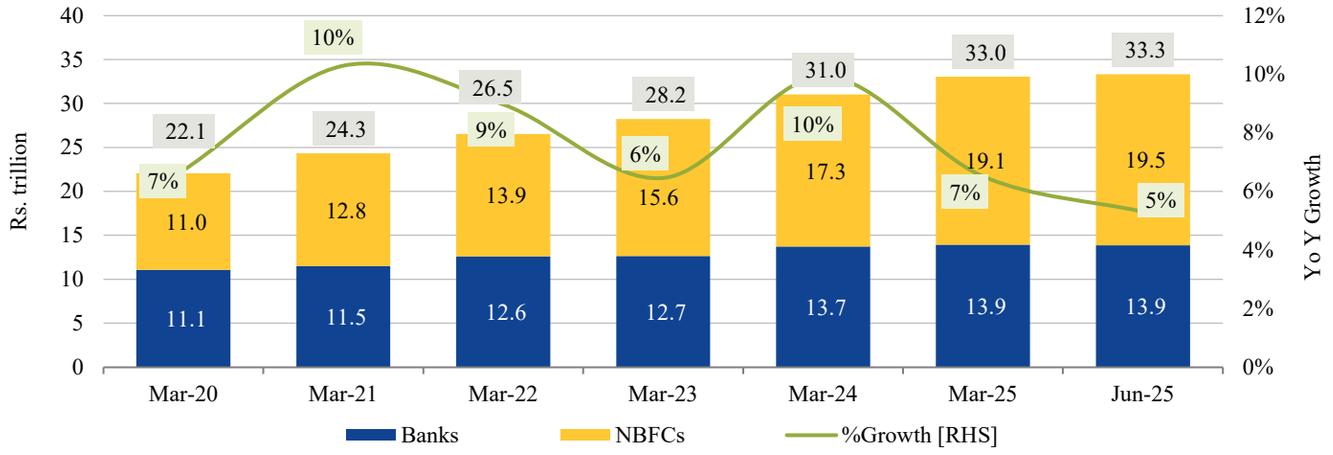
Debt Financing

Bank lending to infrastructure

Bank lending has historically been the cornerstone of infrastructure financing in India, particularly during the early phases of liberalisation and economic expansion. Scheduled Commercial Banks (SCBs) have played a pivotal role in funding large-scale infrastructure projects, especially in sectors such as power, roads, railways, and telecommunications. However, over the past decade, the landscape has undergone significant transformation, driven by structural challenges, regulatory shifts, and the emergence of alternative financing mechanisms.

As of June 30, 2025, total infrastructure credit stood at Rs. 33.3 trillion, with banks contributing Rs. 13.9 trillion (42%). This marked a decline from their earlier share of 50% in March 2020, reflecting a strategic retreat due to asset-liability mismatches and rising non-performing assets (NPAs). In contrast, Non-Banking Financial Company – Infrastructure Finance Company (NBFC-IFCs) have gained prominence, contributing Rs. 19.5 trillion (58%) to infrastructure credit.

Exhibit: Trend in infrastructure finance credit across banks and NBFC-IFCs



Source: RBI, ICRA Research

The power sector continues to dominate bank infrastructure exposure, accounting for nearly 52% of the total infrastructure loan book. Other significant sectors include roads (24%) and telecommunications (9%). However, growth in bank lending to infrastructure has remained subdued over the last five years, with only 5% CAGR between FY2020 and FY2025, reflecting cautious lending practices and tighter risk management frameworks.

Regulatory constraints have also played a role in reshaping bank behaviour. The Reserve Bank of India (RBI) has imposed sectoral exposure limits, capital adequacy norms, and risk-weighted asset provisioning requirements, which have made banks more selective in their infrastructure lending. Additionally, the implementation of Ind AS 109 and Expected Credit Loss (ECL) provisioning (FY2019 onwards) further tightened credit standards, especially for long-tenure, high-risk projects.

Despite these challenges, banks remain critical of infrastructure financing, particularly in the early stages of project development. They provide working capital, bridge loans, and initial debt tranches that enable financial closure. Moreover, public sector banks, due to their government backing, continue to support strategic infrastructure initiatives aligned with national priorities.

To address the limitations of bank-led financing, the Government and regulators have promoted credit enhancement mechanisms, take-out financing, and co-lending models with NBFCs and development finance institutions (DFIs). These innovations aim to de-risk bank exposure and improve capital recycling.

In summary, while the role of banks in infrastructure financing has diminished in relative terms, they continue to be foundational players. Their future effectiveness will depend on improved asset quality, regulatory flexibility, and integration with broader capital market instruments.

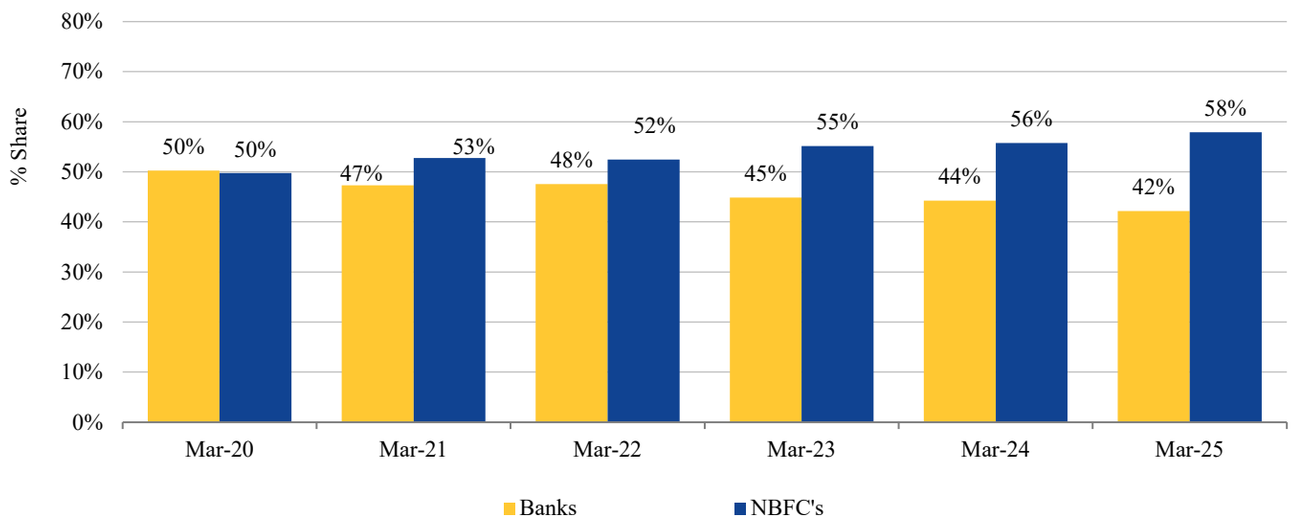
Role of NBFC-IFCs, IDFs, and AIFIs

India's infrastructure financing landscape has evolved significantly over the past two decades, with a growing shift from traditional bank-led models to more specialized and diversified institutions. Among these, NBFC-IFCs, IDFs, and All-India Financial Institutions (AIFIs) such as NIDB have emerged as critical players. These institutions have brought in long-term capital, sectoral expertise, and innovative financial structures to address the unique challenges of infrastructure development, namely long gestation periods, high capital intensity, and regulatory risks.

NBFC-IFCs are a sub-category of NBFCs regulated by the RBI, mandated to deploy at least 75% of their total assets in infrastructure loans. Prominent examples include Rural Electrification Corporation Limited (REC Ltd.), Power Finance Corporation Limited (PFC Ltd.), and Indian Railway Finance Corporation (IRFC), which primarily finance power, energy, and transport infrastructure. Within the NBFCs, the public IFC category continues to account for the majority share (96%) in terms of the aggregate loan book. Consequently, the credit growth trend of NBFC-IFCs largely mirrors the majority contributor, i.e., public IFCs.

Over the past decade, NBFC-IFCs have steadily increased their share in infrastructure credit. As of June 2025, they accounted for 58% of total infrastructure lending, surpassing banks. This shift reflects the growing reliance on specialised institutions with the capacity to manage long-term project risks.

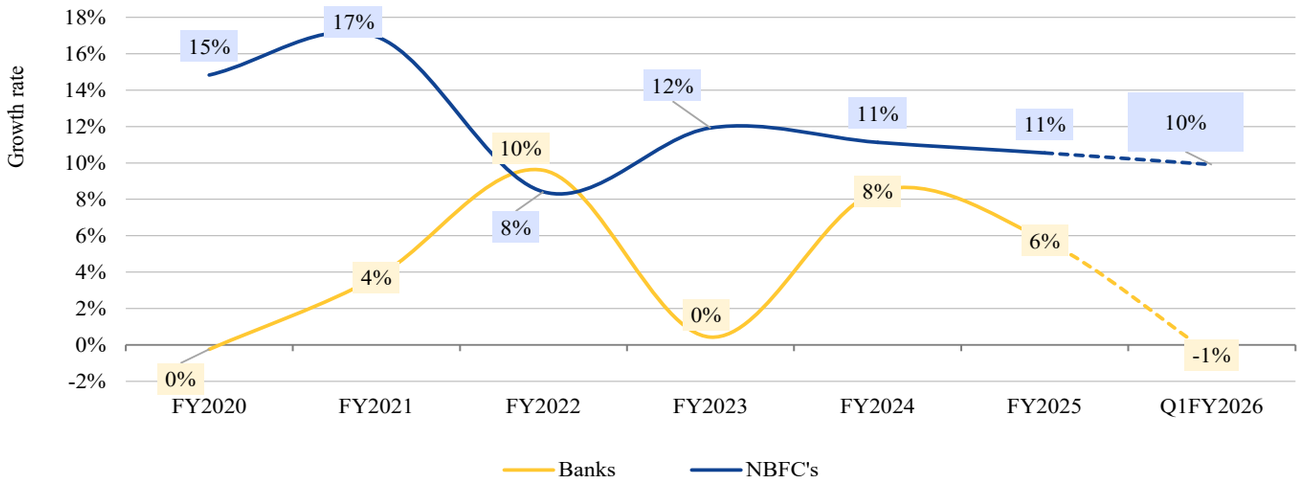
Exhibit: Break-up of infrastructure finance credit across banks and NBFC-IFCs



Source: RBI, ICRA Research

NBFC-IFCs have demonstrated strong growth, with infrastructure loan books expanding by 12% CAGR between FY2020 and FY2025. Their asset quality has also improved, which is attributable to better provisioning, recoveries, and a more cautious approach to project selection. These institutions benefit from access to long-tenure funding and sovereign backing, particularly in the case of public sector NBFC-IFCs. Their ability to raise capital through tax-free bonds and international borrowing allows them to offer competitive financing for large-scale infrastructure projects.

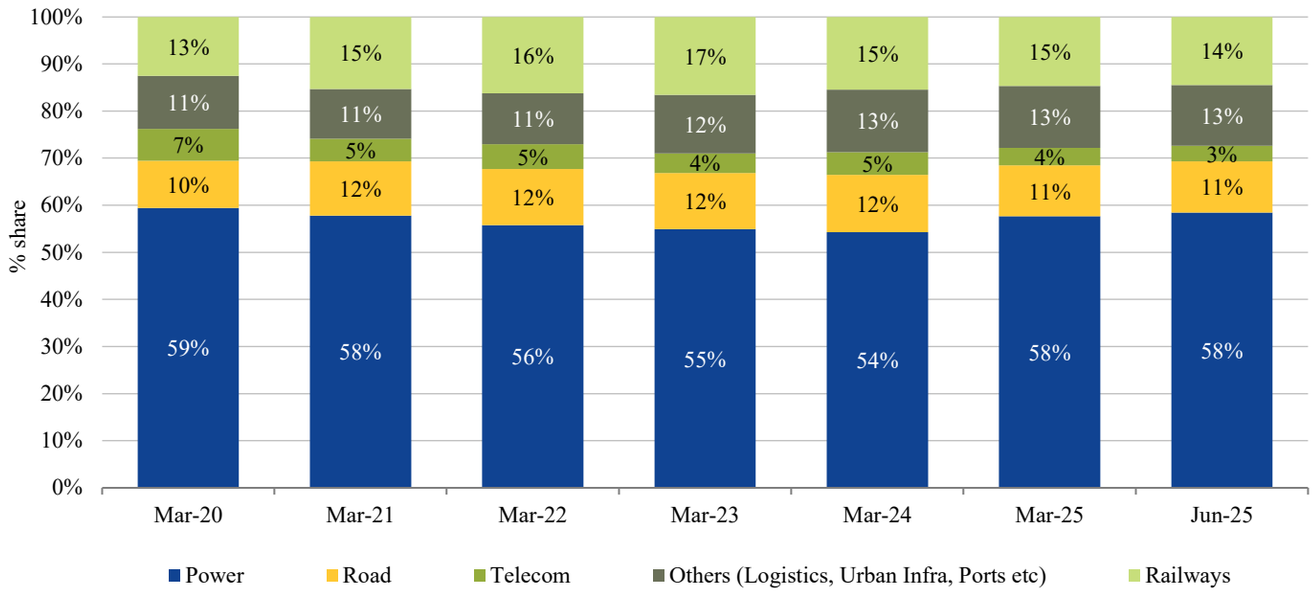
Exhibit: Infrastructure loan book growth trend for banks and NBFC-IFCs



Source: RBI, ICRA Research

The power sector's concentration remains higher for NBFC-IFCs with a share of about 62% of the portfolio (compared to the 53% share of banks' total exposure) as on June 30, 2025. This is due to PFC, REC and Indian Renewable Energy Development Agency Limited (IREDA), which are specialised institutions primarily focussed on the power sector. For NBFC-IFC, the declining trend in thermal generation has continued in FY2025, while the share of the renewable energy (RE) sector has been increasing over the past three years.

Exhibit: Sector-wise break-up of infrastructure finance credit by banks and NBFC-IFCs



Source: RBI, ICRA Research

IDFs were introduced to refinance completed infrastructure projects, particularly those that have achieved commercial operations. By replacing high-cost bank loans with long-term, low-cost debt, IDFs help developers recycle capital and reduce financing costs. IDFs typically target brownfield assets with stable cash flows, such as toll roads and operational renewable energy projects. Their role is complementary to banks and NBFCs, focusing on the post-construction phase of infrastructure financing.

Despite their potential, IDFs remain underutilised, their contribution to total infrastructure credit remaining modest, largely due to regulatory constraints, limited investor awareness, and a lack of scale. However, with the growing emphasis on asset monetisation and InvITs, IDFs are expected to play a larger role in capital recycling and secondary market development.

AIFIs are apex financial institutions established by the Government of India to provide long-term, sector-specific credit to priority sectors. The five AIFI's in India today are - National Bank for Agriculture and Rural Development (NABARD), Small Industries Development Bank of India (SIDBI), Export-Import Bank of India (EXIM), National Housing Bank (NHB) and NIDB.

Exhibit: AIF Funds Raised*

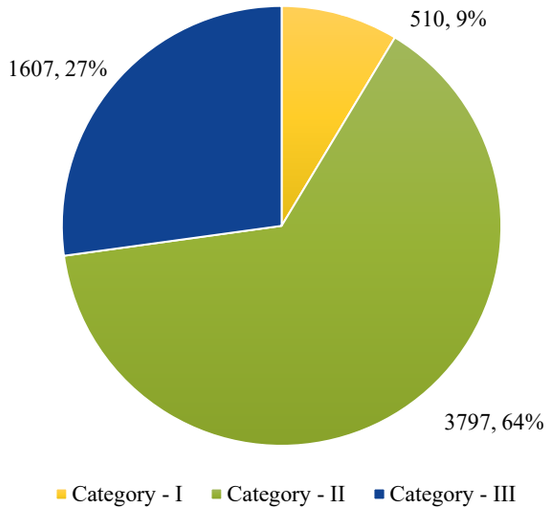
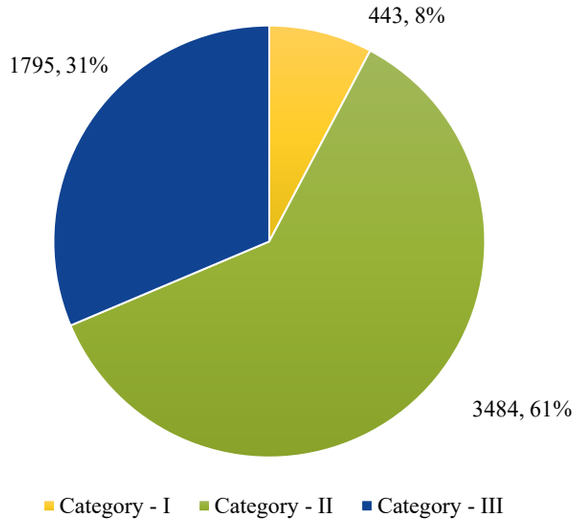


Exhibit: AIF Funds Invested*

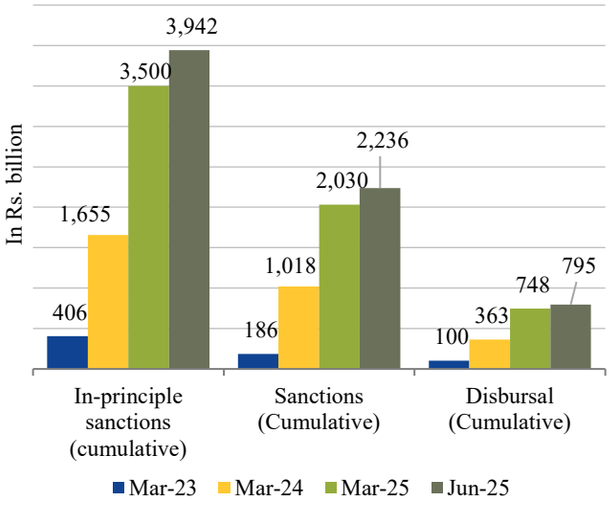


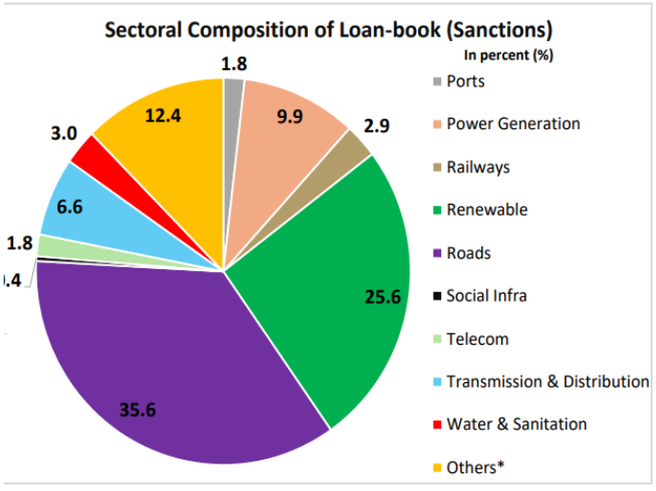
** Cumulative net figures in Rs. billion as at the end of June 30, 2025; Source: SEBI*

Operational since 2022, NIDB was created under the NaBFID Act to serve as a dedicated DFI for infrastructure. Its mandate includes:

- Direct lending to infrastructure projects
- Investment in infrastructure bonds
- Development of sustainable finance ecosystems
- Catalysing private and foreign capital

Exhibit: NIDB - Loan book growth trend and composition of sanctions





*Source: NIDB Investor presentation; * Includes Logistics, Affordable Housing, City Gas Distribution, Rolling Stock , Ropeway and Cable, Oil & Gas Storage facility, Shipyards and Bulk Material Transportation, Education, Hospitals, Logistics*

Recent developments include the launch of a Partial Credit Enhancement (PCE) facility in 2025 for improving the credit ratings of infrastructure bonds and attracting institutional investors. NaBFID is also exploring concessional finance lines for green and climate-resilient infrastructure while working on pooling urban infrastructure assets into InvIT-like structures.

The GoI and RBI have introduced several measures to support NBFCs, IDFs and AIFIs, namely:

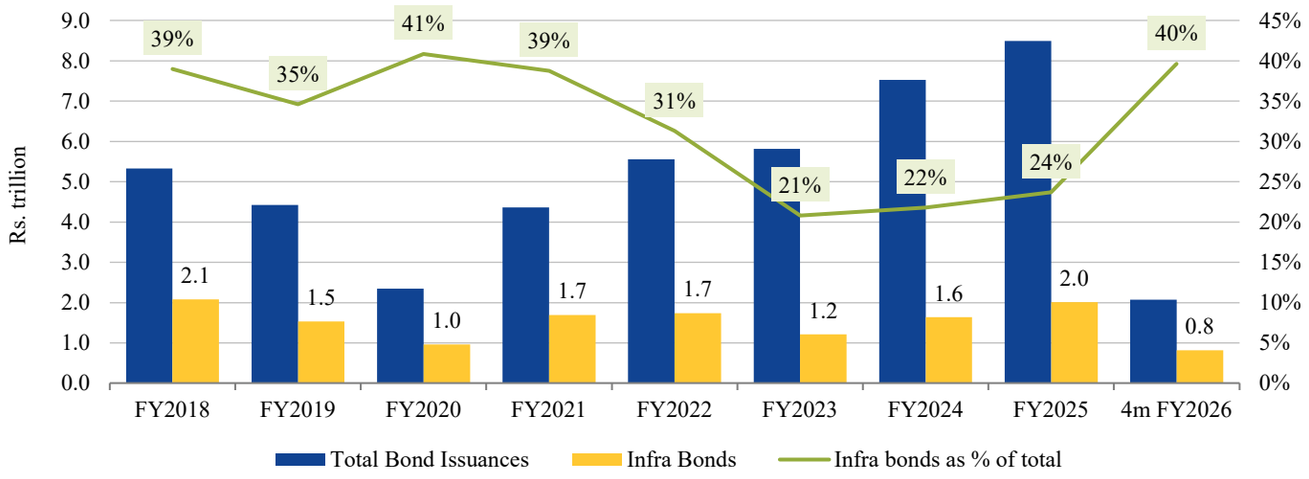
- Relaxed exposure norms for NBFCs lending to infrastructure
- Exemptions from cash reserve ratio (CRR)/ Statutory Liquidity Ratio (SLR) for banks issuing long-term infrastructure bonds
- Permission for banks to lend to InvITs and Real Estate Investment Trust (ReITs)
- Securities and Exchange Board of India (SEBI) reforms to enhance transparency and investor protection in infrastructure investment vehicles

These reforms have created a more enabling environment for debt-based infrastructure financing and encouraged the development of a more diversified and resilient financial ecosystem.

Corporate bond market

The bond market in India has witnessed a robust growth over the past decade, emerging as a vital source of infrastructure financing. As per The Clearing Corporation of India Limited (CCIL), the total bond market grew at a 11% CAGR between FY2019 and FY2025, touching Rs. 8.5 trillion. This reflects improved credit profiles of issuers— public sector undertakings (PSUs) as well as non-PSU—and growing investor confidence. The shift also indicates a structural transformation, with private firms increasingly using debt markets for growth capital and refinancing.

Exhibit: Trend in India's corporate bond issuances



Source: Clearing Corporation of India

The IL&FS crisis in 2018 highlighted the reliance on bank and NBFC funding. Subsequent measures by the RBI and SEBI aimed to improve transparency, accessibility, and investor protection within the bond market. Regulatory actions, including credit enhancement mechanisms, infrastructure credit rating norms, and electronic platforms, have contributed to the development of the market. However, despite the progress, challenges remain. The bond market is still dominated by AAA-rated issuers, and retail participation is limited. Expanding the investor base and improving secondary market liquidity are critical for sustaining growth.

The infrastructure bond market in India has evolved gradually as a response to the growing need for long-term capital to fund the country's expanding infrastructure ambitions. Historically, infrastructure financing was dominated by budgetary allocations and bank lending. However, as the scale and complexity of projects increased, particularly during the post-liberalisation era of the 1990s, the limitations of traditional financing models became evident.

The early 2000s marked a turning point, with the Government and regulators recognising the need to deepen capital markets. The introduction of tax-free infrastructure bonds under Section 10(15)(iv)(h) of the Income Tax Act allowed entities like REC, NHAI, and IRFC to raise funds from retail investors. These instruments offered fixed returns and tax benefits, making them attractive for long-term savers.

In the following decade, particularly after the 2008 global financial crisis, infrastructure bonds gained further traction as banks faced asset-liability mismatches and rising NPAs in the sector. The RBI's 2014 guidelines permitting banks to issue long-term infrastructure bonds exempt from CRR and SLR requirements marked a significant regulatory shift, encouraging more structured and sustainable funding.

In FY2025, infrastructure bond issuances by banks are estimated to have reached Rs. 1.2–1.3 trillion, surpassing previous records. Public sector banks (PSBs) dominate this space, accounting for over 80% of issuances, with infrastructure bonds forming nearly two-thirds of their total bond volume. As of August 2024, 13 major banks had outstanding infrastructure bonds worth Rs. 2.2 trillion, against an infrastructure loan book of Rs. 11 trillion, indicating significant room for expansion.

Several factors have driven this growth:

- **Regulatory incentives,** such as exemption from CRR and SLR requirements
- **Improved capital positions** of PSBs post-recapitalisation
- **Institutional demand** from pension and insurance funds seeking long-duration assets
- **Tight liquidity conditions,** prompting banks to diversify funding sources

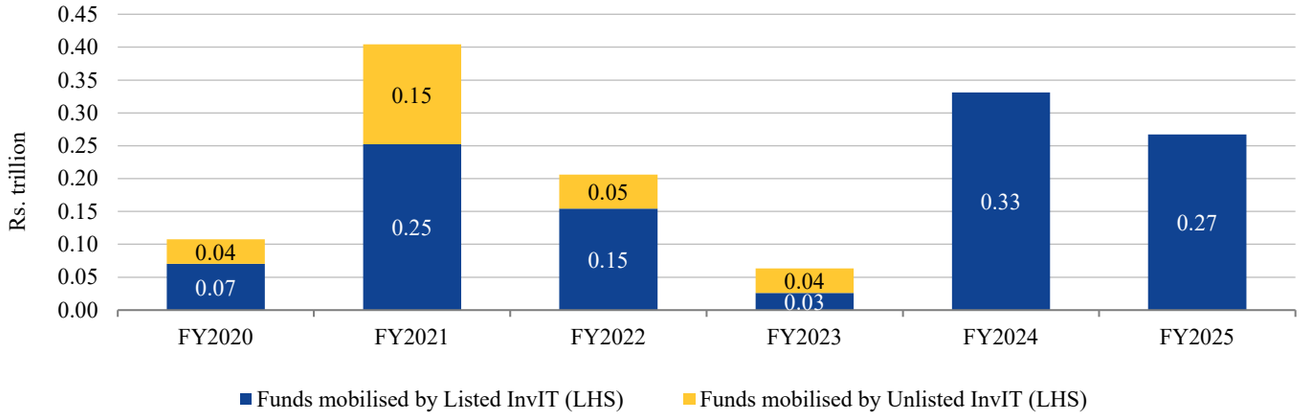
Private sector banks remain cautious, concerned about worsening credit-to-deposit ratios, but may increasingly participate as infrastructure investment scales up.

Infrastructure bonds support key initiatives like the NIP and PM Gati Shakti, while also deepening India's capital markets. Their long maturities (typically 10–15 years) align well with the financing needs of sectors such as transport, energy, and urban development. Going forward, expanding participation, enhancing transparency, and promoting retail and foreign investment will be essential to unlock the full potential of India's infrastructure bond market.

Infrastructure Investment Trusts

InvITs have emerged as a transformative tool for infrastructure financing, enabling capital recycling and attracting institutional and retail investors. These SEBI-regulated vehicles pool funds to own and operate revenue-generating infrastructure assets. As of March 2025, REITs and InvITs in India managed Rs. 9 trillion in AUM, projected to grow by about 3x to Rs. 25 trillion by 2030, as per the projections of The Indian REITs Association (IRA) and Bharat InvITs Association (BIA). This surge is driven by robust infrastructure spending, policy support, and private capital participation.

Exhibit: InvIT/REIT issuances* in the Indian market



*Note: *Includes funds raised through public issue, private placement, preferential issue, institutional placement, rights issue; Source: SEBI, ICRA Research*

InvITs have proven particularly effective in monetising brownfield assets, offering developers liquidity and investors stable returns. The National Monetisation Pipeline 2.0, targeting Rs. 10 trillion by 2030, is expected to create fresh opportunities for InvIT-backed projects. However, sectoral penetration remains low, indicating significant headroom. Only about 20% of NHAI toll assets are under InvITs, while solar InvITs manage less than 5% of installed capacity, despite a target of 230 GW by 2030. Logistics and airport assets remain largely untapped, while telecom InvITs manage a less than 40% share.

Strategic priorities for the next phase include expanding retail participation, enabling pension and insurance fund investments, and offering currency hedging tools to attract foreign capital.

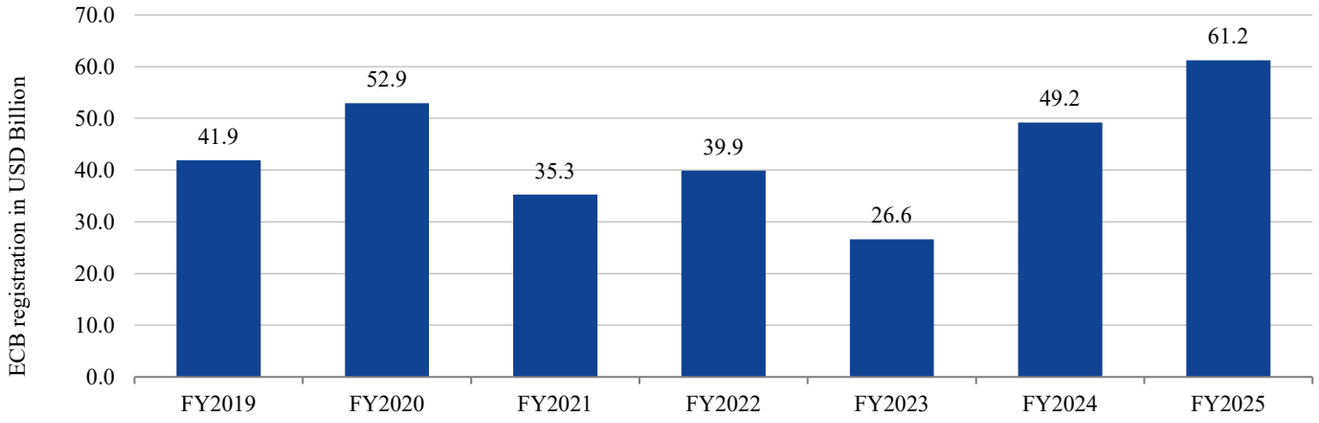
External Commercial Borrowings (ECBs)

The ECBs have become a strategic tool for Indian corporates to access global capital at competitive rates. They are particularly relevant for infrastructure projects requiring large-scale funding and long tenures. The RBI regulates ECBs under a liberalised framework, allowing infrastructure companies to raise funds under the automatic route, subject to sector-specific ceilings and end-use restrictions. Eligible borrowers include companies in power, telecom, metro rail, and logistics, among others. The ECBs can be used for capital expenditure, refinancing of existing debt, and even working capital in certain cases. The maturity period typically ranges from 3 to 10 years, with longer tenors permitted for larger projects.

One of the key advantages of ECBs is the ability to tap into global liquidity pools, including development finance institutions, export credit agencies, and international banks. This is particularly relevant in the context of India's ambitious infrastructure pipeline. ECBs also complement domestic sources such as bank loans, bonds, and budgetary support, thereby diversifying the funding mix and reducing pressure on domestic financial institutions.

As of March 31, 2025, India's outstanding ECBs stood at $204.5 billion as per provisional RBI data[9]. Total ECB registrations reached a record high of $61.2 billion in FY2025, a 24.3% increase over the previous year with nearly 43% earmarked for capex, including on-lending and sub-lending.

Exhibit: Trend in annual ECB registrations



Source: RBI data

However, ECBs are not without risks. Currency volatility, global interest rate fluctuations, and regulatory constraints can impact repayment and project viability. RBI's prudential norms on maturity, end-use, and cost ceilings aim to balance flexibility with macroeconomic stability.

Concluding Remarks

India's infrastructure financing landscape has undergone a profound transformation, with debt instruments playing a central role in mobilising capital. While banks remain important, their declining share has been offset by the rise of NBFC-IFCs, AIFIs, and market-based instruments like corporate bonds, InvITs, and ECBs.

The diversification of funding sources is expected to increasingly enhance resilience, reduce concentration risk, and improve access to long-term capital. However, challenges persist with asset-liability mismatches, regulatory bottlenecks, and limited retail participation in debt markets. Going forward, policy coherence, institutional capacity building, and financial innovation will be key to sustaining momentum.

[9] *https://www.pib.gov.in/PressReleasePage.aspx?PRID=2096480, 6e3f0c0c-b4e2-8482-3123-5b93da8585ae*

GIFT City and its Role in Infrastructure Financing in India

GIFT City (Gujarat International Finance Tec-City) has evolved into a key financial hub supporting India's infrastructure financing ecosystem. As the country's first operational International Financial Services Centre (IFSC), it provides a regulatory and tax-efficient platform for accessing global capital. Governed by the International Financial Services Centres Authority (IFSCA), GIFT City enables institutions to raise and deploy foreign currency funds through mechanisms such as external commercial borrowings (ECBs), masala bonds, and infrastructure investment trusts (InvITs).

The city's robust ecosystem—comprising 200+ financial institutions, including 19 banking units and 25 insurance firms—facilitates efficient fund mobilisation for infrastructure development. As of early 2025, the cumulative assets under management (AUM) of banks operating in GIFT City exceeded Rs. 6.8 trillion (approximately USD 78 billion), with Indian corporates borrowing over Rs. 4.35 trillion (USD 50 billion) from these institutions. Additionally, investments from non-resident Indians and global investors into GIFT-based funds have crossed Rs. 610 billion (USD 7 billion), indicating growing international engagement.

While still in a growth phase, GIFT City is increasingly positioned to complement traditional financing channels by offering access to diversified, long-term capital. Its role in infrastructure financing is expected to strengthen as India scales up investment in transport, energy, and digital infrastructure.

Source: https://ibef.org/news/investments-from-indian-diaspora-in-gift-city-funds-surpass-rs-60-998-crore-us-7-billion-ifsca

National Bank for Financing
Infrastructure and Development

Estimating Infrastructure Investment Needs for Viksit Bharat 2047

The vision of Viksit Bharat demands a comprehensive assessment of sectoral investment needs to bridge existing gaps and future-proof national capabilities. The key sectors requiring substantial investment include transportation, where expansion and modernisation of highways, railways, and urban transit systems are essential to support mobility and logistics. Energy infrastructure, particularly in renewable sources and grid modernisation, will be critical to meet rising demand sustainably. Digital infrastructure, including broadband connectivity and data centres, must scale rapidly to support a tech-driven economy and digital inclusion. Urban development and housing will require robust funding to accommodate growing populations and ensure liveable cities. Water and sanitation, healthcare, and education infrastructure also demand focused investment to improve quality of life and human capital.

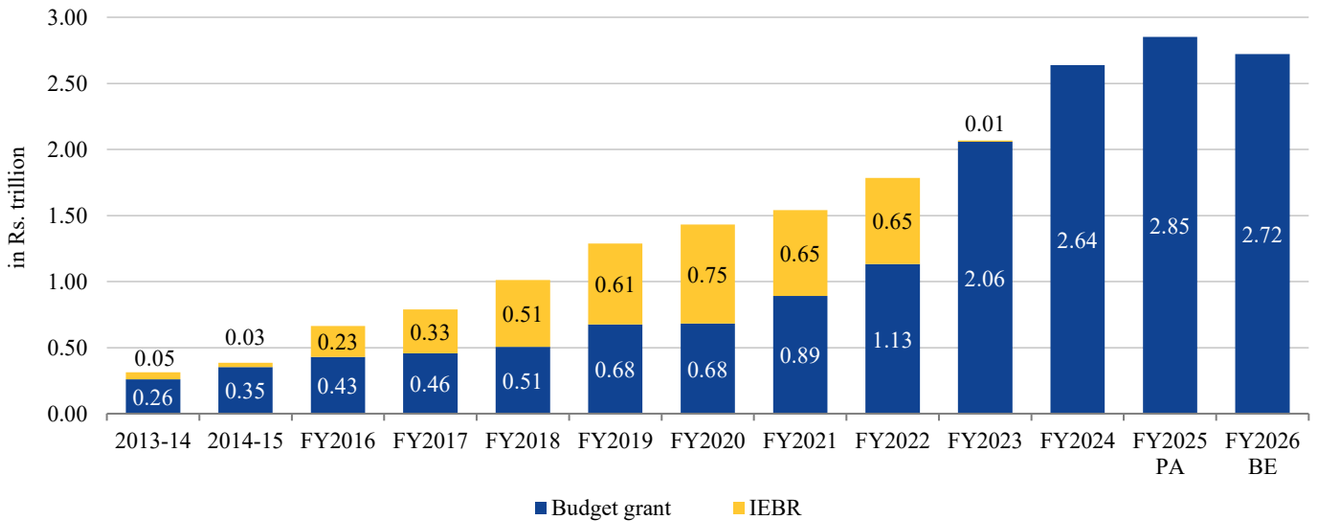
The following sections delve into the projected infrastructure requirements across key domains—transportation, energy, telecom and urban infrastructure-highlighting the scale, scope, and strategic importance of each in realising the Viksit Bharat 2047 vision.

Transportation

ROADS AND HIGHWAYS

National highway (NH) development has been one of the major focus areas of the Central Government over the past few years as reflected in the capital allocation to the Ministry of Road Transportation and Highways (MoRTH), which has increased by more than eight times to Rs. 2.72 trillion in FY2026 BE (budgetary estimate) from Rs. 0.31 trillion in FY2014. The capital allocation to the road ministry accounts for 24.3% of the overall capital outlay under the Union Budget. Additionally, the capital expenditure in the road sector (including private investment) increased by 5.7 times from Rs. 0.53 trillion in FY2014 to Rs. 3.01 trillion in FY2024 (highest ever).

Exhibit: Budgetary allocation of MoRTH

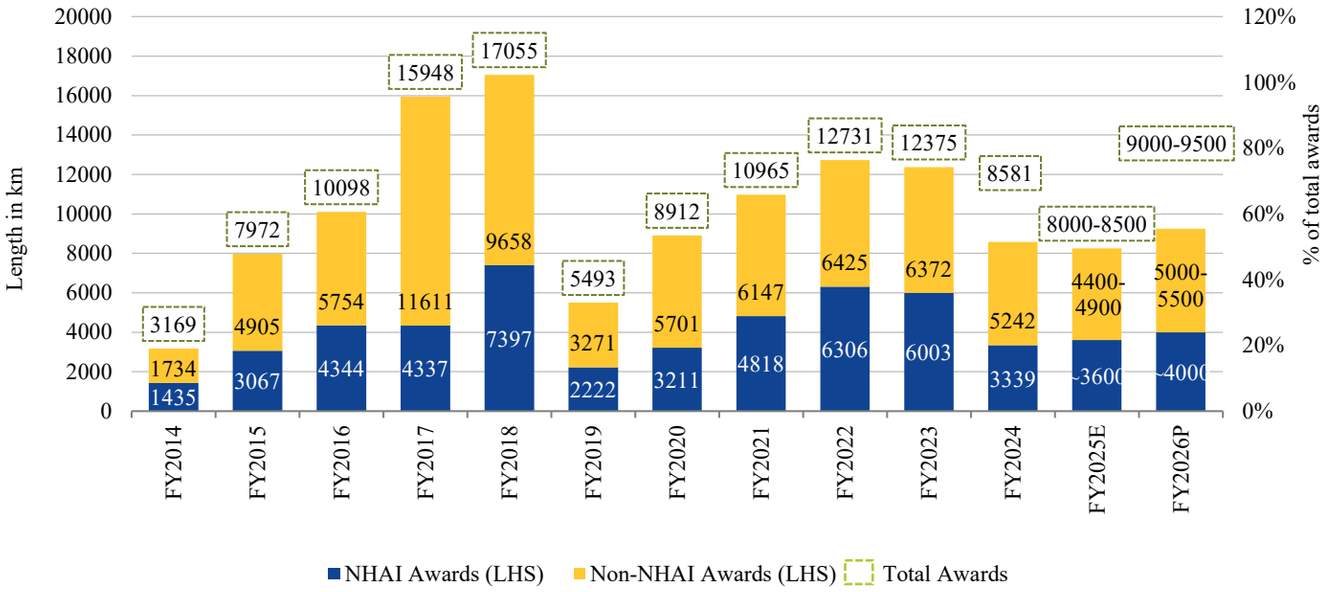


Source: ICRA Research; Union Budget documents; IEBR: Internal and Extra Budgetary Resources; PA: Provisional actuals; BE: Budget estimates

Strong awards and execution have expanded national highways over the decade

In line with increased budgetary allocations, MoRTH awards have significantly increased over the past decade from around 3,200 km in FY2014 to 12,375 km in FY2023, at a CAGR of 16%. Although the awarding activity had slowed down in the past two years on account of delay in approval for revised cost estimates of the Bharatmala Pariyojana (BMP) and the model code of conduct ahead of the General Elections, ICRA expects the road awards by MoRTH to stand at 9,000-9,500 km in FY2026.

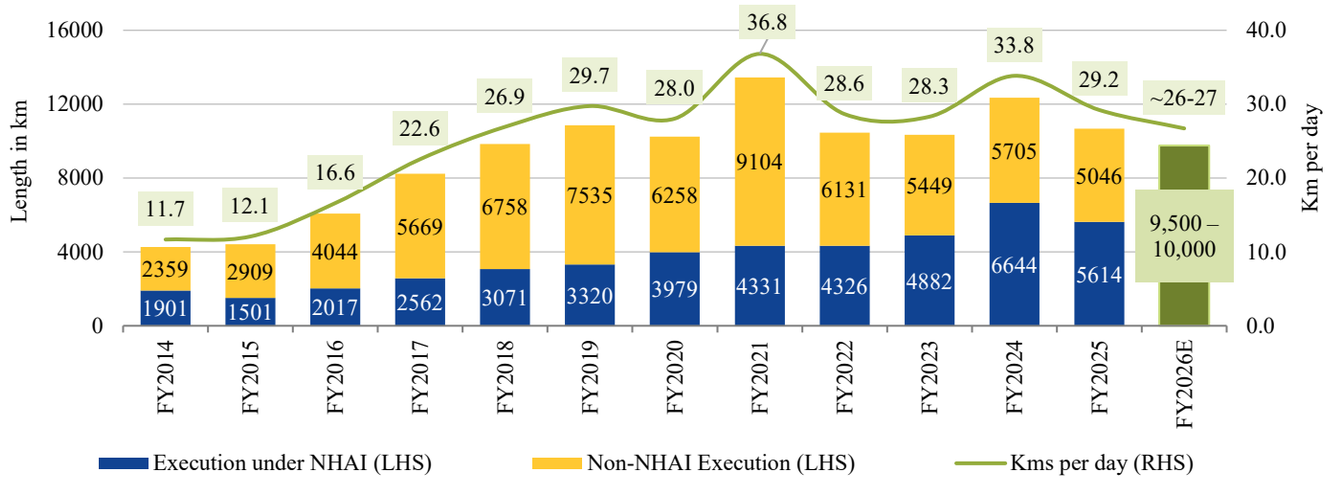
Exhibit: MoRTH annual awards



Source: MoRTH, NHAI, ICRA Research

The road execution by MoRTH has increased from 4,260 km (11.7 km/day) in FY2014 to 10,660 km (29.2 km/day) in FY2025 with a CAGR of 9%. Between FY2015 and FY2025, the ministry has constructed nearly 1,07,000 km of roads, including both greenfield and brownfield expansions. While greenfield construction adds to the length of the highways, brownfield expansions, including conversion of 2-lanes to 4-lanes and 4-lanes to 6-lanes, do not increase the length of national highways. Nonetheless, in terms of lane kilo metres, the length of national highways has increased by a higher proportion (of 99%) during 2014-2024 compared to the 60% increase in the NH length in km during this period. Further, the length of High-Speed Corridors (HSCs) and expressways has increased from less than 100 km in 2014 to 2,474 km as of 2024.

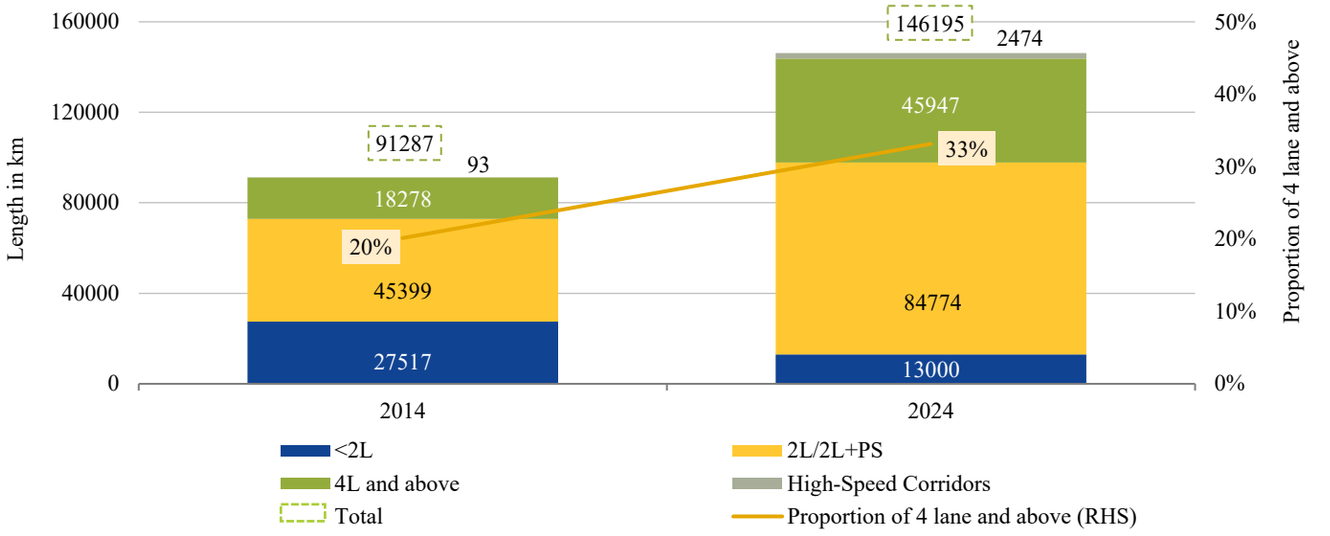
Exhibit: MoRTH annual execution (km)



Source: MoRTH, NHAI, ICRA Research

The length of national highways in the country has increased by around 60% to 1,46,195 km as of 2024 from around 91,287 km in 2014. The network of 4-lane and above highways, including high-speed national corridors, has increased by 2.5 times to about 48,430 km in 2024 from about 18,371 km in 2014. Simultaneously, the share of less than 2-lane national highways has declined significantly from 30% to 9% of the total NH network. About 2,474 km of HSCs and expressways are already operational.

Exhibit: NH lane configuration



Source: MoRTH, ICRA Research

Viksit Bharat – Vision 2047

Vision 2047 for national highways aims to provide equity, efficiency and strategic connectivity to meet five key objectives.

1. Access to high-speed corridors within 100-150 km to all citizens
2. India to rank among the top 10 countries in G20 for high-speed corridor density
3. Equitable access to national highways in underdeveloped regions
4. Improve passenger convenience with world class passenger amenities
5. Reduction in logistics cost as a share of GDP

As per ICRA's estimates, the roadmap for Vision 2047 is expected to be undertaken in two phases—2025-2037 and 2037-2047. The ministry aims to achieve an NH network of 2,00,000 km by 2037 (from 146,195 km in 2024). ICRA estimates new greenfield NH construction after 2037 to moderate to around 25,000–30,000 km (during 2037-2047), compared to an estimated 53,000 km during 2025–2037, as the focus shifts toward expanding existing brownfield highways through lane augmentation to six or eight lanes. That said, the length could increase depending on the development of new regions, requirement of new expressways and country's economic growth.

Hence, ICRA estimates the total length of national highways could increase to 2,25,000–2,30,000 km by 2047. Further, majority of the national highways are expected to be upgraded to four lanes or above configurations, with higher emphasis on expressways and high-speed corridors connecting major travel destinations and important economic centres, which could entail substantial capital expenditure. This transformation aims to deliver world-class infrastructure and amenities and significantly reduce logistics costs as a share of GDP, in line with Vision 2047 objectives.

Assessing capex requirement for NH network till 2047

The cost estimates of national highways vary from project to project depending upon various factors including land cost, geographical location, type of terrain, type of design consideration relating to traffic volume, sub-soil conditions, availability of raw materials, and pavement structure (rigid/flexible), among others. However, for the purpose of cost modelling, capex requirements have been assessed by ICRA using the current estimates of various greenfield highways and expressways, adjusted for inflation, to arrive at an average construction cost.

Considering this, ICRA expects MoRTH to incur capital expenditure of around Rs. 65–70 trillion for the greenfield construction of highways and expressways, upgradation existing highways to access controlled highways/expressway, and lane augmentation to six or eight lanes by 2047. Nevertheless, the same is expected to increase/decrease depending on the design structure, pavement type, development of new regions, requirement of new expressways and the country's economic growth. Further, variation in the land costs, which currently drives construction costs, could result in upside variance of the overall capital expenditure of the ministry.

The budgetary allocation of MoRTH stands at around Rs. 2.72 trillion for FY2026, which has grown at a CAGR of 20% from Rs. 0.31 trillion in FY2014. However, given the current sizable allocation to MoRTH, ICRA has assumed a 1% year-on-year increase in the ministry's budgetary allocation. A portion of this allocation will be directed towards debt servicing, strengthening, and other maintenance

activities. Consequently, the **total budgetary allocation available for capital expenditure during 2025–2047 is estimated to be Rs. 50-55 trillion.**

In addition, capex by states towards roads (state highways and rural roads) is estimated at 65% of the spent on national highways (as most construction/ expansion is of/from 2- to 4-lane roads). **ICRA estimates this cumulative capex by states to stand at Rs. 32-36 trillion between 2025 and 2047.**

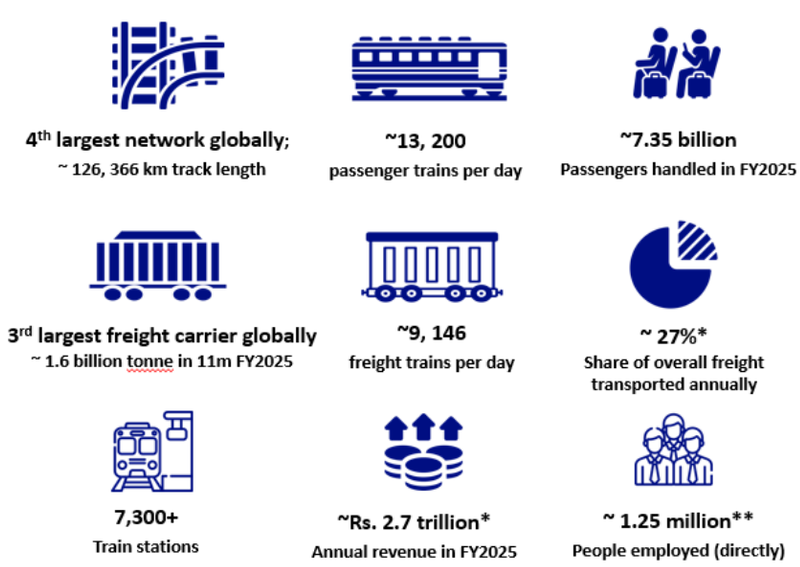
Lending opportunity

While majority of the capital expenditure is expected to be funded through budgetary allocation, market borrowing will also play a critical role for undertaking such large capital expenditure plans of the ministry during the next 20 years. This provides an opportunity of around Rs. 15 trillion over the next two decades.

RAILWAY INFRASTRUCTURE

The Indian Railways (IR), the fourth largest rail network in the world, is a cornerstone of the country's transportation infrastructure. It plays a pivotal role in facilitating the movement of passengers and freight across vast regional expanses, thereby driving economic growth, enabling trade, and fostering social inclusion. As India aspires to become developed economy by 2047, the modernisation and expansion of its railway infrastructure have become critical to achieving this vision.

Exhibit: Indian Railways – Snapshot



*Source: Indian Railways, Annual Report, IBEF; *Estimated; ** April 1, 2024*

Importance of rail infrastructure in reducing logistics costs

As per National Council of Applied Economic Research (NCAER)India's logistics costs currently stood at around 7.8-8.9% of GDP in FY2022. Railways, being more cost-effective and energy-efficient over medium to long distances, offer a viable solution to reduce logistics costs further. Historically, railways accounted for 85% of freight movement (in 1951). However, this share declined to around 27-28% by FY2023 due to capacity constraints, slow transit times, and inadequate terminal infrastructure (though improvement has started in recent years). Freight trains in India average a speed of just 24 km/h [10] , with significant delays at junctions and terminals. These inefficiencies lead to longer transit times and higher costs, making road transport more attractive despite its higher environmental impact.

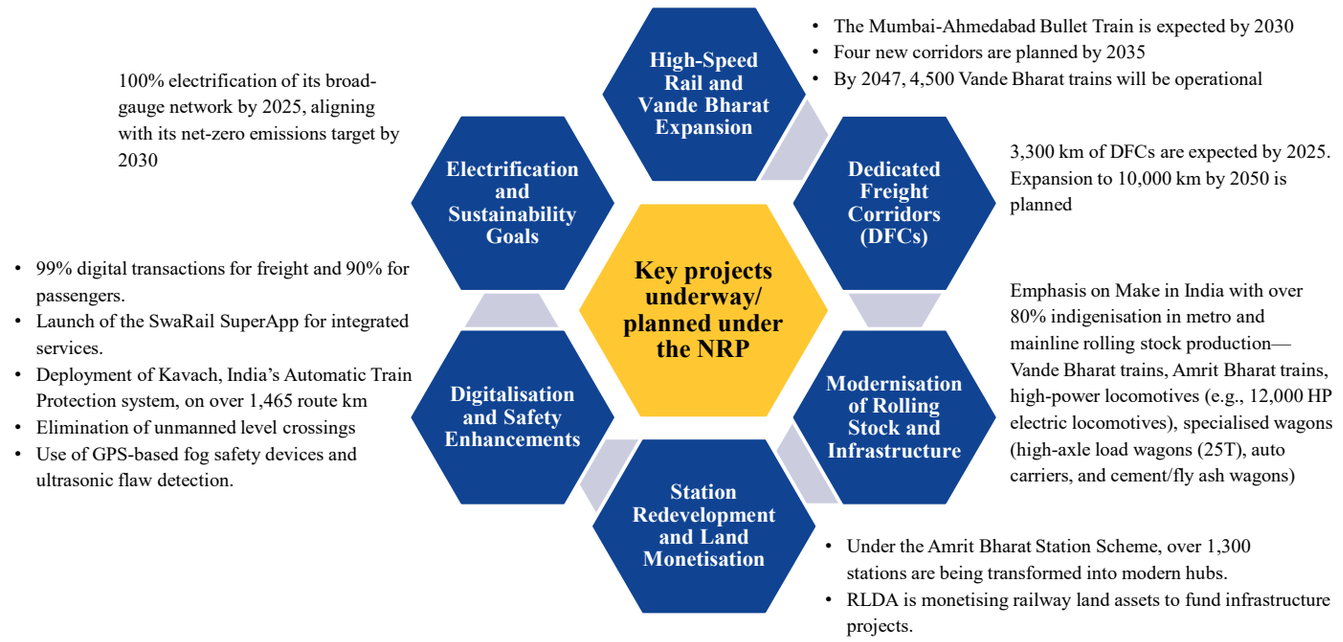
Strategic vision and National Rail Plan

To correct this skewness, the National Rail Plan (NRP) was formulated in December 2020. It aims to create capacity ahead of demand by 2030, ensuring the system can cater to projected needs till 2050. Key objectives include:

- Increasing rail freight modal share to 45% by 2030 and sustaining it beyond
- Enhancing average freight speed to 50 kmph
- Developing DFCs to separate freight and passenger traffic
- Creating High-Speed Rail (HSR) networks
- Upgrading signaling, electrification, and rolling stock
- Transforming stations into modern transit hubs

The plan also encourages private sector participation, digital transformation, and sustainability through green initiatives.

Exhibit: Indian Railways – Key initiatives and progress [11]



Source: ICRA Research

[10]https://www.ibef.org/industry/railways-presentation
[11]https://www.pib.gov.in/PressReleasePage.aspx?PRID=2036516

Capital investment requirements

Over the past decade, the Government of India has significantly ramped up capital expenditure on Indian Railways, marking a strategic shift toward infrastructure-led growth. In FY2014, the capital outlay for the railways stood at a modest Rs. 0.28 trillion. Fast forward to FY2025, and this figure surged to a record Rs. 2.65 trillion—an almost tenfold increase, with substantial investments directed toward new lines, gauge conversion, track doubling, and electrification. This dramatic rise reflects the Government's commitment to modernising the rail network, enhancing safety, and improving logistics efficiency.

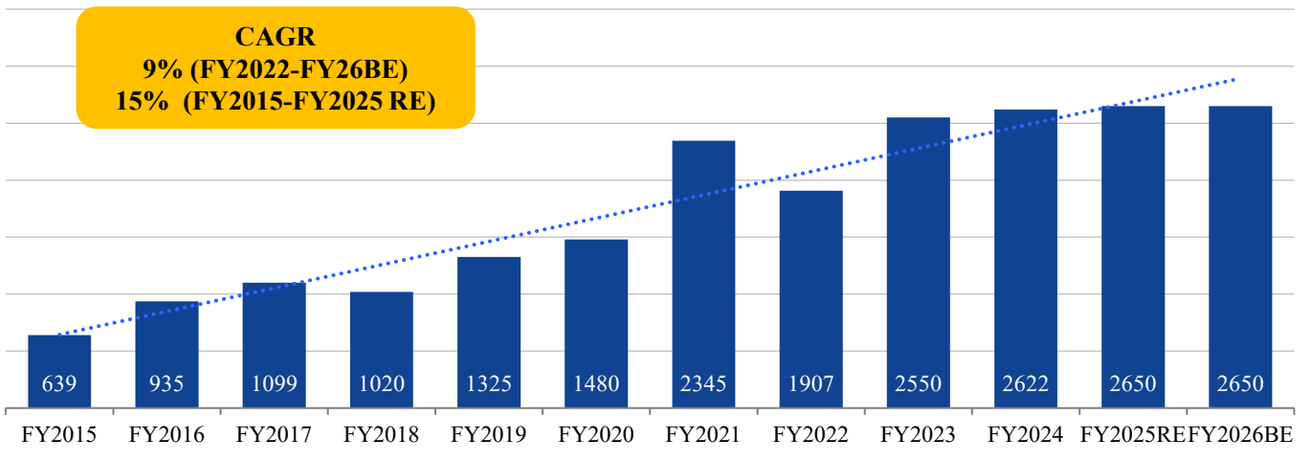
Exhibit: Break-up of capex planned under NRP (Rs. billion)

	Project	2021-31	2031-41	2041-51	Total	% of total	Actual FY2022-25
Track Infra	Dedicated Freight Corridors (DFC)	1,517	482	300	2,300	6%	
	High Speed Rail (HSR)	5,042	2,946	6,970	14,958	39%	
	High-Density Network	451	185	238	874	2%	
	Highly Utilised Network	815	876	767	2,458	6%	
	Others	831	1,180	826	2,837	7%	
	Port Connectivity	138	49	144	331	1%	
	Flyovers and Bypasses	799	-	-	-	0%	
Terminals	Passenger Terminal	705	93	40	839	2%	
	Freight Terminal	104	-	-	104	0%	
Rolling Stock	Rolling Stock	4,824	3,609	4,756	13,189	35%	
Grand Total		14,973	9,345	13,886	38,205	100%	9,197
Annual Average expected outlay		1,523	942	1,404	1,290		1,839

Source: National Rail Plan

Over the coming two decades, the investment needs are extensive—by 2050, cumulative investments could exceed Rs. 75 trillion, factoring in inflation, expansion, and technology upgrades (assuming a 3% CAGR in annual outlay between FY2026 and FY2035, and moderation thereafter).

Exhibit: Trend in IR's budgetary capex outlay (Rs. billion)



Source: ICRA Research; Budget documents

Despite this progress, several challenges continue to constrain the sector. Between FY2019 and FY2025, physical targets for new lines, gauge conversion, and electrification were consistently missed. These delays stem from recurring issues such as land acquisition hurdles, environmental clearances, inter-agency coordination, contractual disputes, and funding gaps. Addressing these bottlenecks is essential to unlocking the full potential of planned infrastructure investments. Other challenges include infrastructure bottlenecks—such as congestion on key routes and limited capacity for high-speed rail—impact both passenger and freight efficiency. The rail freight share remains significantly lower than road transport, largely due to slow speed and limited flexibility in scheduling, which affects pricing and profitability. Efforts to attract private investment through PPPs have seen limited success, hampered by regulatory ambiguity, investor concerns, and competition from the government-run network. Financing and monetisation challenges persist, with slow progress in station redevelopment and private train operations. Operational inefficiencies, gaps in sustainability implementation, and the need for improved data transparency and governance further hinder responsiveness and innovation.

To unlock the full potential of the Indian Railways, a multi-pronged strategy is essential. Key action areas include enhancing data transparency to improve accountability and decision-making and advancing sustainability goals through electrification and green initiatives. Strengthening PPP and monetisation models will be crucial to attract private investment and reduce fiscal burden. Accelerating infrastructure modernisation, especially in freight corridors and station redevelopment, must be paired with capacity building and skill development to prepare the workforce for a tech-driven future. Increasingly empowering zonal railways through decentralised decision-making can improve responsiveness, while a revamped freight strategy focused on diversification and efficiency will help boost competitiveness in the logistics ecosystem.

Going forward, with strategic planning, robust investments, and technological innovation, Indian railways could potentially become a global powerhouse by 2050. The journey ahead demands sustained policy support, stakeholder collaboration, and efficient execution to unlock the full potential of this vital sector.

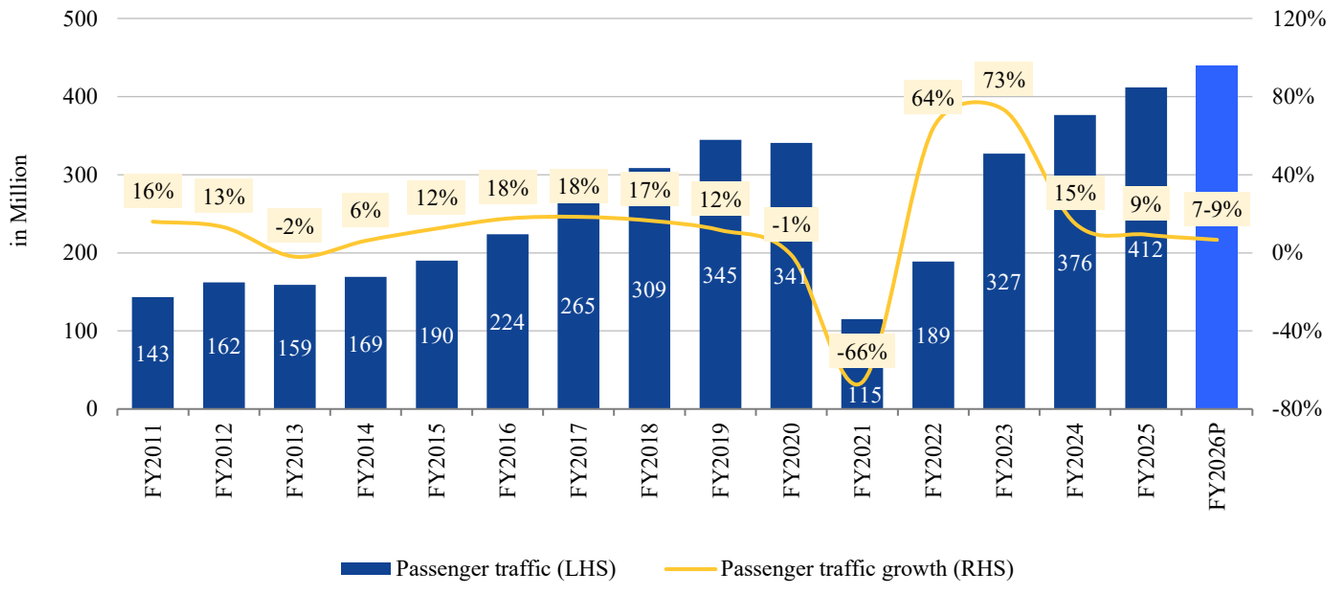
Lending opportunity

India's ambitious rail infrastructure goals present vast opportunities for diversified investment. While the bulk of funding currently comes from budgetary support and institutional finance via IRFC, the over Rs. 75-trillion requirement till 2047 calls for broader participation. Banks, infrastructure debt funds, and sovereign investors can play a pivotal role in financing long-tenure assets like freight corridors, rolling stock, and station redevelopment. Public-private partnerships remain underutilised but offer scalable models for terminals and high-speed rail. With electrification, digitalisation, and Environmental, social, and governance (ESG)-aligned projects gaining momentum, green bonds and climate finance also hold strong potential to bridge funding gaps.

AIRPORT INFRASTRUCTURE

Aviation acts as a significant catalyst for employment, economic activity, international trade and investment, and global connectivity. During 2011-2020 (till pre-Covid), the air passenger traffic in India grew at a double digit CAGR of 10.1%, with air passenger traffic increasing from 143 million in FY2011 to 341 million in FY2020. After declining by 66% to 115 million in FY2021 due to the Covid-19 pandemic, it surpassed pre-Covid levels in FY2024 and increased by 9.4% to reach 412 million in FY2025. The growth momentum is expected to sustain in FY2026 with estimated increase in passenger traffic volumes by 7-9% to reach around 440-450 million.

Exhibit: Yearly trends in total passenger traffic (in million)



Source: Airports Authority of India, ICRA Research

India now ranks as the third largest market in the world in terms of air passenger traffic, only behind United States (US) and China, with India generating around 4.2% of global passenger traffic. Despite this, India's air travel penetration is significantly lower than US and China, with India recording just 0.1 yearly trips per capita, compared to China's 0.5 and the US' 2.1. Given the low penetration of air travel in India, rising middle class incomes, sustained increase in leisure travel and rising numbers of students opting for higher education abroad, the air passenger traffic is expected to witness healthy growth over the medium term. The growth is also likely to be supported by the improvement in air connectivity, and addition of new routes.

Air passenger traffic in India is expected to reach around 650-700 million by 2030 (CAGR of around 8%) as per the Ministry of Civil Aviation, and the Government has set an ambitious plan to increase the operational airports from 159 as of February 2025 to 230-240 airports by 2030. The regional connectivity scheme, Ude Desh Ke Aam Nagarik (RCS-UDAN), is expected to improve domestic connectivity and help operationalise more airports throughout the country. Further, the operational airports are planning to increase their capacities to cater to the passenger growth in the medium term. The top 5 airports in India in terms of passenger handling capacities are Delhi, Mumbai, Bangalore, Hyderabad, and Cochin, accounting for 53% of the passenger traffic while having a current cumulative passenger handling capacity of 260.5 million passengers per annum (mppa). The capacity utilisation of these major airports in the country stands at around 80%, which necessitates these airports to undertake capacity expansions at regular intervals. Given the expected growth in passenger traffic, Mumbai, Bangalore, Hyderabad, Ahmedabad and Delhi are undertaking capacity expansions following the receipt of regulatory approvals. All these airports have envisioned sizeable capacity expansion plans to increase their operational capacity by 80-100 mppa in the medium term. Moreover, new greenfield airports at Navi Mumbai, Jewar, and Visakhapatnam are estimated to add around 40 mppa in the medium term. More than Rs. 1.0 lakh crore of capital investments are likely to be incurred over the next 4-5 years in the airport infrastructure sector, including around Rs. 25,000 crore of capex of the Airports Authority of India (AAI) and the balance for greenfield and brownfield expansions of private airports.

The capacity and utilisation of India's Top-7 airports (in terms of passenger handling) in FY2025 is presented below:

Exhibit: Capacity utilisation of Top-7 airports in the country

Airport	Airport capacity (million)	Passengers handled in FY2025	Capacity utilisation
Delhi	100	79.3	79%
Mumbai	54	55.1	102%
Bangalore	52	41.9	81%
Hyderabad	34	29.2	86%
Cochin	20	11.1	56%
Ahmedabad	17	13.4	80%
Lucknow	12	6.4	52%

Majority of the capex, going forward, would be towards brownfield expansions, given that Jewar and Navi Mumbai airports are likely to become operational in FY2026. There are no major challenges for brownfield expansion given that unencumbered land is available as part of the airport master plan, and funding these projects is not a major challenge as this capex would have regulatory returns. Nevertheless, greenfield airports face challenges in terms of securing clearances from the Directorate General of Civil Aviation (DGCA), the Bureau of Civil Aviation Security (BCAS), environmental and social impact, pre-clearance works and construction delays.

Lending opportunity

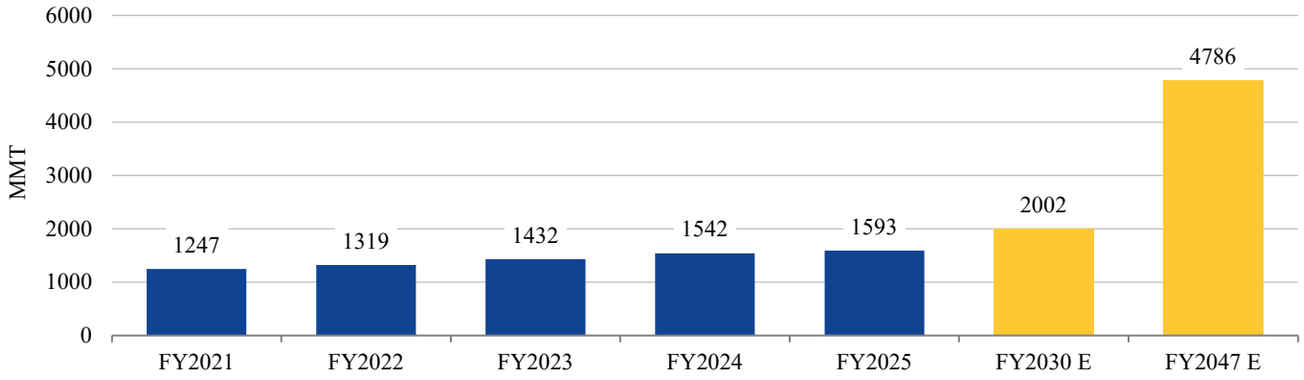
As per ICRA's estimates, the airport infrastructure sector would provide funding opportunities worth Rs. 4-4.5 trillion (assuming debt-to-equity of 70:30, in line with past investment trends in the sector, and adjusted for AAI capex) over the next two decades.

PORT INFRASTRUCTURE

Cargo volumes handled at Indian ports have grown at a CAGR of 4.5% during FY2015–FY2025 with rising industrial activity and global trade. The cargo mix is currently dominated by petroleum products (LNG, LPG, crude oil, etc) generating around 28% of the overall cargo volumes, followed by coal (24%).

Containerised cargo volumes have witnessed healthy growth over the last decade, growing at a CAGR of about 8% during FY2015–FY2025 with the share in cargo volumes rising to nearly 22% in FY2025 from about 16% in FY2015.

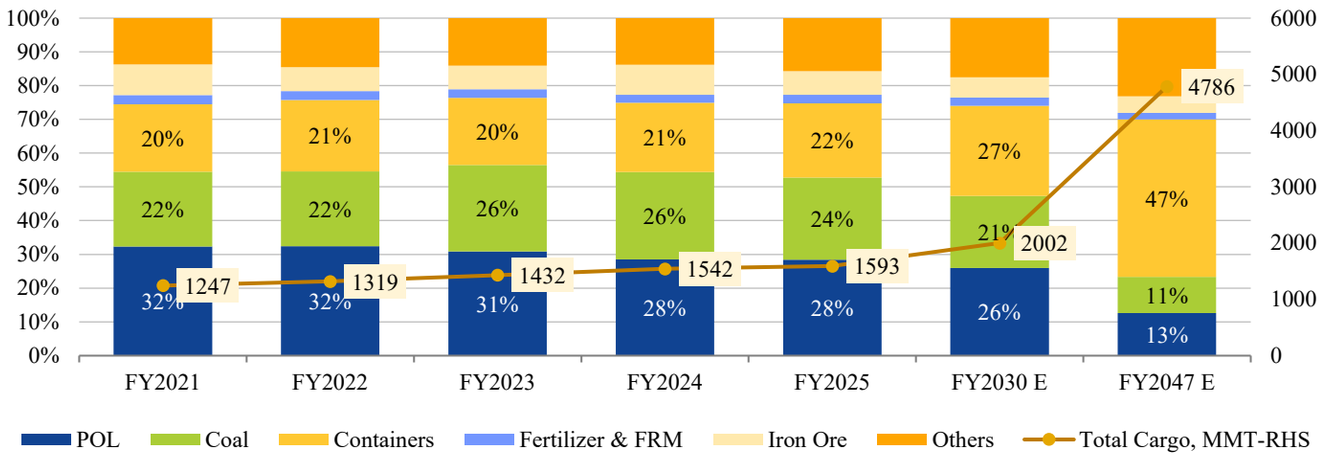
Exhibit: Trend in cargo volumes handled at Indian ports and outlook



Source: ICRA Research, MoPSW

Going forward, cargo volumes are expected to witness healthy growth supported by rising industrialisation and trade. Cargo volumes are estimated to grow to 4,786 MMT by the end of FY2047 from the current 1,593 MMT, indicating a CAGR of 5.2% over the next 22 years. In addition to the growth in volumes, the cargo profile handled at Indian ports is also likely to change significantly. The increasing containerisation of cargo and improving hinterland connectivity for the same is expected to drive growth in containerised cargo at a slightly higher pace than the real GDP growth rate over the long term.

Exhibit: Trend and outlook in share of segment-wise cargo volumes at Indian ports

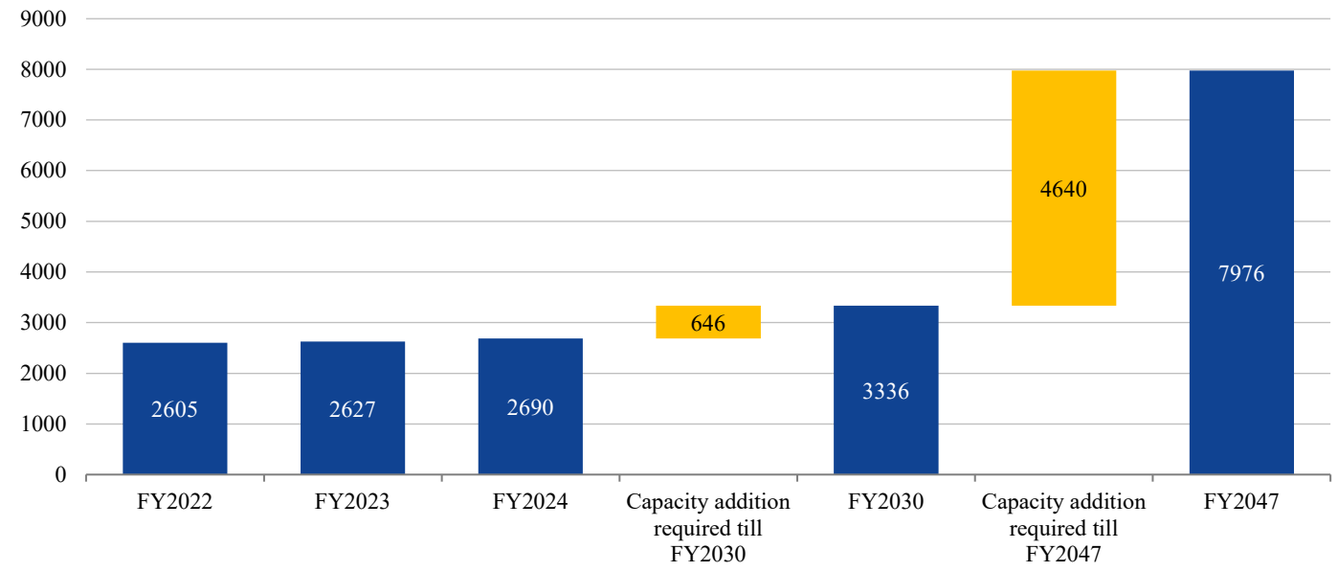


Source: ICRA Research, MoPSW

ICRA expects container cargo to grow at a CAGR of 8-8.5% during FY2025–FY2047 with the overall share rising to around 47% of the total cargo volumes handled at Indian ports by FY2047. Coal and petroleum products are expected to grow at a CAGR of 1.2% and 1.3%, respectively, over FY2025–FY2047 with the share in overall cargo falling to 11% and 13%, respectively, by FY2047. Given the focus of the Government and corporates alike on reducing carbon emissions and the rising electrification of vehicles, the growth rate of coal and petroleum product cargo volumes may decline, going forward. Other segments are likely to grow at a discount to the GDP growth rate.

Currently, the total capacity of India's ports (including major and non-major ports) stands at 2609 MMT (as on March 31, 2024). Given the sizeable growth in cargo volumes expected during FY2025–FY2030 and further till FY2047, the port sector will need to invest in capacity expansions. The capacity utilisation at major ports stood at around 50% and that for non-major ports at 68% in FY2024. Given that ports start witnessing increased congestion and a fall in operating efficiency once 70% capacity utilisation is achieved, India will need to add sizeable capacity in the sector, going forward. As per ICRA's expectations, the port sector will need to add around 650–700 MMT of cargo handling capacity between FY2025 and FY2030 to efficiently manage the anticipated cargo growth. By FY2030, the sector will need to make sizeable investments in ramping up cargo capacity by around 4,600-4,700 MMT to maintain efficient operations while meeting the country's cargo handling requirements.

Exhibit: Expected cargo handling capacity addition at Indian ports over FY2025–FY2047



Source: ICRA Research, MoPSW

To meet the capacity demand, sizeable investments would be required, entailing a robust credit profile of the entities undertaking the projects, a buoyant funding environment with products suitably crafted to match the nature of the project cashflows. ICRA expects that to meet the envisaged capacity expansion, nearly **Rs. 850-900 billion of investments will be required by FY2030** and a further **Rs. 5 trillion during FY2030–FY2047**. The investments are sizeable in nature and while major ports will take up capacity expansions at their own facilities, the major chunk of investments is anticipated to come from the non-major ports, i.e., existing ones and new ports to be bid out. In addition to the above investments to enhance port cargo handling capacity, more investments will have to be made to improve hinterland connectivity and infrastructure by the logistics sector.

Lending opportunity

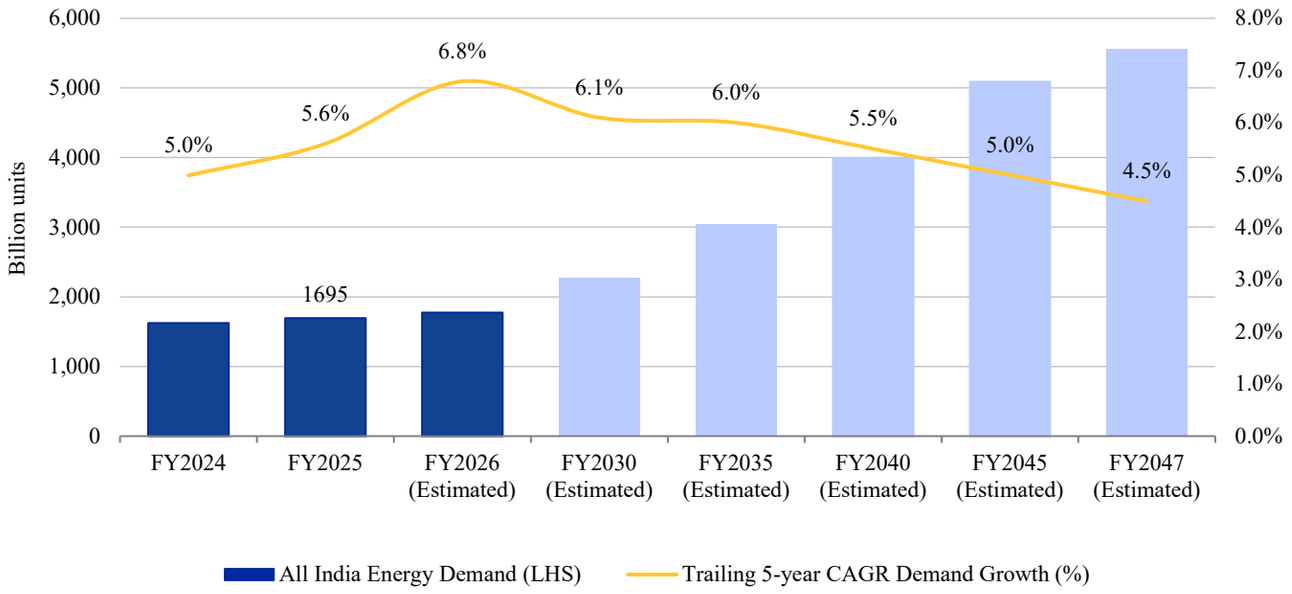
India's sea port sector is poised for robust growth, offering substantial lending opportunities for banks and financial institutions. Key funding avenues include Maritime Development Fund, Sagarmala (flagship initiative of the Ministry of Ports, Shipping, and Waterways) 2.0's Rs. 0.4 trillion[12] budgetary support, complemented by private equity, multilateral loans, and export credit lines. With rising cargo volumes, deepwater port expansions, and transshipment hubs in the pipeline, the sector demands long-term capital across infrastructure, logistics, and shipbuilding.

[12]*https://www.pib.gov.in/PressReleasePage.aspx?PRID=2115878*

Power & Energy

Over the last decade, India's power demand has grown consistently, driven by rapid urbanisation, industrial expansion, and rising household consumption. During FY2015–FY2025, total electricity consumption grew at a CAGR of approximately 4.7%, touching 1,695 billion units in FY2025. This upward trend reflects both economic momentum and improved access to electricity across rural and urban India. The demand is expected to increase to over 5,500 billion units by FY2047, reflecting a 22-year CAGR of 5.5%, highlighting the need for sustained capacity expansion and investment in power generation. Annual demand growth is projected to average 4.5–6.5% between FY2025 and FY2045, closely tracking India's expected GDP growth of 6.0–6.5%, underscoring the strong link between energy consumption and economic development. The demand growth is likely to pare down from the highs of 6.0-6.5% during FY2026-FY2035 to 4.5-5.5% during FY2036-FY2047, owing to impact of energy efficiency measures and higher base effects.

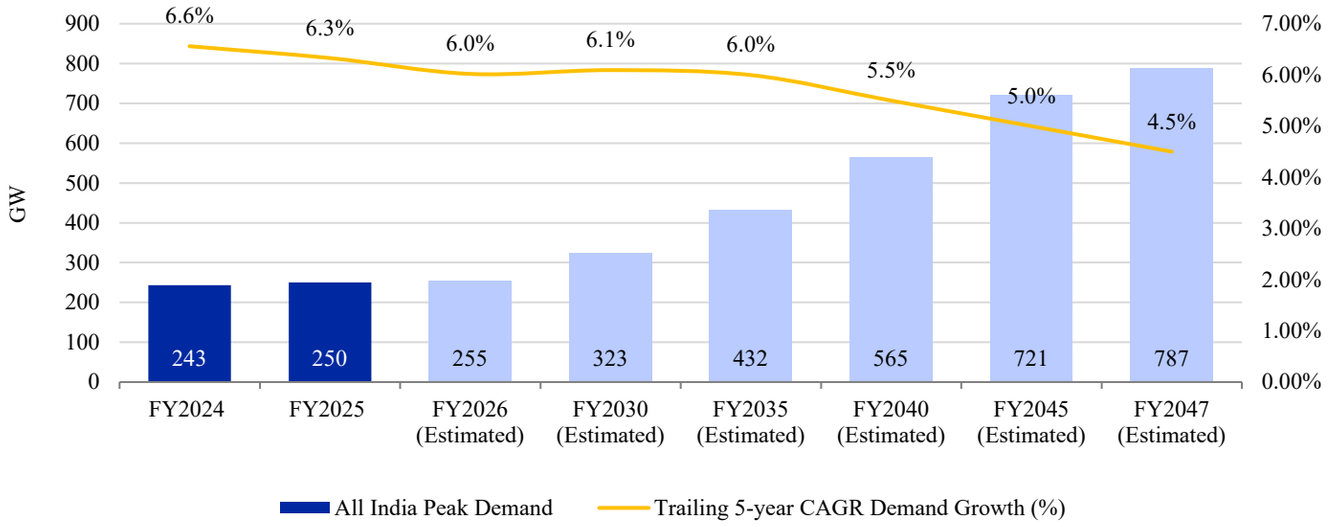
Exhibit: All-India electricity demand trend and outlook



Source: ICRA Research, Central Electricity Authority (CEA)

The peak electricity demand captures the highest instantaneous load, often during extreme weather events or high industrial activity. Typically occurring in the first four months of the fiscal year coinciding with the summer season. The same has surged in India, from around 148 GW in FY2015 to an all-time high of nearly 250 GW in FY2025, marking a 10-year CAGR of 5.4%. The same is projected to reach 320–340 GW by FY2030, and 780–800 GW by FY2047. This strong growth in peak demand, alongside the rising share of renewables, highlights the urgent need for developing energy storage solutions to ensure grid reliability and power availability.

Exhibit: Trends in all-India peak electricity demand

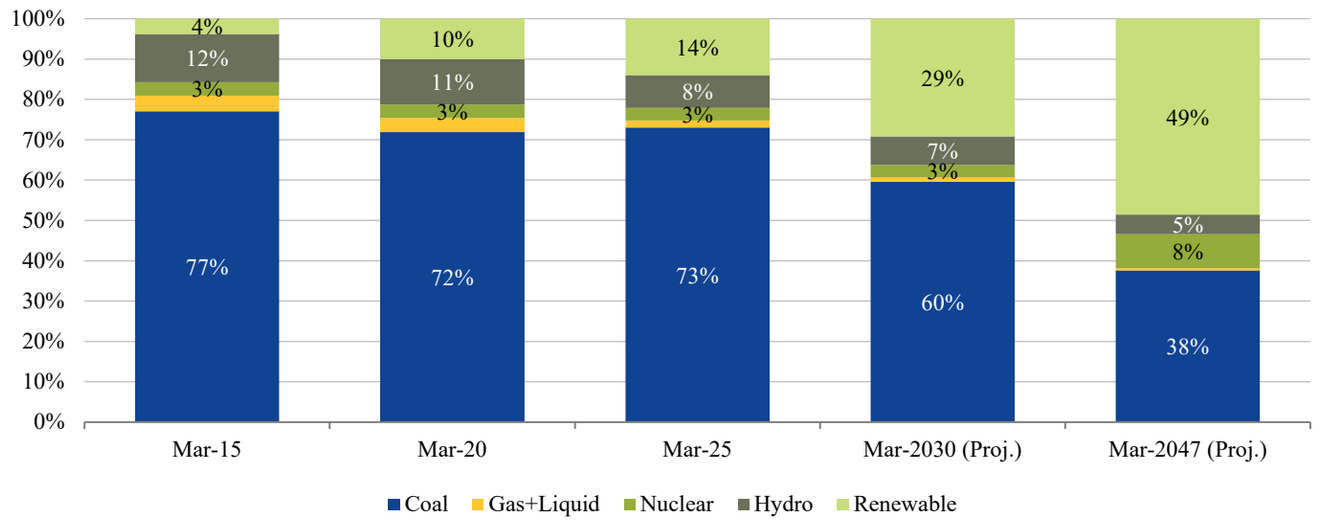


Source: ICRA Research, CEA

Renewables to eclipse thermal in power capacity and generation mix by 2047

India has witnessed a substantial increase in installed renewable energy (RE) capacity over the past decade, driven by strong policy support and clean energy commitments. This momentum is expected to continue, with most of the incremental demands from emerging sectors being met through RE additions. However, to ensure grid reliability and meet peak demand, both Central and state governments have been supporting new thermal capacity as a buffer.

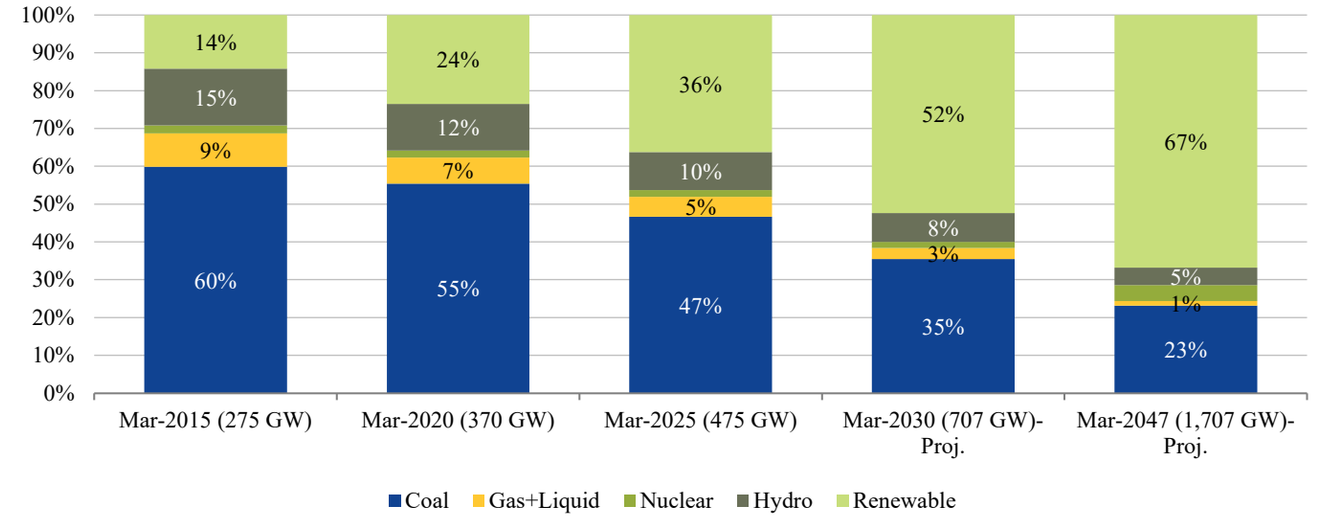
Exhibit: Trends in electricity generation mix by 2047



Source: ICRA Research, CEA

ICRA projects the total installed power generation capacity to rise from 475 GW in March 2025 to 707 GW by March 2030. Over 85% of this 232 GW increase is expected to come from renewable sources, with the remainder from thermal and nuclear. The capacity is further expected to increase to 1,707 GW by March 2047, led by 78% increase in renewable capacity, 14% increase in thermal capacity and 8 % increase in hydro and nuclear capacity. Installed thermal, nuclear and hydro capacity of around 316 GW by March 2030 and 546 GW by March 2047 will partly support the projected peak demand of 323 GW and 787 GW by March 2030 and March 2047, respectively.

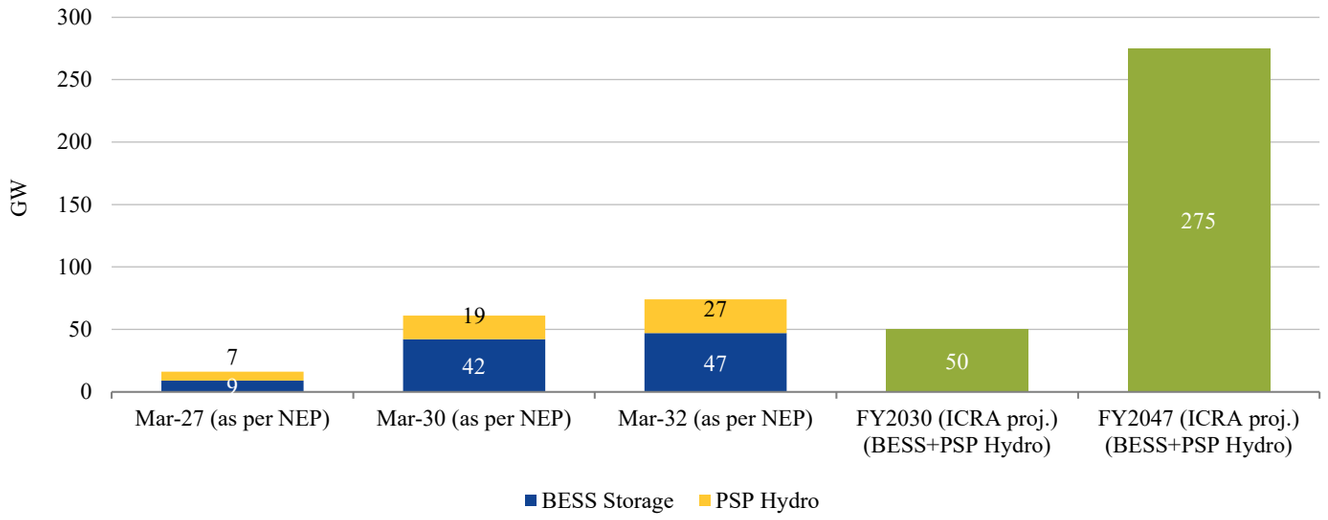
Exhibit: Trends in fuel mix of generation capacity including expected addition by 2047



Source: ICRA Research, CEA

For meeting the balance peak demand, augmentation of storage capacity to 50 GW and 275 GW will be required by March 2030 and March 2047, respectively. Timely execution and stabilisation of these projects will be critical, along with the development of robust energy storage infrastructure to manage the variability of renewables.

Exhibit: Expected addition in storage capacity by 2047



Source: ICRA Research, CEA; Estimate by CEA for March 2027 and March 2032 is as per the NEP; Estimate for March 2030 is as per the optimal generation mix report (Version 2.0) released by CEA

In line with India's updated Nationally Determined Contributions (NDCs), which target 50% of installed capacity from non-fossil sources by 2030, the focus remains on accelerating RE deployment, including large hydro. The share of renewables (including large hydro) in installed capacity is projected to increase from 46% in March 2025 to 60% by March 2030, and further to 71% by 2047. Coal's share in installed capacity is expected to decline significantly, from 47% in March 2025 to 35% by March 2030, and further to 23% by 2047. Despite this, coal will continue to play a key role in electricity generation due to its dispatchable nature, especially during peak demand periods.

The share of renewables (excluding large hydro) in actual electricity generation mix has grown from 4% in FY2015 to 14% in FY2025, reflecting the scale-up in RE capacity. However, the share of hydro in energy generation has declined due to limited new additions. Going forward, the combined share of RE and hydro is expected to exceed 35% by 2030 from 22% in FY2025 and further increase to over 50% by 2047, while coal-based generation is projected to fall to 60% and 38% in FY2030 and FY2047, respectively, from 73% in FY2025.

Thermal Plant Load Factors (PLFs) are expected to remain in the 65–70% range over the next two decades, which is likely to reach 251 GW in 2030 and 395 GW in 2047 as per ICRA's projections, supported by the role of coal in meeting base load demand. However, these estimates are sensitive to changes in electricity demand growth and the pace of RE integration.

India has set an ambitious target of achieving 100 GW of nuclear power capacity by 2047, positioning nuclear energy as a cornerstone of its clean energy transition and long-term energy security strategy. This goal is part of the broader Nuclear Energy

Mission for Viksit Bharat, which aims to reduce carbon emissions, support industrial growth, and meet the country's net-zero commitments by 2070. To reach this target, the government plans a phased capacity expansion—from the current level of 8.2 GW to 22 GW by 2032, 49 GW by 2037, 67 GW by 2042, and finally 100 GW by 2047. Key enablers include the development of Small Modular Reactors (SMRs), public-private partnerships, and legislative reforms to open the sector to private and foreign investments. However, several challenges persist, such as restrictive laws, safety concerns, high capital costs, limited financing options, regulatory gaps, and slow progress in international collaborations. Given the various execution related challenges, ICRA anticipates the nuclear capacity base to increase to about 12 GW by 2030 and around 72 GW by 2047.

Meeting rising electricity demand will need about Rs. 6.5-7.0 trillion in annual investment through FY2047

The power sector is slated for significant capital expenditure of about Rs. 22 trillion over the next five-year period and further to a whopping Rs. 148 trillion for capacity addition in renewable (including hydro and nuclear) and thermal generation, as well as for strengthening India's transmission and distribution network, along with storage capacity. This translates to an annual investment run rate of Rs. 6.5-7.0 trillion over a 22-year period.

Exhibit: Investment required in power sector till FY2030

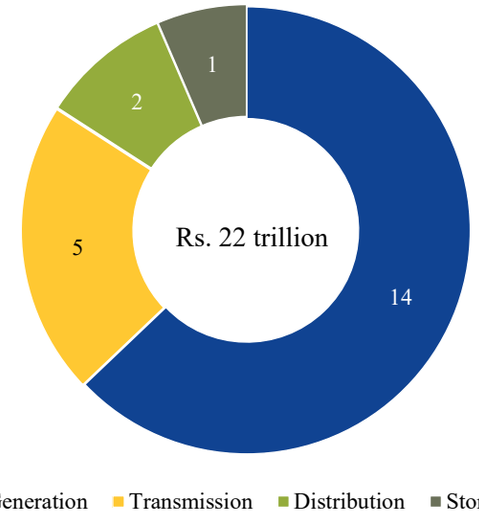
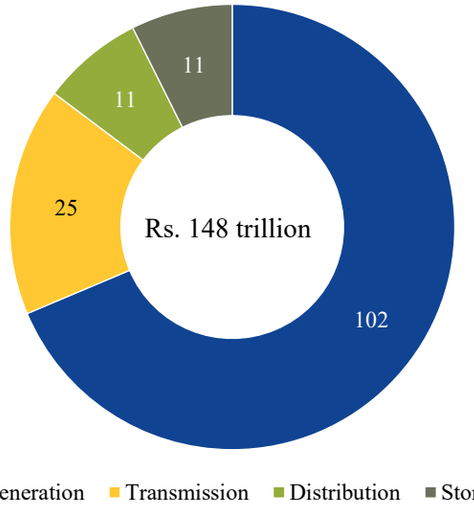


Exhibit: Investment required in power sector till FY2047



Source: ICRA Research, CEA

Generation	Transmission	Distribution
The power sector is expected to see 60-70% of its capex directed toward power generation (renewable + non-renewable), which will play a pivotal role in India's energy transition.	This will require Rs. 25 trillion in investments over the next two decades. ICRA expects an average annual addition of 19,000-20,000 cKM for transmission line and average annual augmentation of 100 GVA for substations over the coming years, which will be needed to meet the growing capacity and electricity demand.	The annual investment in the power distribution sector is estimated to remain at Rs. 40,000-60,000 crore till FY2047 for investments in meeting the growing demand and to improve reliability of supply and reduce distribution losses.

Given the intermittent nature of RE generation, energy storage capacity is required to ensure grid balancing. The storage capacity is expected to be used to meet the evening peak demand, when solar energy is not available, and to enable grid operators to manage the variable generation associated with solar and wind resources. The National Electricity Policy (NEP) projects an installed storage capacity of 74 GW by 2032, together providing 411 GWH of storage for integrating RE with the grid. ICRA expects the energy storage capacity requirement at 50 GW by 2030 and further to 275 GW by 2047 with 5-6 hours of storage, which will be met through a mix of battery energy storage system (BESS) and pumped hydro storage projects. The significant decline in tariffs for BESS projects over the past months, driven by the sharp decline in battery prices, is likely to improve the adoption of storage projects.

Lending opportunity

With goals like net-zero emissions by 2070, the sector offers vast scope for private capital, banks, and green finance. Public sector banks and government budgets remain key funding sources, but long-term financing needs call for deeper private and foreign participation. Opportunities span generation, transmission, storage, and emerging areas like green hydrogen and data centre electrification. A stable regulatory framework and innovative PPP models will be critical to unlocking this potential.

Telecommunication Infrastructure

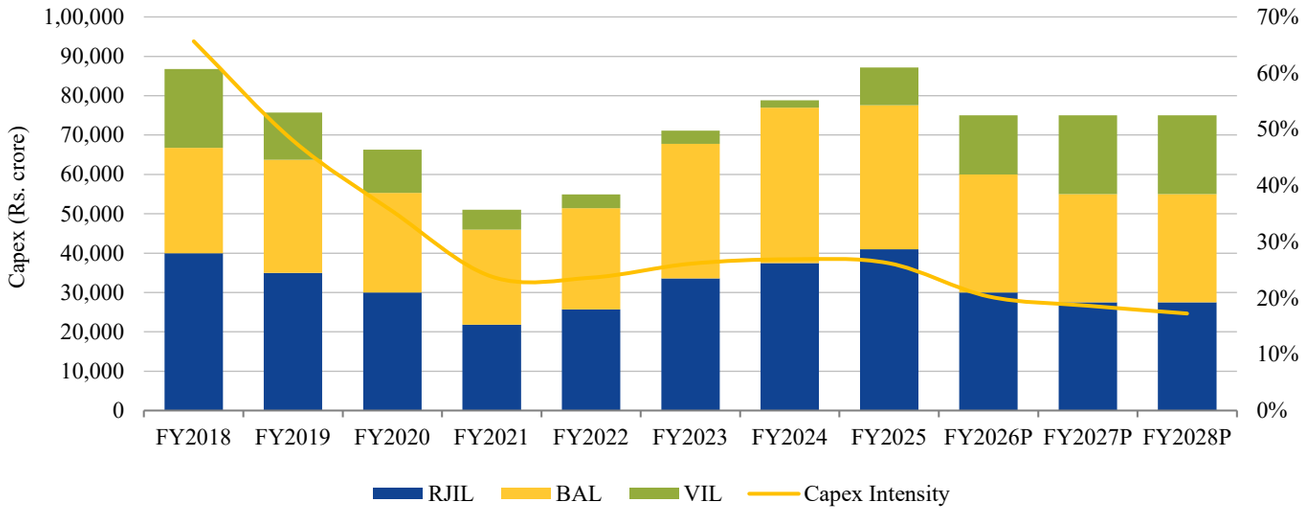
The telecom industry is inherently capital intensive and requires regular capital expenditure commitments to support subscriber growth, allow for deeper network penetration to ensure adequate service quality, and introduce new products/services. The primary capex in the telecom industry is towards creating, maintaining and expanding the network infrastructure. Spectrum is the key raw material for the industry and is acquired through auctions for a period of 20 years. Spectrum acquisition involves sizeable cash outflow and generally has a deferred payment plan. Further, the shift in Government policy from administratively priced to auction-based spectrum allocation increased the industry's capital expenditure commitments. As a result, most industry participants have witnessed a significant increase in funding requirements. However, with time Department of Telecom has also eased the payment norms for this spectrum and the latest auction involved the most relaxed payment terms, wherein the telcos had the option to make payments in 20 equal instalments at 8.65% rate of interest, thus elongating the payment terms as well as easing the liquidity by eliminating sizeable upfront payment requirements.

The capex intensity, as measured by the ratio of annual capex to revenues, remains high whenever there is a technology transition or a spectrum auction. On an ongoing basis (excluding spectrum acquisition related capex), the industry is required to incur capex in a timely manner to keep pace with the technology changes, which is likely to prevent the capex intensity from dipping materially, being driven by the need for increasing fiberisation to take care of the rising data usage. The fiber penetration levels in India are quite low vis-à-vis other parts of the world as reflected by the fact that in India only about 40% of the towers are fiberised against 80-90% in China, Japan, the EU, and the US, etc.

Given the high capital intensity of the industry, sharing of infrastructure improves asset utilisation for the entire industry and helps lower the funding requirements. Inadequate utilisation of network capacity can result in significantly weak profitability. The high capital intensity in the telecom industry also mandates high operating efficiencies for telcos to be able to maintain stable profitability. The operating margins of the private telcos range between 40% and 55%, while the RoCE remains low due to high capital requirements.

While technology upgrade to 5G is progressing, a large part of the capex by private telcos was upfronted in the last two fiscals, thereby leading to expectations of some moderation in the capex intensity, going forward. ICRA expects telecom services capex to be around Rs. 700-750 billion per annum for the medium term, which will largely entail network expansion as well as fiberisation. In addition, there will be capex by the telecom tower industry, which is expected to be in the range of Rs. 80-100 billion annually, largely towards expansion of the tower base in line with the network expansion by operators.

Exhibit: Movement of operator-wise capex in the telecom services industry (excl. spectrum auctions)



Source: ICRA Research

Data centres

India's data centre (DC) industry is undergoing a transformative expansion, positioning itself as a critical pillar of the country's digital economy. The need for data centres is exploding across multiple sectors - technology firms, banking and financial services, government bodies, e-commerce and over-the-top (OTT) media platforms being some of the major drivers. Resultantly, over the past five years, the sector has grown at a compound annual growth rate (CAGR) of over 24%, with installed capacity rising from 540 MW in 2019 to over 1.2 GW by March 2025. This momentum is expected to continue and ICRA expects at least a 3x increase in capacity by FY2030 and potentially to 25 GW by FY2047. This would entail investments of ~Rs. 1.2-1.5 trillion by FY2030 and cumulative investments of over Rs. 15 trillion by FY2047.

Several structural and technological drivers underpin this growth. The proliferation of 5G networks, rapid digitalisation across sectors, and the exponential rise in data consumption—particularly from Artificial intelligence (AI) workloads, cloud computing, and fintech—are creating unprecedented demand for scalable, secure, and high-performance data infrastructure. The Mumbai Metropolitan Region (MMR) and Chennai have emerged as key data centre hubs, with Hyderabad and Pune also witnessing significant capacity additions.

Policy support has played a catalytic role. The Digital Personal Data Protection Act (DPDPA) 2023, the RBI's data localisation mandate, and the granting of infrastructure status to data centres have enhanced regulatory clarity and investor confidence. Additionally, several state governments have introduced targeted incentives, including land subsidies, power tariff rebates, and single-window clearances, to attract data centre investments.

The investment landscape is also evolving. While hyperscalers like Amazon Web Services, Microsoft Azure, and Google Cloud continue to expand their footprint, there is growing interest from private equity firms, sovereign wealth funds, and pension funds. These investors are increasingly participating in joint ventures, real estate investment trusts (REITs), and infrastructure investment trusts (InvITs) focused on digital infrastructure.

Looking ahead, the next two decades will likely see India emerge as a global data centre hub, not just for domestic consumption but also for serving regional and international markets. However, challenges remain. These include ensuring reliable power supply, managing environmental impact, and addressing the shortage of skilled professionals in data centre operations and cybersecurity.

Lending opportunities

From a lending perspective, the data centre sector presents a robust pipeline of opportunities for banks, NBFCs, and infrastructure financiers. With capex per IT MW ranging between Rs. 50–60 crore (hard cost only i.e. excluding land-cost, interest during construction etc.), and large campuses often exceeding 100 MW, the financing requirements are substantial and long-tenured. Lenders can participate across multiple layers—land acquisition, construction finance, equipment leasing, and green energy integration. The sector's classification as infrastructure also enables access to priority sector lending norms and lower capital risk weights. As demand for AI-ready and hyperscale facilities grows, structured debt products, green bonds, and sustainability-linked loans are expected to gain traction, offering diversified exposure to a high-growth digital asset class.

Urban Infrastructure

India's urban infrastructure encompasses a wide array of systems and services essential for sustaining urban life and economic productivity. This includes transport networks (roads, metro rail, e-buses), water supply and sanitation, solid waste management, stormwater drainage, affordable housing, digital infrastructure, energy distribution, and public amenities such as parks, schools, and health facilities.

As India transitions toward becoming a developed economy by 2047, the scale of urbanisation demands a massive expansion and modernisation of these assets. With urban areas expected to house over 950 million people by 2050 and contribute nearly 70% to GDP, the investment requirement is both urgent and transformative.

Over the past decade, the Government has launched several flagship missions to address urban infrastructure needs:

- **Smart Cities Mission (SCM):** As of November 2024, 91% of 8,066 projects worth Rs. 1.64 lakh crore have been completed across 100 cities. These include 1,740 km of smart roads, 713 km of cycle tracks, 84,000 CCTV cameras, and over 9,400 smart classrooms.
- **AMRUT [13] & AMRUT 2.0:** Focused on water supply and sewage, AMRUT has created 4,649 MLD of water treatment and 4,429 MLD of sewage treatment capacity. AMRUT 2.0 prioritises stormwater drainage and waterlogging mitigation.
- **Urban Mobility:** Metro rail coverage has expanded from 248 km in 2014 to 1,013 km [14] operational as of September 2025, with another ~1,000 km under construction. Daily ridership has grown from 2.8 million to over 11.2 million as of Aug 2025. The PM-eBus Sewa aims to deploy 10,000 electric buses with Rs. 200 billion central assistance.
- Urban Housing (PMAY-U 2.0): Over 6 million houses have received in-principle approval, with a new rental housing division introduced for migrant and vulnerable populations.

Despite the above, according to the World Bank, nearly 70% of the urban infrastructure needed by 2047 is yet to be built. ICRA projects, that to meet this demand, an estimated Rs. 385-468 trillion (or $4.4-5.3 trillion) investment will be needed towards urban infrastructure by 2047, averaging Rs. 17.5-21.3 trillion annually.

Funding landscape and challenges

Currently, Central and state governments fund 72–75% of urban infrastructure, while urban local bodies (ULBs) contribute 15% and private/commercial financing accounts for the remaining share. Municipal finances remain weak, with property tax collections marginal compared to GDP, and cost recovery for services.

Low absorptive capacity is another challenge-nearly 20% of municipal revenue remains unspent, and many cities struggle to utilise allocated funds effectively. For example, the Smart Cities Mission and AMRUT have achieved 70–80% fund utilisation, indicating room for improvement.

[13] *Atal Mission for Rejuvenation and Urban Transformation*
[14] *https://static.pib.gov.in/WriteReadData/specificdocs/documents/2025/aug/doc2025810604101.pdf*

Lending opportunity

To bridge the investment gap, there is a need to diversify funding sources. Strengthening the municipal bond market, expanding PPP models, and enabling commercial financing are critical. Over 160 cities are investment-grade, yet few have tapped into debt markets. Building ULB capacity to execute bankable projects and improving financial transparency will be essential.

Concluding Remarks

India's infrastructure development under the Viksit Bharat 2047 vision requires substantial investment across key sectors—transportation, energy, urban infrastructure, telecom, and aviation. In transportation, road infrastructure has seen significant capital allocation growth, with India's national highway length expanding by 60% and expressways by 26x since 2014. Railways, critical for reducing logistics costs, are undergoing modernisation through DFCs, HSR, and digitalisation, with projected investments exceeding Rs. 75 trillion by 2050.

Airport infrastructure is expanding to meet rising passenger traffic, which is expected to reach 700 million by 2030. Capacity utilisation at major airports necessitates brownfield expansions and new greenfield projects, with Rs. 7–7.5 trillion in investments projected by 2047. Ports are expected to handle 4,786 MMT of cargo by 2047, requiring Rs. 5.9 trillion in capacity expansion, especially in containerised cargo.

Power demand is projected to grow at 5.5% CAGR, reaching 5,555 BU by 2047. Renewable energy will dominate capacity additions, supported by storage infrastructure. Total investment needs in the power sector are estimated at Rs. 148 trillion. Telecom infrastructure faces high capex intensity due to spectrum costs and network expansion, with likely annual investments of at least Rs. 700–750 billion.

Urban infrastructure, driven by rapid urbanisation, requires Rs. 385–468 trillion by 2047 towards (urban transport, basic municipal services, solid waste management, and social and community infrastructure, excluding housing). Despite flagship missions like Smart Cities and AMRUT, funding gaps persist due to weak municipal finances and low absorptive capacity. Diversifying funding sources through PPPs, municipal bonds, and commercial finance is essential to bridge the gap and ensure sustainable urban growth.

Exhibit: Snapshot – Infrastructure requirement from key segments

	Cumulative Requirement – FY2026-FY2030		Cumulative Requirement - FY2026-FY2047	
	In Rs. trillion	In USD trillion	In Rs. trillion	In USD trillion
Road (NH +States)	~18	~0.21	83-91	0.9-1.0
Rail	~14	~0.16	75-77	~0.8
Port	~1	~0.01	~6	~0.1
Airports	~1	~0.01	7-7.5	~0.1
Power	~22	~0.25	143-154	1.6-1.7
Telecom (incl data centres)*	~6	~0.06	30-31	~0.3
Others (urban infra, river linking)	~74	~0.84	335-405	3.8-4.6
*Urban Infra***	*~68*	~0.77	310-375	~3.5-4.2
Irrigation (incl. river linking)	~6	~0.06	~27-30	~0.3
Total	**~136**	**~1.5-1.6**	**680-770**	**7.6-8.6**

*Source: ICRA Research; Note: *Movement of telecom operator wise capex in the telecom services industry (exsl. Spectrum auctions); ** Excl. affordable housing; Conversion - 1 USD= Rs. 88*

Bridging the Infrastructure Financing Gap

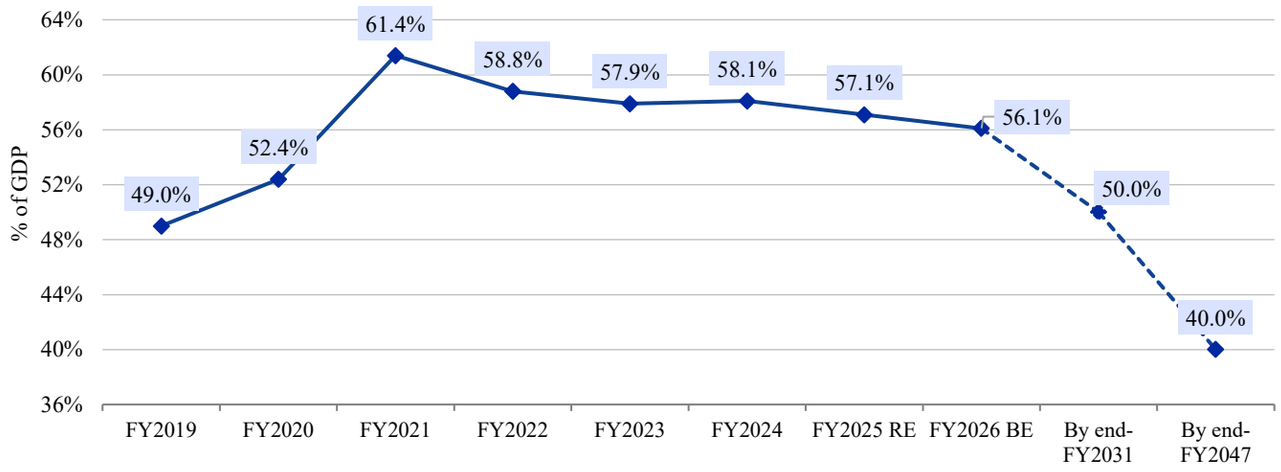
Available Government Funding

Central government investment appetite

The GoI's fiscal strategy is set to witness a marked shift from FY2027, with a focus on the debt-to-GDP as the new fiscal anchor against the past practice of announcing a glide path for the fiscal deficit-to-GDP ratio over the near-to-medium term. It has already been announced that from FY2027, it would endeavour to keep the fiscal deficit each year such that the Central Government debt will be on a declining path as a percentage of GDP. It has set the target debt to GDP level at 50±1% by March 31, 2031, which would be the last year of the 16th Finance Commission cycle, assuming that there is no major macro-economic disruptive exogenous shock(s) and also keeping in mind the potential growth trends and emergent development needs.

Thus, any assessment of the GoI's ability to enhance capex until FY2031 should factor in the fiscal constraint on account of this debt consolidation target. Besides, with the debt remaining on the higher side (at about 50%) even in end-FY2031, consolidation is likely to continue thereafter, albeit at a relatively modest pace, to avoid sharp fiscal compression. We have assumed that the GoI would gradually bring down its debt to around 40% of GDP by FY2047, in line with the target proposed by the NK Singh Committee in 2017; although more clarity on this may emerge once the 16th Finance Commission submits its report towards the end of the ongoing fiscal.

Exhibit: Central government debt-to-GDP ratio

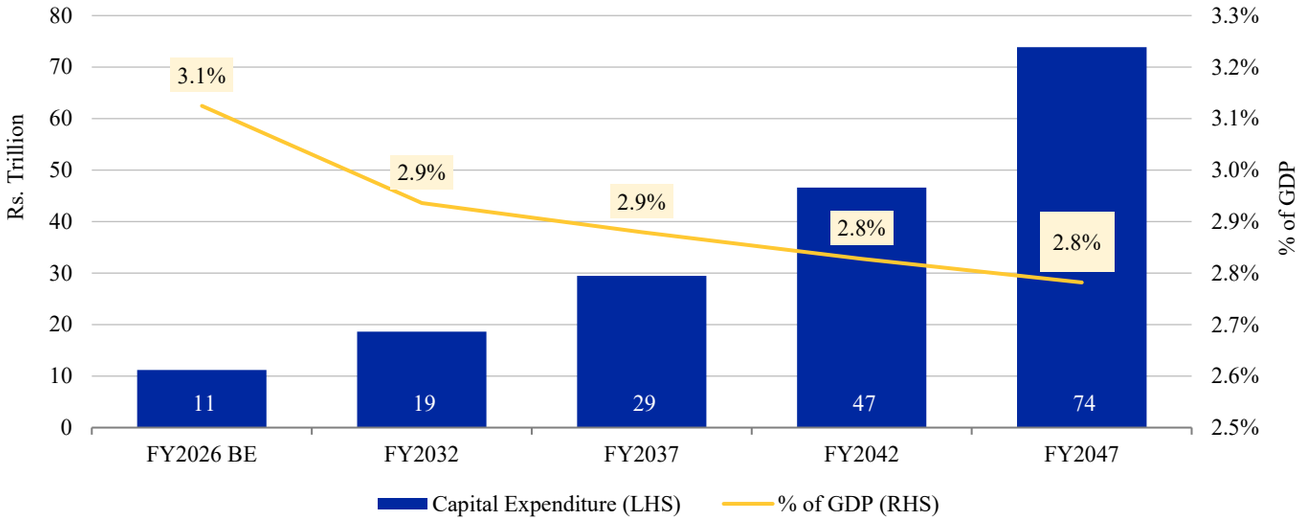


Source: Union Budget; CGA, Ministry of Finance, GoI; ICRA Research

Given the fiscal constraints, and reasonable assumptions around the growth in nominal GDP, GoI's revenues and revenue expenditure requirements, ICRA estimates the GoI's capex to rise at a CAGR of about 9.4% between FY2026 and FY2047. This would imply a gross capex number to the tune of around Rs. 74 trillion in FY2047, around 5.6 times the FY2026 BE of Rs. 11.2 trillion and entail a total capex of nearly Rs. 710 trillion during this 21-year period (based on the simple summation of yearly capex).

As a percentage of GDP, while the GoI's gross capex may ease slightly in the immediate years (which could lead to an off-budgeting of capex back to some CPSEs, reversing the trend seen in the post-Covid period) owing to the relatively sharper delta pencilled in for debt reduction until FY2031, it could average at 2.8-2.9% of GDP thereafter, until the end of FY2047.

Exhibit: Projections for trends in capital expenditure by the GoI

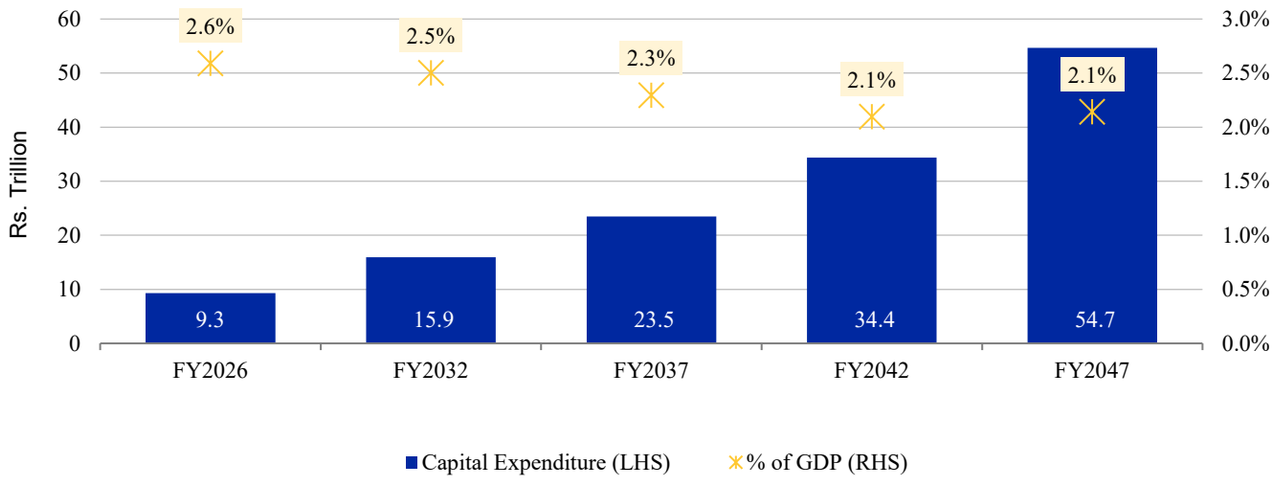


Source: Union Budget; CGA, Ministry of Finance, GoI; ICRA Research

Potential spending capacity of states

For FY2047, ICRA estimates the combined capital expenditure of the 28 state governments at Rs. 54.7 trillion, indicating a CAGR of about 9% during FY2027-FY2047. As a proportion of GDP, the total capital expenditure of the 28 states is estimated to remain at 2.0-2.6% during this 20-year period. This assumes an average 10% growth in India's GDP during the 20-year period of FY2027-FY2047, aggregate debt-to-GDP ratio of the 28 states remaining around 30% and fiscal deficit of around 3% of GDP. At present, the debt-to-GSDP ratio of several states (Himachal Pradesh, Kerala, Punjab, Rajasthan and West Bengal) is at a range of 35-45% while there are many states (Gujarat, Karnataka, Maharashtra, Odisha, and Uttarakhand) with a ratio of under 25%.

Exhibit: Projections for trends in capital expenditure for 28 states



Source: ICRA Research, NSO; CAG; State Budgets

Accordingly, a distinct road map of debt and deficit targets may need to be carved out for each individual state for bringing the debt-to-GSDP ratio of each state close to 30% by FY2047. During the 20-year period, the states with high debt-to-GDP ratio would gradually target a ratio of 30% while states with a lower ratio will have the scope for enhancing their spending, leading to debt levels moving towards 30% of GSDP by FY2047.

Downside risks to achieving the target debt-to-GSDP ratio by FY2047 include unanticipated events (wars, natural calamities, major disruptions in the sector, etc) leading to relaxation in deficit and debt targets. Moreover, additional borrowing support (over and above the NBC) provided by the GoI to states in the coming years, may delay the path of convergence towards the target of debt at 30% of GSDP by FY2047, if states opt to avail additional borrowings.

However, in an increasingly uncertain global environment, a continued focus on infrastructure creation by the Centre and the states would help to provide sustained momentum to economic growth, complementing the expected demographic-dividend led consumption push.

Unlocking Private Capital

Unlocking private capital for infrastructure financing is not merely a financial imperative, it is a strategic enabler of inclusive and sustainable development. Blended finance and viability gap funding (VGF) can de-risk projects and catalyse investment. Strengthening PPP frameworks ensures efficient delivery and equitable risk-sharing. Attracting long-term institutional capital provides the scale and stability needed for transformative infrastructure. India's policy ecosystem is evolving to support these objectives, but continued reforms, capacity building, and stakeholder engagement are essential. A coordinated approach that aligns public and private interests, integrates ESG principles, and fosters innovation will be key to bridging the infrastructure financing gap and achieving long-term development goals.

Blended finance and viability gap funding (VGF)

Mobilising private capital is essential to meet India's growing infrastructure needs, especially as public resources remain constrained. Blended finance—defined as the strategic use of public or concessional funds to attract private investment—has emerged as a key tool to bridge this gap. It is particularly effective in infrastructure sectors where commercial viability is uncertain or where risks are perceived to be high.

India's VGF scheme, introduced in 2005 and revamped in 2020, has been instrumental in supporting PPP projects that are economically justified but financially unviable. Administered by the Ministry of Finance, the scheme provides upfront capital grants of up to 40% of the project cost—20% from the Central Government and an optional 20% from state governments. From a credit perspective, VGF improves project bankability by reducing upfront capital requirements and enhancing projected cash flows. It lowers the debt burden and improves the debt service coverage ratio (DSCR), making projects more attractive to lenders and investors. This is particularly relevant in sectors where user charges alone cannot ensure financial viability.

Several high-profile projects illustrate the scheme's effectiveness:

- Noida International Airport received Rs. 1,500 crore in VGF, enabling Zurich Airport International AG to participate as the concessionaire.
- Pune Metro Line III secured Rs. 1,225 crore in VGF, facilitating private investment from Tata Realty and Siemen
- Ganga Expressway and Bangalore Peripheral Ring Road also benefited from VGF support, catalysing private interest in high-capex transport infrastructure.

These examples demonstrate how VGF can de-risk large-scale projects, improve credit profiles, and accelerate execution timelines. Beyond VGF, blended finance includes a range of instruments designed to improve the risk-return profile for private investors:

- Guarantees and insurance to mitigate political and regulatory risks
- Subordinated debt or equity to improve the risk-return profile for private investors
- Technical assistance grants to strengthen project preparation and capacity building

International DFIs such as the World Bank, Asian Development Bank (ADB), and the newly established NIDB plays a key role in structuring blended finance deals. Their participation enhances credibility, reduces risk, and catalyses private sector involvement. However, the effectiveness of blended finance depends on robust governance, transparent project selection, and alignment with national priorities. It is essential to ensure that public funds are used strategically to crowd in—not crowd out—private investment.

Despite its utility, the VGF scheme faces several challenges. A few of these, along with a few suggestions/ possible actionable, are listed below:

Challenges and Credit Risks	Actionable
▪ Sectoral concentration in transport and energy limits diversification and exposes the scheme to cyclical risks.	▪ Expand sectoral scope to include social infrastructure such as healthcare, education, and water management.
▪ Over reliance on government grant/subsidy adversely impacts project's financial viability and sustainability.	▪ Integrate performance-based funding to align incentives and improve fund utilisation.
▪ Inadequate monitoring can lead to inefficiencies and moral hazard, where private entities rely excessively on subsidies without optimizing operational efficiency. This poses latent credit risks for lenders dependent on timely project completion and revenue generation.	▪ Leverage technology for governance—AI-driven monitoring, real-time fund tracking, and transparent disclosures can enhance accountability and creditworthiness.
▪ Procedural delays can impair project timelines and increase cost overruns, weakening creditworthiness.	▪ Streamline approval processes (through single-window clearances) and digital platforms to reduce delays and improve investor confidence.

Blended finance and VGF have proven effective in unlocking private capital for infrastructure development in India. Their continued relevance will depend on the ability to evolve in response to changing infrastructure needs, fiscal realities, and investor expectations. By addressing implementation challenges and adopting global best practices, India can position these instruments as foundational pillars of a sustainable and inclusive infrastructure financing strategy.

Enhancing PPP frameworks and risk-sharing mechanisms

Public-private partnerships have long been a preferred model for infrastructure delivery in India. However, their success hinges on well-designed contracts, balanced risk allocation, and institutional capacity. India has made significant progress in developing PPP frameworks, including:

- Model concession agreements for highways, airports, and urban infrastructure
- Online portals for project monitoring and stakeholder engagement
- Dedicated PPP cells at Central and state levels

Despite these advancements, challenges persist. Many PPP projects face delays due to land acquisition issues, regulatory bottlenecks, and disputes over revenue-sharing. Risk allocation often remains skewed, with private partners bearing disproportionate construction and demand risks. To enhance PPP effectiveness, the following measures are recommended:

- Dynamic risk-sharing models that adjust based on project lifecycle and performance
- Capacity building for Government agencies to manage complex contracts and negotiations
- Dispute resolution mechanisms such as fast-track arbitration and independent regulators
- Lifecycle cost analysis to ensure sustainability beyond construction

Innovative PPP structures such as Hybrid Annuity Models (HAM) in road projects and Design-Build-Finance-Operate (DBFO) models in urban transport have shown promise. These models combine annuity payments with performance-linked incentives, reducing revenue risk and improving service delivery. Furthermore, integrating ESG criteria into PPP frameworks can enhance project resilience and attract sustainability-focused investors.

Attracting long-term capital: Pension funds, sovereign wealth funds, insurance

Infrastructure assets are inherently long-term, making them well-suited for institutional investors such as pension funds, sovereign wealth funds (SWFs), and insurance companies. These entities seek stable, inflation-linked returns and have the capacity to invest in large-scale projects.

Globally, institutional investors manage over $100 trillion[15] in assets, yet only a small fraction is allocated to infrastructure in emerging markets. In India, the potential is significant but underutilised. Regulatory constraints, lack of investment-grade projects, and limited exit options have hindered participation. However, recent reforms aim to address these barriers:

- InvITs and REITs offer transparent, liquid vehicles for institutional investment
- Relaxation of investment norms by the Insurance Regulatory and Development Authority of India (IRDAI) and Pension Fund Regulatory and Development Authority (PFRDA) allows greater exposure to infrastructure
- Credit enhancement mechanisms such as partial guarantees and first-loss structures improve project ratings and investor confidence

Sovereign wealth funds from countries like Singapore and Canada have already invested in Indian infrastructure through platforms such as the National Investment and Infrastructure Fund (NIIF). NIIF operates as a collaborative investment vehicle, pooling capital from domestic and international sources to finance roads, ports, and renewable energy. It manages over $ 4.9 billion (Rs. 432.5 billion) in assets across three funds—Master Fund, Fund of Funds, and Strategic Opportunities Fund. Its role as a sovereign-backed anchor investor enhances credibility and helps bridge India's infrastructure financing gap.

To further attract long-term capital, India must:

- Develop a pipeline of bankable projects with clear revenue models and regulatory clarity
- Strengthen secondary markets for infrastructure assets to improve liquidity
- Promote ESG-aligned investment frameworks to meet global sustainability mandates

Institutional investors also require robust governance, predictable policy environments, and transparent reporting standards. Building trust and reducing perceived risks are critical to unlocking their full potential.

[15] *PwC. (2023). Global Asset & Wealth Management Survey. Retrieved from PwC Website*

Policy and Regulatory Enablers

India's infrastructure financing landscape has evolved significantly over the past decade, supported by reforms in land acquisition, dispute resolution, and institutional strengthening. Initiatives like NIP, Gati Shakti, and NIDB have laid the foundation for a more coordinated and investor-friendly ecosystem. However, persistent challenges in regulatory consistency, institutional capacity, and data transparency need constant addressing to unlock the full potential of private capital. A forward-looking strategy should focus on simplifying legal frameworks, enhancing digital governance, and fostering collaboration between public and private stakeholders. With sustained policy momentum and targeted reforms, India can position itself as a global leader in infrastructure-led development.

Reforms in land acquisition, dispute resolution, and contract enforcement

Land acquisition has historically been one of the most contentious and delay-prone aspects of infrastructure development in India. The enactment of the Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act (2013) marked a significant step toward balancing development needs with social justice. More recently, the NHAI implemented a 336-day structured timeline for land acquisition, supported by the digital 'Bhoomi Rashi' portal. This framework includes weekly monitoring, fixed deadlines for objections, and centralised compensation disbursement, significantly reducing delays and improving transparency. However, implementation challenges persist, particularly in multi-state projects and urban corridors. Recent RBI guidelines for project finance (June 2025) now mandate that land acquisition must be completed for at least 75% of non-PPP projects and 50% of PPP projects before financial closure, aiming to reduce execution risk and improve credit viability.

Dispute resolution remains another critical bottleneck. Infrastructure projects often suffer from prolonged litigation, leading to cost overruns and investor hesitation. The Government has promoted fast-track arbitration, model concession agreements, and independent regulators to streamline resolution. Yet, enforcement of arbitral awards and consistency in judicial interpretation remain areas needing reform.

Contract enforcement reforms are critical to ensuring that infrastructure agreements-especially under PPP models are resilient and adaptable. Outdated concession agreements have been identified as a major cause of delays and cost overruns. Contract enforcement is further complicated by frequent policy changes, such as retrospective tax amendments or delays in GST reimbursements, which erode investor confidence. To address these issues, policy measures have/must focus on:

- Reducing approval timelines through single-window clearances
- Shifting responsibility for regulatory permits from concessionaires to Government agencies in PPPs
- Ensuring consistency in legal frameworks and honouring contractual obligations under force majeure and change-in-law clauses

Strengthening institutional frameworks

India has made notable progress in institutionalizing infrastructure planning and financing. The NIP, launched in 2019, outlined a nearly $1.5 trillion investment roadmap (initially) across sectors such as transport, energy, and urban development. As of August 2025, over 1,139 projects were under various stages of implementation under NIP of the 13,984 projects approved. Complementing NIP is the PM Gati Shakti Master Plan, a digital platform integrating 16 ministries and 36 states/union territories (UTs) to enable multimodal connectivity, improve coordination and reduce project delays. By October 2024[16] , over 1,600 data layers and 208 big-ticket projects worth Rs. 15.39 trillion had been mapped under Gati Shakti principles. The platform's spatial planning tools, powered by Indian Space Research Organisation (ISRO) imagery and enables real-time tracking of assets, logistics corridors, and utility networks, thereby enhancing planning efficiency and reducing duplication.

The NMP and NIIF have further expanded the financing toolkit. NMP aims to unlock value from existing public assets, while NIIF serves as a collaborative investment platform involving global investors and multilateral institutions. Additionally, the establishment of NIDB in 2021 has filled a critical gap in long-term project financing. NIDB is mandated to provide debt and equity support for commercially viable infrastructure projects, especially those with long gestation periods.

Challenges	Focus Areas
▪ Deficiencies in unified planning/execution across Central and state agencies leads to coordination issues	▪ Enhancing inter-agency coordination through integrated planning platforms
▪ Limited bandwidth in urban local bodies and state infrastructure agencies affect project preparation and execution	▪ Building capacity at sub-national levels for project appraisal and monitoring
▪ Overlapping mandates between regulators (e.g., NHAI, NGT etc) can create procedural delays	

Role of digital platforms and data transparency

Digitalisation has emerged as a powerful enabler of infrastructure financing. Platforms like PM Gati Shakti and INFRACON (for contractor and consultant registration) have improved transparency and accountability. The use of geographic information systems (GIS) mapping, real-time dashboards, and AI-based analytics allows for better project tracking and risk assessment. The establishment of Data Benchmarking Institutes (DBIs) for Infrastructure Investment Trusts (InvITs), as proposed by SEBI and the Bharat InvIT Association, is a game-changing initiative. These institutes will collect and standardise data on financial performance, operational metrics, and risk parameters, allowing investors to compare InvITs and make informed decisions. This level of transparency fosters market discipline, improves credit ratings, and facilitates efficient capital allocation. Moreover, digital platforms facilitate investor access to project pipelines, concession agreements, and performance benchmarks. This reduces information asymmetry and enhances investor confidence.

[16] *PwC. (2023). Global Asset & Wealth Management Survey. Retrieved from PwC Website*

The RBI's Project Finance Directions (2025) emphasise the importance of data transparency in credit appraisal. Lenders are now required to assess project viability based on standardised metrics, including debt-equity ratios, cash flow forecasts, and milestone-linked disbursements. However, challenges persist in data standardisation, interoperability between platforms, and cybersecurity risks. Actionable areas include:

- Expanding digital platforms to include ESG metrics and climate risk assessments
- Ensuring interoperability between Central and state-level databases
- Strengthening data governance and cybersecurity protocols

ESG-related initiatives relating to infra financing

ESG principles are increasingly becoming central to investment strategies in India. As the country targets net-zero emissions by 2070, ESG-aligned finance is emerging as a key enabler of sustainable development, particularly in sectors like energy, transport, and urban infrastructure.

By the end of 2024 , India had issued $55.9 billion in green, social, sustainability, and sustainability-linked (GSS+) debt—an increase of 186% since 2021. Green debt comprises 83% of this total, mainly funding clean energy and transport. Sovereign green bonds worth Rs. 477 billion have helped set benchmarks and boost investor confidence. Innovative platforms like Green NBFCs and AIFs are emerging to serve underserved segments such as small and medium enterprises (SMEs) and retail investors. Venture debt and private credit are increasingly used to fund early-stage climate tech firms, especially in electric vehicles (EVs), clean energy, and circular economy sectors.

India's regulatory landscape is also evolving rapidly. SEBI's Business Responsibility and Sustainability Report (BRSR) mandates ESG disclosures for the top 1,000 listed companies. The RBI has introduced a Green Deposit Framework, encouraging banks and NBFCs to offer ESG-linked savings products. Additionally, India launched its first Sovereign Green Bonds in 2023, aligned with ICMA Green Bond Principles, covering nine categories including climate mitigation, biodiversity conservation, and green buildings. India's Union Budget 2025 marked a significant shift toward ESG-aligned infrastructure investment. Key announcements included expanded funding for renewable energy, green hydrogen, and sustainable transport, alongside the introduction of tax incentives for ESG-compliant businesses. The budget also reinforced the role of sovereign green bonds, which are now a core instrument for financing climate-aligned infrastructure projects.

There has been an increased participation by Indian corporates and financial institutions in driving ESG-aligned investments. Innovative platforms like Green NBFCs and AIFs are emerging to serve underserved segments such as small and medium enterprises (SMEs) and retail investors. Venture debt and private credit are increasingly used to fund early-stage climate tech firms, especially in electric vehicles (EVs), clean energy, and circular economy sectors.

Despite progress, challenges persist. Many climate projects face bankability issues, with uncertain cash flows and long payback periods. Policy uncertainty and limited ESG literacy among investors and employees also hinder broader adoption. Addressing these gaps through third-party assessments, ESG education, and cross-sector collaboration remain crucial.

[17] https://www.sebi.gov.in/statistics/greenbonds.html

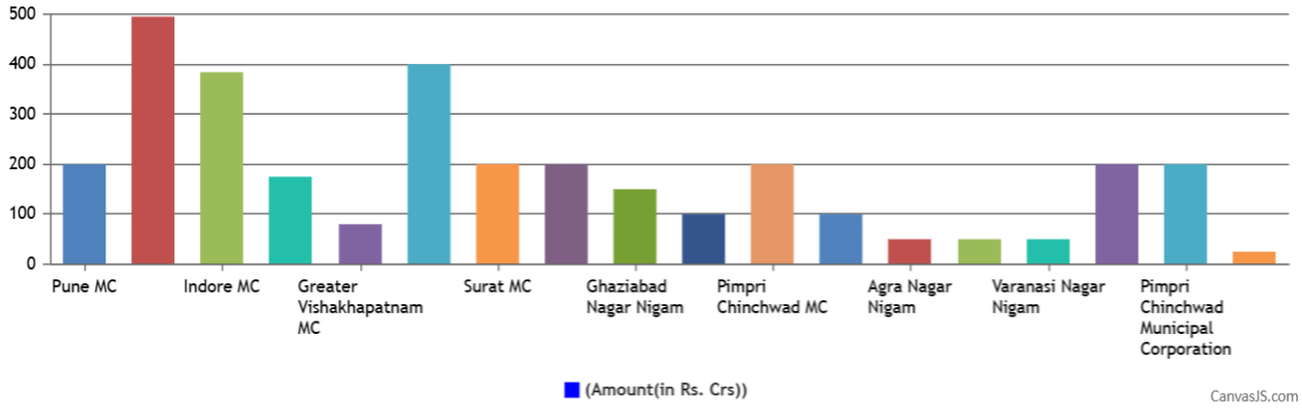
Innovative Financing Mechanisms

Municipal bonds and pooled financing

India's urban infrastructure faces a significant financing deficit, driven by rapid urbanisation, limited fiscal capacity of ULBs, and constrained access to long-term capital. Municipal bonds and pooled financing mechanisms offer promising solutions to bridge this gap by enabling cities to tap into capital markets and attract institutional investors. These instruments not only diversify funding sources but also introduce market discipline and transparency into urban infrastructure development.

Municipal bonds are debt securities issued by ULBs to finance infrastructure projects such as water supply, sanitation, roads, and public transport. Globally, municipal bonds are a cornerstone of urban finance-especially in the US, where they account for over $4 trillion[18] in outstanding debt. In India, the market is growing steadily. Since Ahmedabad's pioneering issuance in 1998, cities like Pune, Indore, and Hyderabad have successfully raised funds through municipal bonds. Indore, for instance, issued Rs. 2.44 billion in 2023, backed by ring-fenced revenue from water user charges and property tax collections

Exhibit: Municipal bonds outstanding as on July 31, 2025



Source: SEBI, as of May 31, 2025

From a credit perspective, municipal bonds face unique challenges. Many ULBs lack robust revenue streams, professional financial management, and credit histories, making it difficult to secure investment-grade ratings. However, credit enhancement mechanisms-such as escrow accounts, state guarantees, and structured repayments-can significantly improve the credit profile of municipal issuances. SEBI has played a pivotal role by introducing the Municipal Debt Securities Regulations in 2015, mandating credit ratings, audited financials, and project-specific disclosures.

[18] https://www.sifma.org/resources/research/statistics/us-municipal-bonds-statistics/

Pooled financing offers an alternative model for smaller municipalities that lack the scale or creditworthiness to issue bonds independently. Under this approach, multiple ULBs aggregate their borrowing needs into a single issuance, backed by a common fund and credit enhancements. The Tamil Nadu Urban Development Fund (TNUDF) and the Karnataka Water and Sanitation Pooled Fund (KWSPF) are pioneering examples. KWSPF, managed by KUIDFC, has mobilised over Rs. 40 billion[19] for urban infrastructure projects across Karnataka, supporting water supply, sanitation, and urban transport initiatives.

From a credit standpoint, pooled financing mitigates individual city risk through portfolio diversification and centralized governance. It also enables the use of blended finance-where concessional capital from multilateral agencies is layered with commercial debt-to improve affordability and sustainability. The KfW-assisted Sustainable Municipal Infrastructure Financing Program in Tamil Nadu, for example, combines loans and grants to support urban infrastructure.

To scale municipal bonds and pooled financing, several steps could be taken. First, ULBs need to strengthen their financial management systems, including revenue forecasting, expenditure control, and asset monetization. Second, state governments must play a proactive role in providing guarantees, technical assistance, and regulatory support. Additionally, integrating ESG criteria into municipal bond frameworks can attract sustainability-focused investors. Green municipal bonds-used to finance climate-resilient infrastructure-are gaining traction globally and could be adapted to India's smart city and clean energy initiatives. International examples, such as Johannesburg's green bond and San Francisco's climate bonds, offer valuable lessons in structuring, disclosure, and impact measurement.

Asset monetisation and recycling strategies

Asset monetisation and recycling have emerged as pragmatic strategies for governments to mobilise infrastructure financing without expanding fiscal deficits. These approaches involve transferring operational rights of revenue-generating public assets—typically brownfield—to private entities for a defined period. The proceeds are reinvested into new infrastructure, creating a cycle of capital regeneration and improved service delivery.

Globally, asset recycling has gained traction. Australia's program, which offered matching grants to states for monetizing assets, resulted in over US$15 billion in recycled capital. These funds were reinvested into public transport and energy infrastructure. The World Bank and Global Infrastructure Facility have endorsed asset recycling as a sustainable financing model, particularly for emerging economies with limited fiscal space. India's flagship initiative in this domain is the NMP, launched in 2021, targeting Rs. 6 trillion in monetisation value over FY2022–FY2025 (NMP 1.0).

Covering sectors such as roads, railways, power, telecom, and aviation, the NMP is built on the principle of "Creation through Monetisation". It aims to unlock value from underutilised assets while leveraging private sector efficiencies in operations and maintenance.

The road sector has demonstrated early success. The Toll-Operate-Transfer (ToT) model and InvITs adopted by the NHAI have monetised operational highway stretches, attracting institutional investors. For example, NHAI's has so far raised over Rs. 926 billion (FY2019-FY2025) through InVIT and TOT monetisation from domestic and global investors, including pension funds and insurance companies. These structures offer upfront payments or periodic returns to the Government while transferring operational responsibilities to private concessionaires. Backed by traffic data, escrowing mechanisms, and performance-linked contracts, these models enhance credit quality and investor confidence.

From a credit perspective, monetized brownfield assets are attractive due to their established revenue streams and lower construction risk. They appeal to long-term investors such as sovereign wealth funds and pension funds seeking stable returns. Asset recycling also reduces reliance on debt financing and improves fiscal sustainability. However, implementation challenges persist. Public resistance, especially when assets are perceived as strategic or socially sensitive, can delay transactions. Valuation complexities and lack of standardized frameworks may lead to suboptimal pricing. Regulatory clarity and institutional capacity are essential to ensure transparent bidding, enforceable contracts, and post-transfer monitoring.

To address these issues, adoption of robust governance frameworks, including clear asset selection criteria, transparent transaction structures, and performance-linked contracts is imperative. Blended finance—combining public guarantees with private capital—can further enhance credit profiles and attract global investors.

Use of fintech and tokenization in infrastructure finance

Fintech and tokenisation are increasingly recognised as strategic instruments in advancing infrastructure finance, particularly in emerging markets like India. These technologies are facilitating more efficient capital mobilisation, improving credit assessment, and expanding investor participation across asset classes.

Fintech platforms are being deployed to enhance transparency and operational efficiency in infrastructure projects. Real-time monitoring tools, automated disbursement systems, and predictive analytics are now integrated into project finance workflows. For instance, smart contracts are being used to trigger payments upon verified completion of construction milestones, thereby reducing execution delays and mitigating corruption risks. Platforms such as Yubi and CredAvenue have enabled infrastructure debt syndication and supply chain financing, improving access to capital for mid-sized developers. Additionally, digital marketplaces are emerging where infrastructure projects can be listed, rated, and funded by institutional and retail investors, thereby broadening the investor base and lowering transaction costs.

Tokenisation further extends these capabilities by enabling fractional ownership of infrastructure assets through blockchain-based digital tokens. This model allows investors to acquire units representing a share in future cash flows or asset value from projects such as solar parks, toll roads, or smart grids. Tokenized assets offer enhanced traceability, enforceability, and liquidity, particularly through secondary market trading.

[19] https://kuidfc.com/EN/Fund_management.php

These features are increasingly appealing to institutional investors seeking transparency and risk-adjusted returns. Internationally, jurisdictions like Singapore have successfully piloted tokenized green bonds and infrastructure REITs. In India, regulatory bodies such as SEBI and International Financial Services Centres Authority (IFSCA) have initiated frameworks for fractional ownership and tokenised investment vehicles, with GIFT City emerging as a hub for digital asset innovation.

Despite the potential, several challenges remain. Regulatory ambiguity, cybersecurity vulnerabilities, and the absence of standardised legal frameworks continue to impede adoption. Credit rating agencies have yet to fully integrate blockchain-based performance data into their methodologies, and interoperability between digital platforms and traditional financial systems remains limited.

To scale these innovations, India must establish clear legal recognition of digital asset ownership and smart contract enforceability. Public-private partnerships should incorporate tokenised structures to attract diversified capital, and blended finance models combining concessional funding with tokenized instruments can help de-risk early-stage projects.

Fintech and tokenisation represent more than technological evolution—they are foundational to building a scalable, inclusive, and transparent infrastructure financing ecosystem. With appropriate regulatory support and institutional engagement, these models can significantly contribute to closing India's infrastructure investment gap.

Green bonds and sustainability-linked instruments

India is rapidly advancing its sustainable finance ecosystem, with green bonds and sustainability-linked instruments emerging as key tools to mobilise capital for climate-resilient infrastructure. These instruments are increasingly aligned with global standards and are supported by evolving regulatory frameworks, making them attractive to institutional investors seeking ESG-compliant assets.

The issuance of India's first sovereign green bonds in 2023 marked a significant milestone, raising over Rs. 80 billion for clean energy, public transport, and water conservation projects. These bonds adhered to the International Capital Market Association's Green Bond Principles and were backed by third-party verification, enhancing transparency and investor confidence. By the end of 2024 , India had issued $55.9 billion in green, social, sustainability, and sustainability-linked (GSS+) debt—an increase of 186% since 2021. Green debt comprises 83% of this total, mainly funding clean energy and transport. As of July 2025, outstanding green bonds stood at over Rs. 76.5 billion (about $920 million), with major issuers including L&T Infrastructure Finance Company Ltd, Larsen & Toubro Limited, Mindspace Business Parks REIT, DME Development Limited and municipal corporations like Ahmedabad Municipal Corporation, Pimpri Chinchwad Municipal Corporation, among others.

To further strengthen the market, SEBI introduced a comprehensive ESG Debt Securities Framework in June 2025. This framework expands beyond green bonds to include social bonds, sustainability bonds, and sustainability-linked bonds (SLBs). It mandates rigorous pre-issuance disclosures, third-party verification, and annual impact reporting. Issuers must classify bonds based on their primary sustainability objective and disclose fund utilisation, project eligibility, and performance metrics. SLBs, in particular, link financial terms to ESG performance targets, such as emission reductions or renewable energy adoption.

Despite progress, India's green bond penetration remains modest. Emerging markets account for less than 10% of global green bond issuance, and India's share is constrained by limited capital market depth, inconsistent post-issuance reporting, and concerns over greenwashing.

SEBI's new framework addresses these issues by enforcing independent reviews and enabling investor recourse in cases of misalignment or misuse of proceeds.

To scale adoption, India needs to harmonise ESG taxonomies, integrate ESG metrics into credit rating methodologies, and promote blended finance models. Combining concessional capital with green or sustainability-linked instruments can de-risk early-stage projects and attract long-term institutional investment.

In conclusion, green bonds and sustainability-linked instruments are no longer niche products—they are strategic enablers of India's infrastructure and climate goals. With robust regulatory support, growing issuer participation, and alignment with global standards, these instruments are poised to play a central role in financing inclusive and resilient development.

Conclusion

India's aspiration to become a developed economy by 2047 hinges on its ability to build resilient, inclusive, and future-ready infrastructure. With cumulative investment needs estimated at over $7.5 trillion across transport, energy, urban infra development, among others the challenge is not only financial but also institutional and strategic.

The evolving financing landscape reflects a shift from traditional public funding to diversified capital sources. Instruments such as InvITs, green bonds, blended finance, and long-tenure debt are increasingly central to mobilizing private and institutional capital. Institutions like NIDB play a catalytic role in de-risking projects, building bankable pipelines, and crowding in foreign investment. However, unlocking this potential requires more than capital. It demands robust governance, streamlined regulatory frameworks, and enhanced institutional capacity. Reforms in land acquisition, dispute resolution, and contract enforcement must continue to reduce execution risks. Digital platforms and ESG-aligned instruments are improving transparency and aligning infrastructure with sustainability goals.

Strategic planning, fiscal prudence, and collaborative action across government, private sector, and civil society will be essential. By embracing innovation, strengthening institutions, and fostering inclusive growth, India can build an infrastructure ecosystem that supports economic expansion, enhances quality of life, and ensures environmental resilience.

The path to Viksit Bharat is complex but achievable. With sustained momentum and coordinated execution, India is well-positioned to transform its infrastructure landscape and realize its long-term development vision.

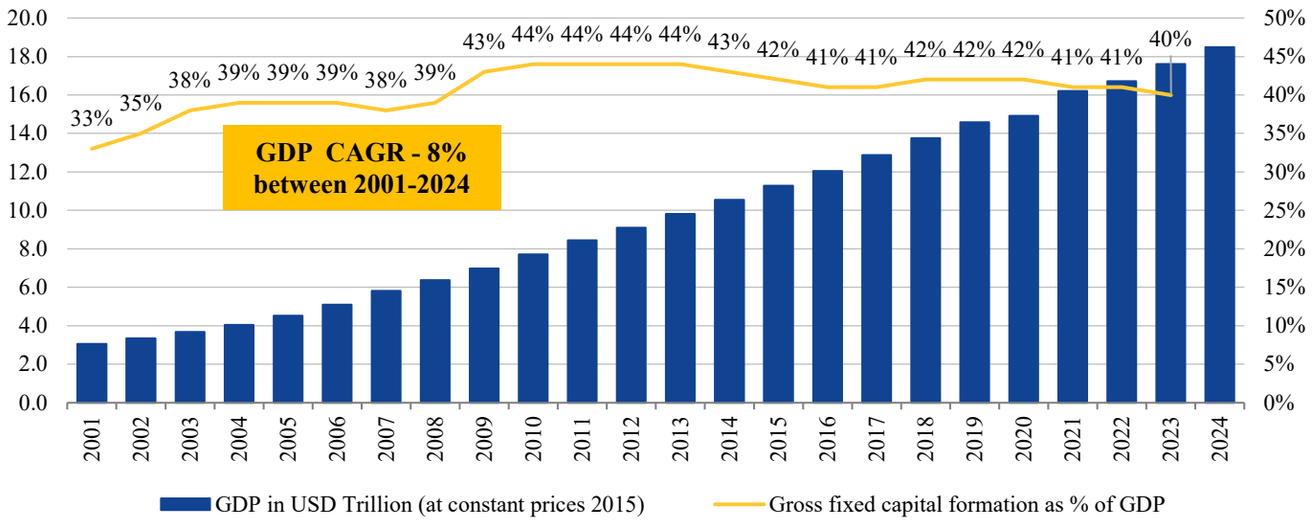
Learning from Global Best Practices

Chinese Experience

Learnings: Scale, speed, and strategic alignment in infrastructure development

Between 2001 and 2024, China's GDP growth was marked by a sustained upward trajectory, underpinned by a deliberate and large-scale investment strategy in infrastructure. A key indicator of this approach was the persistently high levels of Gross Fixed Capital Formation (GFCF), which often exceeded 40% of GDP—significantly above global averages. This reflects a policy bias toward capital-intensive development, particularly in transport, energy, and urban infrastructure. The Chinese government leveraged infrastructure investment not only as a growth stimulant but also as a structural enabler of industrial expansion and urbanisation. During periods of global economic stress, such as the 2008 financial crisis, China intensified its GFCF to buffer external shocks, demonstrating its use as a counter-cyclical tool. Over time, this investment-led model facilitated productivity gains, improved regional connectivity, and laid the groundwork for transitioning toward a more consumption- and innovation-driven economy.

Exhibit: China's GDP growth and GFCF trend



Source: World Bank

India can draw several valuable lessons from China's infrastructure-led development model, which has played a pivotal role in transforming China into the world's second-largest economy. While the contexts of the two countries differ, China's experience offers insights into how strategic infrastructure investment can accelerate growth, improve connectivity, and enhance global competitiveness.

Exhibit: Few learnings from China's infrastructure-led development experience

	What China Did	Learning for India
Centralised long-term planning with local execution	Through successive Five-Year Plans, China has aligned infrastructure development with broader economic goals, ensuring consistency and scale. Also, its approach has been top-down - planning led by the central government with strong coordination across ministries and provinces.	India can benefit from adopting a similarly integrated planning framework, where infrastructure priorities are closely tied to industrial policy, regional development, and sustainability targets. The PM Gati Shakti initiative is a step in this direction, but further institutional strengthening and inter-agency coordination will be key to replicating China's execution efficiency.
Emphasis on logistics infrastructure	China's emphasis on logistics infrastructure—high-speed rail, expressways, ports, and airports—has significantly reduced transportation costs and improved supply chain efficiency. This has enabled the rapid growth of manufacturing hubs and export-oriented industries.	India, while making progress through Bharatmala, Sagarmala, and DFCs, still faces high logistics costs and fragmented connectivity. Accelerating multi-modal integration and investing in last-mile infrastructure can help India unlock similar productivity gains.
Diverse financing instruments	China has leveraged state-owned banks, local government financing vehicles (municipal bonds), and public-private partnerships to mobilise massive capital for infrastructure. Pitfall: High local government debt (over 280% debt-to-GDP by 2023).	India must deepen its municipal bond market, innovate in financing—through InvITs, green bonds, and blended finance models—to attract private and institutional capital. Establishing a dedicated infrastructure development bank like NIBD could also help channel long-term funding into strategic projects. India must ensure fiscal prudence (in Government debt), transparent project appraisals, and sustainable debt servicing.
Urban governance	Urbanisation in China has been supported by proactive infrastructure development, including mass transit systems, affordable housing, and smart city planning. This enabled the creation of economically vibrant urban clusters	India's urban growth, by contrast, has often been unplanned and under-serviced. Strengthening urban governance, empowering local bodies, and investing in transit-oriented development can help India manage its urban transition more effectively.
Prioritising lagging regions	China's use of infrastructure as a tool for regional development is also instructive. By investing in lagging regions and connecting them to economic centres, China has reduced regional disparities.	India can adopt a similar approach by prioritizing infrastructure in underdeveloped states and border areas, thereby fostering inclusive growth and national integration.
Global infrastructure outreach	China's global infrastructure outreach through the Belt and Road Initiative (BRI) enhanced its geopolitical influence and trade connectivity.	While India has taken a more cautious stance, it can still pursue strategic infrastructure diplomacy—through regional connectivity projects, energy corridors, and digital infrastructure partnerships—to strengthen its position in South Asia and beyond.

Source: ICRA's analysis

In summary, India can learn from China's By adapting these lessons to its democratic and federal context, India can build a resilient, inclusive, and globally competitive infrastructure ecosystem that supports the vision of Viksit Bharat 2047.

Case Study: Urban Infrastructure Financing in Shanghai

Shanghai, China's largest city and financial hub, has undergone rapid urban transformation since the 1990s. Its infrastructure development—spanning metro systems, highways, water treatment, and green spaces—has been financed through a mix of conventional and innovative mechanisms.

Key Steps Taken

1. Diversified Financing Channels

- **Municipal Bonds:** Shanghai was among the first cities to issue local government bonds after the 2014 reform that legalized direct municipal borrowing.
- **Public-Private Partnerships:** Used extensively in metro expansion, waste management, and smart city projects. Private firms co-invested and operated services under government oversight
- **Land Sales:** The city monetized land-use rights, especially in Pudong, to fund infrastructure and attract foreign investment.

2. Institutional Reforms

- **Decentralised Fiscal Authority:** Shanghai's municipal government gained autonomy over budgeting and resource allocation, allowing tailored infrastructure planning.
- **Special Purpose Vehicles:** Created to manage large-scale projects like the Shanghai Metro and the Yangshan Deep-Water Port, separating financial risk from core government operations.

3. Green Finance Initiatives

- **Green Bonds:** Shanghai pioneered green bond issuance to fund low-carbon infrastructure, including energy-efficient buildings and electric transit.
- **Environmental Thresholds:** Projects funded by special-purpose bonds were required to meet sustainability criteria, aligning with China's carbon neutrality goals.

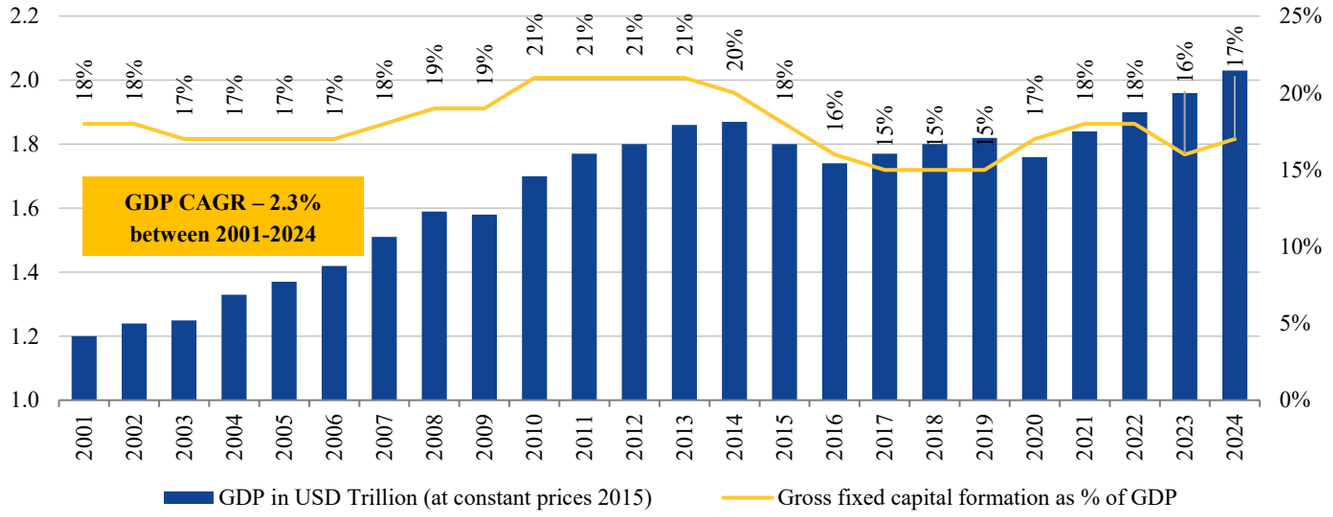
4. Impact

Advantages	Challenges
• **World-Class Infrastructure:** Shanghai now boasts one of the world's largest metro systems, advanced logistics hubs, and high-quality public services. • **Economic Growth:** Infrastructure investment catalysed real estate, finance, and tech sectors, making Shanghai a global city. • **Sustainability Leadership:** Green finance and planning reforms positioned Shanghai as a model for low-carbon urban development.	• **Debt Management:** Despite reforms, off-budget liabilities from SPVs and LGFVs remain a concern. • **Equity Issues:** Rapid development led to gentrification and uneven access to services in peripheral districts. • **Coordination Gaps:** Fragmented data-sharing and planning across agencies sometimes slowed project execution.

Brazilian Experience

Between 2001 and 2024, Brazil's GDP growth averaged approximately 2.3% (CAGR), with phases of strong expansion—particularly during the commodity boom years—interspersed with periods of slowdown. GFCF remained relatively stable, ranging between 16–20% of GDP, reflecting moderate investment intensity compared to peer emerging markets like China (~40%) and India (~30%).

Exhibit: Brazil's GDP growth and GFCF trend



Source: World Bank

Infrastructure development saw notable spikes around major global events such as the 2014 FIFA World Cup and 2016 Olympics, contributing to short-term increases in capital formation. However, long-term investment planning remained constrained by fiscal pressures and macroeconomic adjustments. Brazil's growth model during this period was largely supported by domestic consumption and commodity exports, which accounted for over 60% of total exports in several years. While infrastructure investment played a role in supporting growth, its scale and consistency were comparatively limited, influencing the pace of productivity gains and economic diversification.

Learnings from infra-financing in Brazil: PPP reform and capital market deepening

Despite the above, through innovative financing, decentralised PPP frameworks, and strategic use of development banks, Brazil has built strong infrastructure. Few of the steps taken and learnings for India are summarised below:

Exhibit: Learnings from Brazil's infrastructure financing experience

	What Brazil Did	Learning for India
PPP institutionalisation across Government levels	Brazil has developed a robust legal and institutional framework for PPP projects, applicable at federal, state, and municipal levels. Since the enactment of Law No. 11.079/2004, Brazil has become the largest PPP market in Latin America, with contracts spanning transport, sanitation, healthcare, and education.	India can learn from Brazil's decentralised yet standardised PPP model, enabling local governments to attract private capital while maintaining national oversight.
Development bank as catalyst	Brazil's BNDES (Brazilian Development Bank) played a pivotal role in infrastructure financing by offering long-term concessional loans, acting as a catalyst to crowd in private and foreign capital and supporting risk mitigation through guarantees and blended finance.	India's NIBD can have a similar catalytic role, especially in sectors like urban mobility, logistics, and green infrastructure.
Innovative Instruments and capital market integration to unlock private capital	Brazil has innovated with Mini-Perm loans, CePACs (Certificates of Additional Construction Potential) and project bonds and PPPs to reduce risk and attract private capital to fund long-term projects. These instruments helped recycle BNDES assets and broaden the investor base.	India can deepen its InvITs, REITs, and infra bonds market by offering similar incentives and regulatory clarity.
Risk Mitigation and Contract Standardization	Brazil has focused on mitigating currency and construction risks, standardising EPC contracts and insurance policies and introducing "Mini-Perm" loans to bridge short- and long-term financing.	India has already been adopting some of these tools/strategies (like standardised/ model concession agreements for PPP/EPC projects) to reduce project delays and improve bankability.
Sustainability and Inclusion	Brazil's recent infrastructure strategy emphasizes climate resilience, social inclusion, and productivity. BNDES has proposed (final review undertaken in Apr 2025) a $250-million green on-lending facility to support renewable energy and climate-resilient infrastructure.	India can align its infra push with SDGs, ensuring equitable access and environmental sustainability.

Source: ICRA's analysis

Case Study: Água Espraiada Urban Operation – São Paulo

Project Overview: The Água Espraiada Urban Operation in São Paulo is a transformative infrastructure and urban renewal initiative aimed at improving mobility, housing, and public spaces in a densely populated and economically strategic area.

Unique Financing Model: The project employed Certificates of Additional Construction Potential (CePACs), a pioneering land value capture instrument in Brazil.

- CePACs are tradable rights that allow developers to build beyond standard zoning limits.
- These certificates were auctioned publicly, generating substantial revenue without incurring public debt.
- Funds raised were earmarked for infrastructure improvements, including the iconic Estaiada Bridge, road expansions, and social housing.

Impact:

- Enabled large-scale urban transformation without relying on traditional taxes or loans.
- Integrated social housing provisions through legal tools like ZEIS (Zones of Special Social Interest).
- Balanced real estate development with community needs, although implementation faced challenges in delivering promised housing units.

Key Takeaway: This model demonstrated how land value capture can finance infrastructure sustainably while promoting inclusive urban development.

About National Bank for Financing Infrastructure and Development

National Bank for Financing Infrastructure and Development is a Development Financial Institution (DFI) established in April 2021. The institution is dedicated to accelerating the development of India's infrastructure ecosystem by addressing the long-term financing needs of the sector. The institution plays a pivotal role in driving the nation's economic growth and fostering sustainable development. It is committed towards its vision of becoming a strong provider of impact investment, catalysing infrastructure financing for the transformative growth of India.

The institution aims to be a key partner in helping India achieve its ambitious infrastructure development objectives – responsibly and sustainably. Additionally, the institution will work towards developing a deep and liquid market for bonds, loans, and derivatives for infrastructure financing.

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ICRA Limited (formerly Investment Information and Credit Rating Agency of India Limited) was set up in 1991 by leading financial/investment institutions, commercial banks and financial services companies as an independent and professional investment Information and Credit Rating Agency. Today, ICRA and its subsidiaries together form the ICRA Group of Companies (Group ICRA). ICRA is a Public Limited Company, with its shares listed on the Bombay Stock Exchange and the National Stock Exchange.

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