Crisil
Intelligence

Assessment of O&M in Telecom Towers in India and India's Construction Industry with Focus on Horizontal Directional Drilling Segment

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by S&P Global

Crisil Intelligence

Contents

1. Global and Indian macroeconomic overview 4

Global macroeconomic overview 4
India macroeconomic overview 9
Key growth drivers of India's economy 14
Digital Economy 17

2. Assessment of Telecom and Telecom Tower industry in India 23

2.1. Overview of Telecom industry in India 23
Key trends in telecom customers in India 25
Overview on outlook of wireless and wireline/broadband telecom customers in India 27
Subscriber market share of the key service providers in the India 28
Data users and consumption grew multi-fold over the past decade 28
Wireless internet penetration is projected to reach 80-81% of total population by fiscal 2031 29
Regulatory and network capex combined is projected to witness 2-2.5% growth from FY26 to FY31 32
India emerges as the second-largest global telecom market with over 1244 million mobile subscribers 33
State-wise telecom subscriber base highlights strong connectivity across both urban and rural India 34
Key emerging trends in the Indian telecom industry 35
Key growth drivers of the Indian telecom industry 37
Key reforms and regulatory actions in the Indian telecom industry 38
Key challenges and risks in the Indian telecom industry 39
2.2. Overview of telecom tower industry in India 41
Tower additions to moderate as the 5G rollout cycle matures 42
Industry tenancy ratio to improve on continued network investments 43
GBTs to dominate tower industry, despite a decrease in their share 44
Passive telecom infrastructure market is projected to be between ~Rs 2,000-2,100 billion between fiscals 2026-31 45
Active telecom infrastructure market is projected to be between ~Rs 3,500- 3,600 billion between fiscals 2026-31 46
Market of maintenance of telecom towers to rise on back of tower additions 47
Key success factors of the telecom tower O&M industry in India 48
SWOT analysis of the telecom tower O&M industry in India 48
Key government regulations 49
Capex to surpass Rs. 300 billion in FY27 51
Key growth drivers of the Indian telecom tower industry 53
Key challenges and risk factors 54

DRAFT

3. Assessment of Horizontal Directional Drilling (HDD) in India 56

3.1. Overview of structure of HDD industry in India 56
3.2. Key growth drivers of the industry 61
3.3. Key challenges and entry barriers in the industry 65

4. Overview of construction industry in India 68

4.1. Construction sector's share in overall GVA estimated to have risen further in fiscal 2026 68
4.2. India's gross fixed capital formation as % of GDP to have further improved in fiscal 2025 69
4.3. Private sector is a major contributor to GFCF 69
4.4. Investments in construction sector 70
4.5. Overview of Oil Refining & Marketing industry 75
4.6. Overview of solar power industry 79
4.7. Overview of Wastewater treatment landscape in India 90
4.8. Key growth drivers for construction industry in India 101
4.9. Government initiatives across infrastructure sectors 1
4.10. Key challenges faced by the construction industry in India and the role of consultancy services . 5

5. Peer benchmarking 2

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1. Global and Indian macroeconomic overview

Global macroeconomic overview

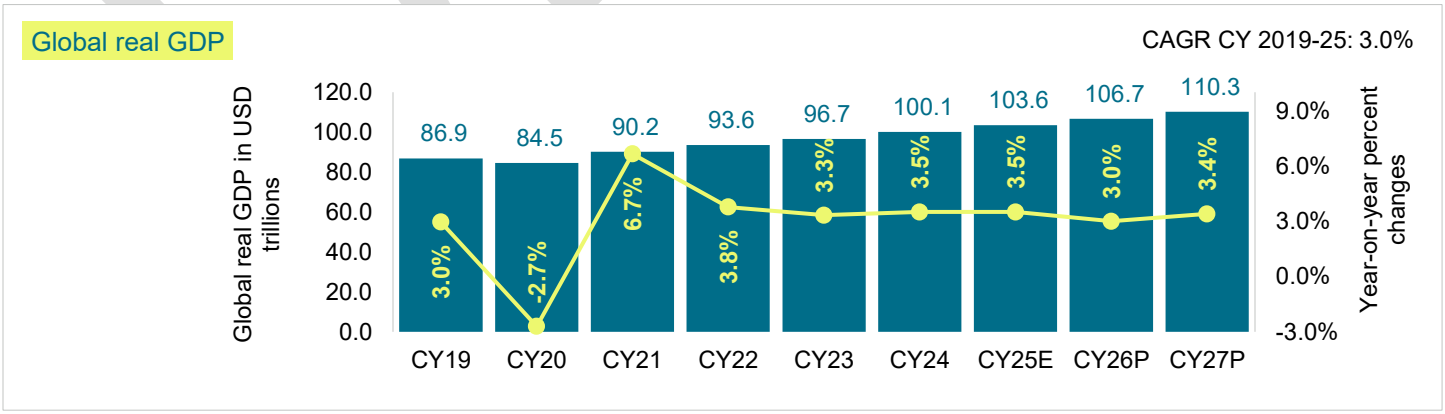
Global GDP to grow by 3.0% in CY2026 and 3.4% in CY2027

According to the *World Economic Outlook: July 2026 Update* published by the International Monetary Fund (IMF), the global economic environment is currently being influenced by two contrasting developments with varying implications across countries. On one hand, the ongoing conflict in the Middle East has created a negative supply-side shock, affecting commodity markets and trade flows. On the other hand, rapid advancements in artificial intelligence (AI) and its increasing adoption across industries have strengthened the global technology cycle, providing a positive impetus to economic activity. While the magnitude of these effects differs across economies, the IMF projects global GDP growth at 3.0% in CY2026, rising to 3.4% in CY2027. The improvement reflects the expected support from technology-driven investment and demand, which is anticipated to partly offset the adverse economic consequences of the Middle East conflict. Global headline inflation is forecast to rise to 4.7% in CY2026, before moderating to 3.9% in CY2027.

The IMF's projections are based on four key assumptions: (i) maritime trade through the Strait of Hormuz gradually resumes from mid-July, with conditions normalising and returning broadly to pre-conflict levels by March 2027; (ii) existing trade policy measures, including those initially introduced as temporary arrangements, remain in place throughout the forecast period; (iii) geopolitical tensions and policy-related uncertainty remain elevated through CY2027; and (iv) the momentum of the AI-led technology cycle moderates over time, with no additional exogenous boost to productivity growth.

Risks to the global outlook remains skewed to the downside. Potential upside factors include a faster-than-anticipated stabilisation of energy markets, stronger investment in technology and innovation, renewed international cooperation leading to lower trade barriers, and the implementation of structural reforms that enhance long-term growth prospects. Conversely, downside risks arise from the possibility of a resurgence or escalation of the Middle East conflict, which could prolong commodity price volatility, disrupt global supply chains, tighten financial conditions, intensify trade fragmentation, and place further pressure on inflation while dampening economic growth. In addition, a correction in the expectations surrounding technology-led growth could weaken investment sentiment and adversely affect economic activity.

Global real GDP trend (CY 2019-25) and outlook (CY2026-27)



Note: E: Estimated, P: Projection
Source: IMF, World Economic Outlook – July 2026 Update; Crisil Intelligence

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India is the fastest growing among the world's 10 largest economies

The IMF classifies 197 economies across the world into two broad categories: Advanced Economies and Emerging Market and Developing Economies. Notably, based on nominal GDP for CY2025, six of the world's ten largest economies belong to the former group, while four belong to the latter.

Key economic groups

Advanced Economies	
1	The United States
2	Japan
3	The United Kingdom
4	Canada
5	Euro area (21)
6	Other Advanced Economies (18)

Emerging Market and Developing Economies	
1	Emerging and Developing Asia
	China
	India
	Twenty-eight other economies
2	Emerging and Developing Europe (14)
3	Latin America and the Caribbean (33)
4	Middle East and Central Asia (32)
5	Sub-Saharan Africa (45)

Ten largest economies by nominal GDP (2025)	
1	The US
2	China
3	Germany
4	Japan
5	The UK
6	**India**
7	France
8	Italy
9	Russia
10	Brazil

Note: The numbers in bracket denote the number of economies included in the corresponding group.
Source: IMF's World Economic Outlook – July 2026 Update, Crisil Intelligence

Advanced Economies comprise 43 countries, including the US, Japan, the UK, Canada, and 21-euro area members. Growth for the group is projected at 1.7% in CY2026 and 1.8% in CY2027, although performance is expected to vary across economies. US GDP growth is projected at 2.3% in 2026 and 2.2% in CY2027, supported by fiscal stimulus, accommodative financial conditions, sustained technology-related investment, and productivity growth. As a net energy exporter, the US is expected to face only limited direct impacts from the war. On the other hand, growth in the euro area is expected to reach 0.9% in CY2026 and 1.2% in CY2027, reflecting a negative first-quarter carryover effect, persistent pressure from higher energy prices, and subdued consumer confidence, partly mitigated by fiscal support measures.

Emerging Market and Developing Economies, which account for 154 of the world's 197 economies, are projected to grow by 3.8% in CY2026 before rebounding to 4.5% in CY2027. Growth outcomes are expected to differ across countries, driven by variations in commodity exposure, geographic factors, remittance and tourism revenues, financial conditions, and participation in global technology value chains. Within this group, Emerging and Developing Asia is projected to expand by 5.0% in CY2026 and 4.8% in CY2027. China's growth is expected to slow to 4.6% in CY2026 due to higher oil

prices, persistent uncertainty, and structural economic challenges. Meanwhile, India is projected to grow by 6.4%, supported by resilient private consumption and strong services-sector performance.

Year-on-year real GDP growth, CY2019-27P

Economies	Year-on-year real GDP growth							IMF projections	
	CY2019	CY2020	CY2021	CY2022	CY2023	CY2024	CY2025	CY2026	CY2027
World	3.0%	-2.7%	6.7%	3.8%	3.3%	3.5%	3.5%	3.0%	3.4%
Advanced Economies	1.9%	-3.9%	6.1%	3.1%	1.7%	1.9%	1.9%	1.7%	1.8%
Emerging Market & Developing Economies	3.8%	-1.8%	7.0%	4.3%	4.4%	4.5%	4.5%	3.8%	4.5%
Emerging & Developing Asia	5.4%	-0.5%	7.8%	4.7%	5.6%	5.5%	5.6%	5.0%	4.8%
Emerging & Developing Europe	2.6%	-1.7%	7.2%	0.5%	3.6%	3.8%	2.0%	1.9%	2.1%
Latin America & the Caribbean	0.2%	-6.9%	7.5%	4.3%	2.3%	2.4%	2.4%	2.4%	2.7%
Middle East & Africa	2.1%	-2.2%	4.7%	6.4%	2.6%	3.1%	3.7%	0.7%	6.5%
Sub-Saharan Africa	3.0%	-3.1%	3.9%	4.4%	3.8%	4.2%	4.5%	4.3%	4.5%
US	2.6%	-2.1%	6.2%	2.5%	2.9%	2.8%	2.1%	2.3%	2.2%
China	6.1%	2.3%	8.6%	3.1%	5.4%	5.0%	5.0%	4.6%	4.1%
Germany	1.0%	-4.1%	3.9%	1.8%	-0.9%	-0.5%	0.2%	0.7%	1.0%
Japan	-0.3%	-4.3%	3.6%	1.3%	0.7%	-0.2%	1.1%	0.6%	0.7%
UK	1.3%	-10.0%	8.5%	5.1%	0.3%	1.0%	1.4%	1.0%	1.3%
India	3.9%	-5.8%	9.7%	7.6%	7.2%	7.1%	7.7%	6.4%	6.7%
France	2.1%	-7.6%	6.8%	2.8%	1.6%	1.4%	0.9%	0.6%	0.9%
Italy	0.4%	-8.9%	8.9%	4.8%	0.9%	0.8%	0.5%	0.5%	0.5%
Russia	2.2%	-2.7%	5.9%	-1.4%	4.1%	4.9%	1.0%	1.1%	1.1%
Brazil	1.2%	-3.3%	4.8%	3.0%	3.2%	3.4%	2.3%	2.4%	2.2%

Note: For India, data and projections are presented on a fiscal year basis, with FY 2024-25 (starting in April 2024) shown in the 2024 column
Source: IMF's World Economic Outlook – July 2026 Update, Crisil Intelligence

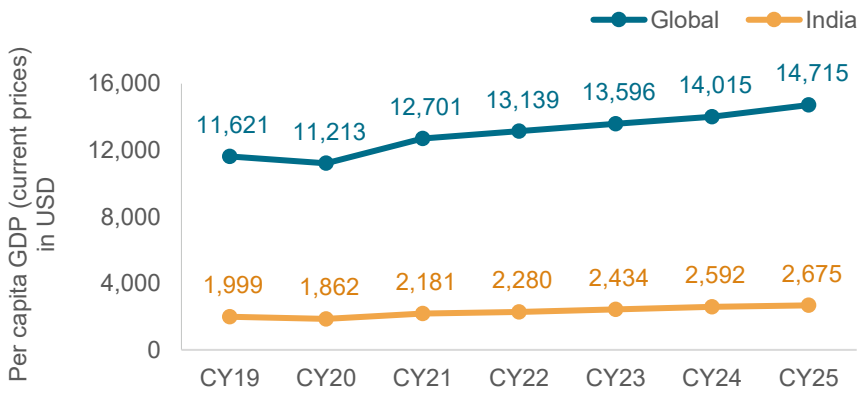
Per capita GDP growth of India outpaces that of the world

Based on nominal GDP in 2025, the world's ten largest economies are the United States, China, Germany, Japan, the United Kingdom, India, France, Russia, Brazil, and Italy. Among these economies, India has been the fastest-growing major economy since 2021. Between CY2019 and CY2025, India's per capita GDP at current prices increased at a CAGR of 5.0%, outpacing the global per capita GDP CAGR of 4.0% over the same period. However, India's per capita GDP at current prices was USD 2,675 in CY2025, compared with the global average of USD 14,715, highlighting the gap between aggregate economic size and individual income levels, thereby suggesting growth for further improvement.

Per capita GDP at current prices: India v. Global, CY 2019-25

Per capita GDP: Global v. India

Global GDP per capits, CAGR CY19-25: 4.0%
India's GDP per capita, CAGR CY19-25: 5.0%



Source: IMF; Crisil Intelligence

Anti-dumping and trade protection measures in key markets

Dumping is the practice of exporting goods to another country at prices lower than their normal value, which can unfairly harm domestic producers. Normal value generally refers to the price at which the goods are sold in the exporting country's domestic market. Countries often implement measures to counter dumping. However, in some cases, countries may adopt policies to protect domestic industries from imported goods or to level the playing field between domestic and foreign producers.

Measures adopted by key markets to prevent dumping and/or protect their domestic industries

Measures	
Anti-dumping duty or tariffs	• An import duty imposed on imported goods to prevent dumping in the domestic market. • In India, before an anti-dumping duty is imposed, the Directorate General of Trade Remedies (DGTR) under the Ministry of Commerce and Industry investigates to determine whether dumping has occurred and caused material injury to domestic producers. • **Example:** Following an investigation by DGTR, in April 2014, India imposed an anti-dumping duty of 57.39% on imports of cold rolled flat products of stainless steel from China. • **Key markets** that impose anti-dumping duty or tariffs include the US, the EU, Japan, South Korea, and India.

Measures	
Countervailing duty (CVD)	• An import duty imposed on imported goods when the manufacturers or exporters of those goods receive subsidies from their government. • Countervailing duties are intended to offset the benefit of such subsidies and protect domestic industries from unfair foreign competition. • **Example:** In September 2017, India imposed a CVD of 18.95% on imports of stainless-steel flat products from China for the next five years on account of the subsidies given by the government of China to its domestic steel manufacturers. • **Key markets** that impose CVD include the US, the EU, and India
Safeguard duty	• A temporary import duty imposed when the volume of imports increases to a level that causes or threatens to cause material injury to domestic producers. • Safeguard duties are intended to provide domestic industries with time to adjust to increased import competition. • **Example**, In April 2025, India imposed a 12.0% safeguard duty on the import of certain non-alloy and alloy steel flat products to protect domestic steel manufacturers from the adverse impact of surges in imports of those products. • **Key markets** that impose safeguard duty include the US, South Korea, and India.
Import quota	• A quantitative restriction that limits the volume of specific goods that may be imported into a country. • Import quotas may be imposed to protect domestic producers from injury caused by increased imports. • **Example**: In August 2017, India imposed import quotas for pulses (0.2 million MT for tur, ~0.2 million MT for each urad and moong) aimed at stabilising their prices in the domestic market to protect domestic farmers. • **Key markets** that impose import quotas include the US, the EU, China, India, and Japan.
Product standards	• Safety, quality, or technical requirements imposed on imported goods to prevent substandard products from entering the domestic market. • **Example:** In India, the Directorate of Revenue Intelligence (DRI) and Customs field formations maintain constant vigilance to prevent the import of substandard goods into the country. In FY25 (up to February 2025), they booked 206 cases involving the import of substandard goods in violation of Intellectual Property Rights (IPR), Bureau of Indian Standards (BIS), and Food Safety and Standards Authority of India (FSSAI) norms. • **Key markets** that impose product standards include the US, the EU, India, and Japan.
Import licensing	• A requirement under which importers must obtain authorization or a license from the government before importing certain goods into the country. • **Example:** In India, import license is required for importing several categories of drugs. • **Key markets** that implement import licensing include the US, the EU, China, and India.
Industry support	• Since cheaper imports can discourage domestic manufacturing, governments may implement policies to support domestic industries in competing with imports. • **Example:** In India, the government launched schemes like Semicon India Programme and Production Linked Incentive (PLI) Scheme to boost domestic industries. Semicon India Programme was launched to develop a domestic semiconductor manufacturing ecosystem aiming to reduce the country's reliance on imported semiconductors, whereas PLI was launched to support domestic manufacturing through targeted, performance-based incentives across strategic sectors. • **Key markets** that support their domestic industries in competing against imports include China, India, and South Korea.

Source: Crisil Intelligence

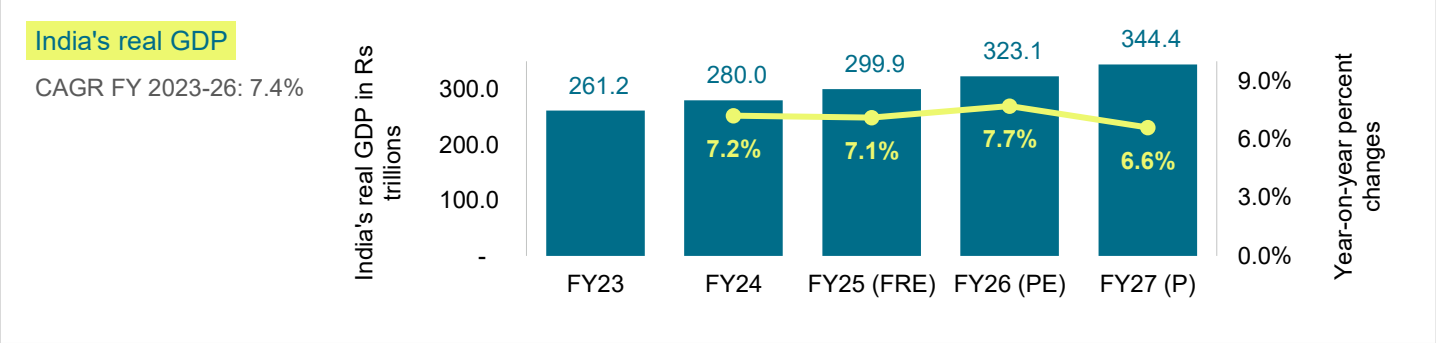
India macroeconomic overview

Crisil: India's GDP to grow by 6.6% in FY27

In February 2026, the Ministry of Statistics and Programme Implementation (MoSPI) released a new series of national accounts estimates with FY23 as the base year, as it represents a recent normal year following the COVID-19 pandemic. This revision was undertaken to capture the structural changes that have occurred in India's economy and to leverage the availability of comprehensive data across various sectors. Consequently, the new series not only improves estimation methodologies but also incorporates the latest data sources, thereby enhancing both the coverage and accuracy of the national accounts.

Under the new 2022–23 series, India's real GDP increased from Rs 261.2 trillion in FY23 to Rs 323.1 trillion in FY26, recording a CAGR of 7.4% during FY23–FY26. Furthermore, according to the Provisional Estimates (PE) released by the National Statistics Office (NSO), India's real GDP grew by 7.7% in FY26. The primary drivers of this growth were the secondary and tertiary sectors, which expanded by 8.8% and 9.3%, respectively. The Manufacturing; Trade, Repair, Hotels, Transport, Communication & Services Related to Broadcasting and Storage; and Financial, Real Estate & Professional Services sectors recorded double-digit growth at both constant and current prices in FY26.

India's real GDP (2022-23 series) trend and outlook, FY23-27P



Note: FRE: First Revised Estimates, PE: Provisional Estimates, P: Projection (based on Crisil's forecast)
Source: Ministry of Statistics & Programme Implementation (MoSPI), Crisil Intelligence

Crisil's initial forecast for FY27 considered three scenarios, under which the base-case scenario projected India's GDP growth at 7.1% in FY27. However, as the conflict in West Asia has persisted for more than two months, the downside risks to India's economy have begun to materialize. Accordingly, Crisil has outlined the following macroeconomic outlook for FY27.

Crisil's projection for India for FY27

Macroeconomic variables	Forecast for FY27
Real GDP growth	6.6%
CPI inflation	5.1%
10-year government security (G-sec) yield (March average)	7.0%
Current account balance (% of GDP)	-2.2%

Source: Crisil Intelligence

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Geopolitical and macroeconomic headwinds remain key monitorables for India's growth trajectory

India' growth trajectory is subject to several domestic and global risks that could moderate economic activity and delay infrastructure investments including geopolitical tensions, volatility in energy prices, dependence on key imported goods, etc. For example, India's economy has deep linkages with West Asia through trade, investment, and remittances. Approximately 45–50% of India's crude oil imports and 65% of its LNG imports originate from the region. For India, West Asia is a crucial supplier of petroleum products, fertilizers, and industrial raw materials. Conversely, India exports engineering goods, gems and jewellery, food products, chemicals, and construction materials to the region, which collectively account for around 13% of India's total merchandise exports. In addition, West Asia accounts for approximately 8% of India's total FDI inflows. The Gulf Cooperation Council (GCC) region also employs more than 9.3 million Indians, who together contribute nearly 38% of the total remittances received by India.

In addition to the direct impact of the ongoing conflict in West Asia, India is also being affected by global supply chain disruptions, rising freight and insurance costs, weakening global demand for exports, subnormal monsoon conditions driven by El Niño, and the manufacturing sector's high dependence on imported inputs.

Risks to India's economic growth and infrastructure investments

Risks	
Geopolitical tensions	India's economy, although primarily driven by domestic consumption, is closely integrated with global trade. Geopolitical conflicts and protectionist policies disrupt global supply chains and lead to economic uncertainty. These often lead investors to prioritise investments with faster commercial returns while postponing discretionary capital expenditure.
Volatility in energy prices	India remains one of the world's largest importers of crude oil. Consequently, fluctuations in international energy prices have significant implications for inflation, transportation costs, manufacturing expenses, and fiscal balances. Prolonged periods of elevated energy prices can reduce operating margins and delay capital expenditure programmes.
Climate change and extreme weather events	Floods, cyclones, heatwaves, droughts, and other extreme weather events can disrupt industrial production, transportation networks, power supply, and construction activities. As climate-related risks intensify, infrastructure developers will increasingly need to invest in resilient and climate-adaptive designs.
High dependence on imports for critical industrial inputs	India continues to depend on imports for several high-value technology components, including semiconductors, electronic components, and capital goods. Supply chain disruptions stemming from geopolitical tensions can increase procurement costs and affect infrastructure projects. Although government initiatives promoting domestic manufacturing are gradually reducing import dependence, supply chain resilience remains an important policy objective.

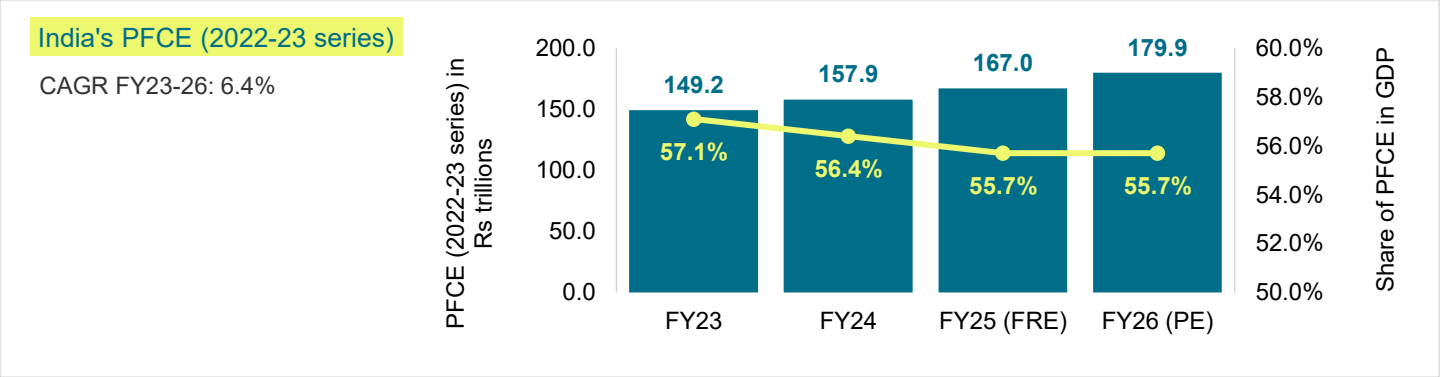
Source: Crisil Intelligence

Despite these challenges, India's economic outlook remains favourable supported by favourable demographics, rising disposable incomes, growing urbanisation, and rapid digitalisation across sectors.

Private consumption continues to anchor India’s economic growth

India’s Private Final Consumption Expenditure (PFCE) recorded a CAGR of 6.4% during FY23–FY26, with growth accelerating to 7.7% in FY26. Consumption growth was underpinned by the positive impact of GST rate rationalisation, stable employment conditions, improving real purchasing power, sustained rural demand supported by robust agricultural performance, and a gradual strengthening of urban consumption driven by the rationalisation of direct and indirect taxes.

India's PFCE at constant prices (2022-23 series), FY23-26



Note: FRE: First Revised Estimates, PE: Provisional Estimates
Source: MoSPI, Crisil Intelligence

Inflation is expected to firm up in FY27 but stay within RBI’s upper tolerance limit

In January 2026, the MoSPI rebased the CPI series to 2024, updating basket weights using the latest Household Consumption Expenditure Survey and increasing the relative share of non-food items. In the revised CPI series, food and fuel together account for approximately 52.7% of the CPI basket, making the index particularly sensitive to monsoon outcomes and global energy prices.

In the coming fiscal year, the pace of consumption growth will be shaped by the evolving inflation trajectory. Crisil estimates CPI inflation to firm up and average 5.1% in FY27, compared with 2.0% in FY26, although it is expected to remain within the Reserve Bank of India's upper tolerance limit of 6%. This upward trend is driven primarily by elevated crude oil prices, which, despite easing from their recent peak, remain high on a year-on-year basis and continue to keep retail petrol and diesel prices elevated throughout the year. The situation is further compounded by producers gradually passing on higher energy, input, and transportation costs to consumers, eroding real purchasing power and pushing core inflation higher. Adding to these pressures, the disinflationary support from GST rationalisation measures is expected to diminish in the near term, while the depreciation of the rupee continues to increase the imported component of inflation. Nonetheless, with inflation projected to remain within the RBI's tolerance band, the broader consumption trend is expected to remain resilient.

Manufacturing and capital goods drive growth of IIP

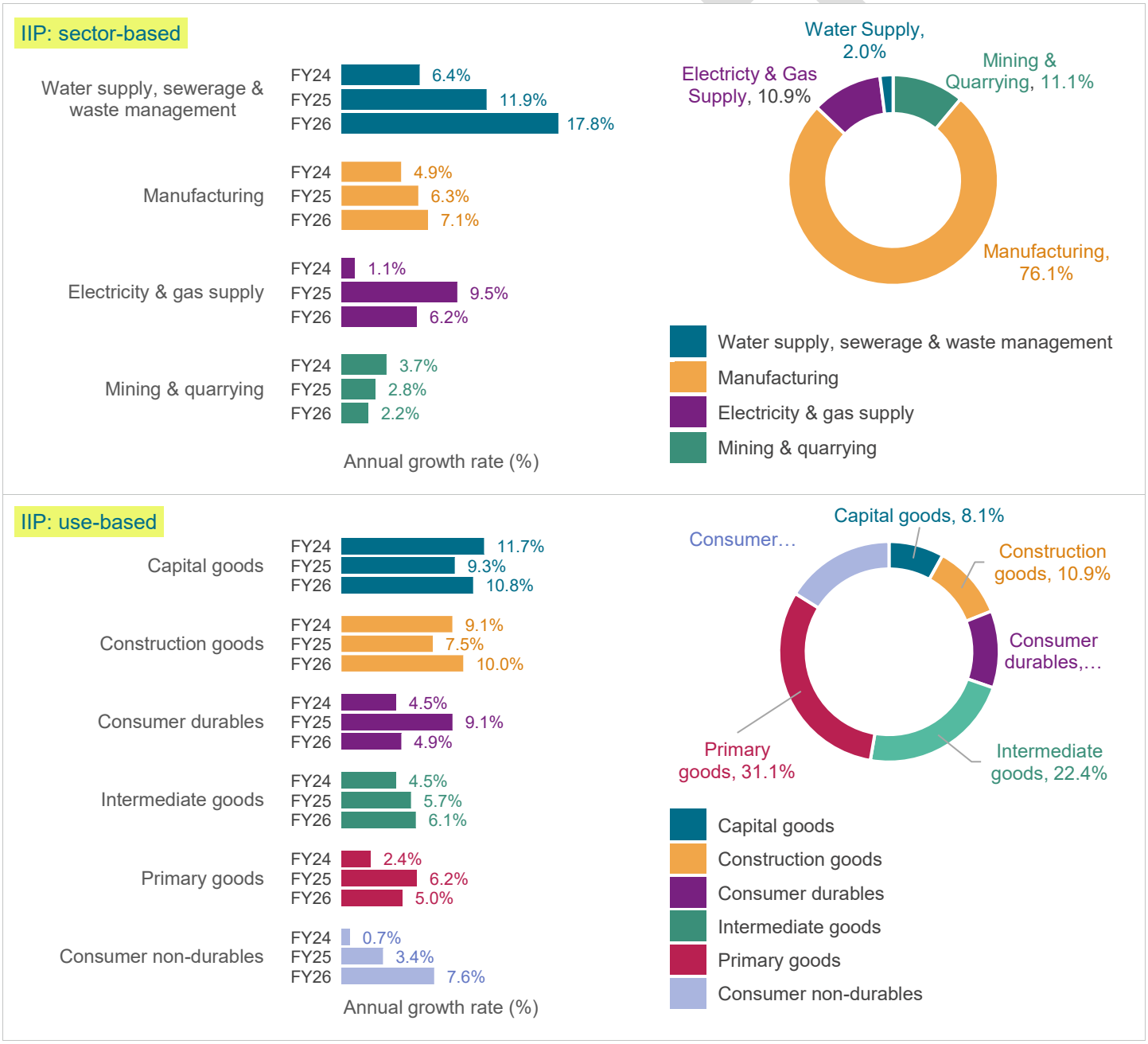
The Index of Industrial Production (IIP) is one of India's most closely monitored high-frequency economic indicators. In June 2026, MoSPI revised the base year of the IIP from 2011-12 to 2022-23 to make the index more representative of the current structure and dynamics of the industrial sector. The new series, with its expanded sectoral coverage, revamped item basket, enhanced granularity, and updated weights, provides a more representative, reliable, and methodologically robust measure of industrial growth that is aligned with evolving economic structures and international best practices.

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The revised IIP series (base year: 2022-23) also underscores the significance of the manufacturing sector, which accounts for 76.1% of the overall index, followed by mining and quarrying (11.1%), electricity and gas supply (10.9%), and water supply, sewerage, and waste management (2.0%). The high weight assigned to manufacturing in the IIP highlights its critical role in driving industrial output. At the same time, the gradual increase in the manufacturing index (increasing from 107.1 in FY24 to 119.4 in FY26) reflects sustained activity supported by policy initiatives, capacity expansion, and continued investments across key industries.

Among the use-based sectors covered in the revised IIP series, capital goods recorded the fastest growth during FY24-FY26, signalling strengthening industrial activity and continued capacity creation in the economy.

Annual growth rates of Index of Industrial Production (base year: 2022-23)



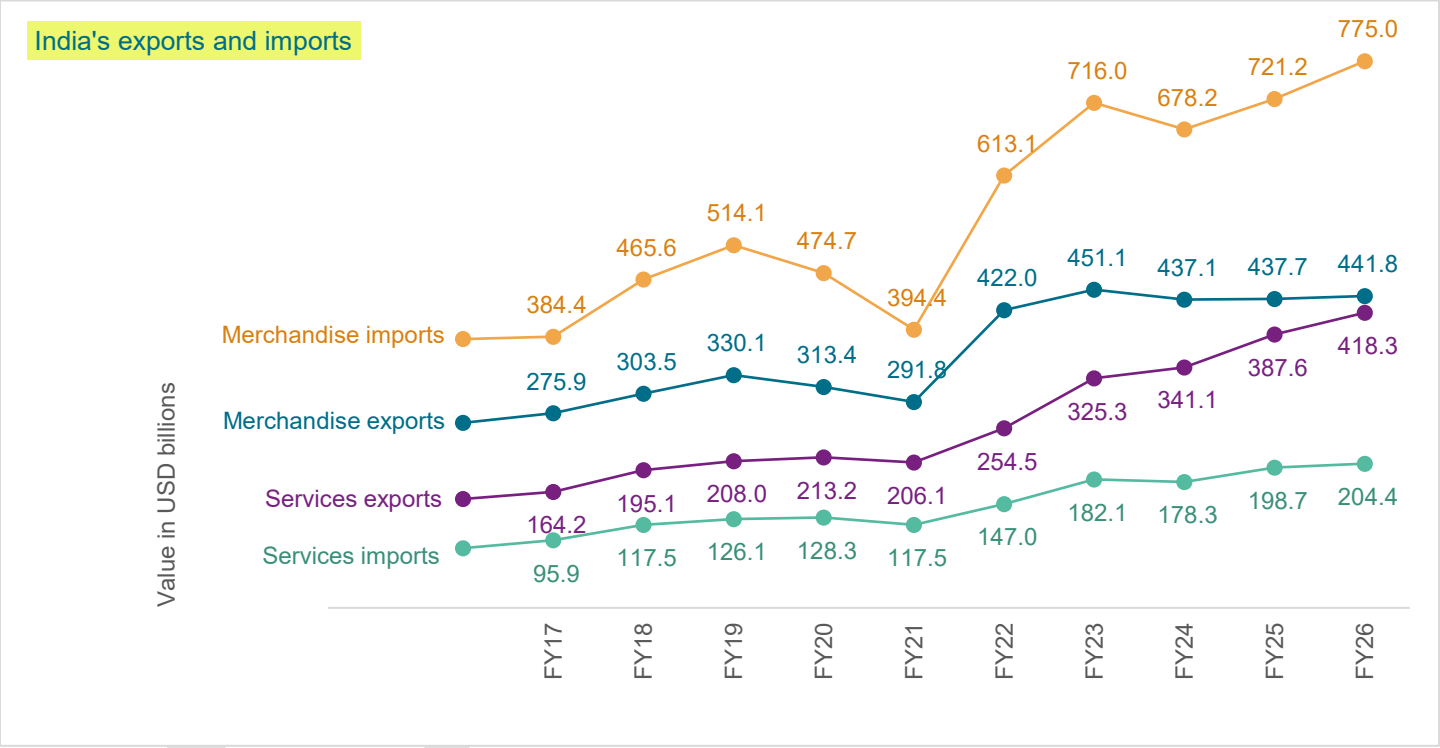
Source: : Ministry of Statistics and Programme Implementation, Crisil Intelligence

Overall exports from India further improved in FY26

India's external trade has expanded steadily, supported by strong domestic economic growth, the expansion of manufacturing under industrial policies, and the continued strength of services exports. Merchandise exports continue to be driven by engineering goods, petroleum products, electronics, pharmaceuticals, gems and jewellery, textiles, and agricultural products. On the other hand, imports are dominated by crude oil, gold, electronic components, machinery, and capital goods, reflecting India's growing industrial base and dependence on imported energy and technology inputs.

While merchandise imports continue to exceed merchandise exports, resulting in a structural trade deficit, the country's globally competitive services sector, particularly IT/ITeS and digital services, has helped strengthen the overall external sector. Services exports, which include IT/ITeS, digital services, consulting, financial services, engineering services, and business process management, reached an all-time high of USD 418.3 billion in FY26. Rising global demand for software development, cloud services, cybersecurity, engineering services, artificial intelligence (AI), and digital transformation has supported robust growth in services exports.

India's exports and imports, 2017-26



Source: Directorate General of Commercial Intelligence and Statistics (DGCI&S), Crisil Intelligence

Despite strong long-term growth prospects, India's trade performance remains vulnerable to key structural risks. Dependence on imported crude oil and semiconductors heightens exposure to price volatility and supply chain disruptions, while geopolitical tensions and shipping disruptions can raise logistics costs. However, a diversified export basket, growing services sector, and manufacturing initiatives offer resilience against these headwinds.

Trade expansion to indirectly support telecom infrastructure demand

Expanding trade volumes are expected to increase demand for telecom infrastructure, including fibre networks, towers, data centres, and international connectivity. Modern trade increasingly depends on reliable broadband connectivity, cloud platforms, IoT-enabled logistics, and real-time data exchange. Additionally, services exports, a key strength of the Indian

economy, require reliable domestic fibre networks, international submarine cable connectivity, hyperscale data centres, and low-latency broadband infrastructure, creating sustained demand for telecom investments.

Furthermore, India continues to import several high-value telecom components, including semiconductor chips, radio equipment, optical networking hardware, advanced electronic components, and specialised communication equipment. These imports support ongoing investments in 4G expansion, nationwide 5G rollout, fibre network deployment, and future technology upgrades.

Key growth drivers of India’s economy

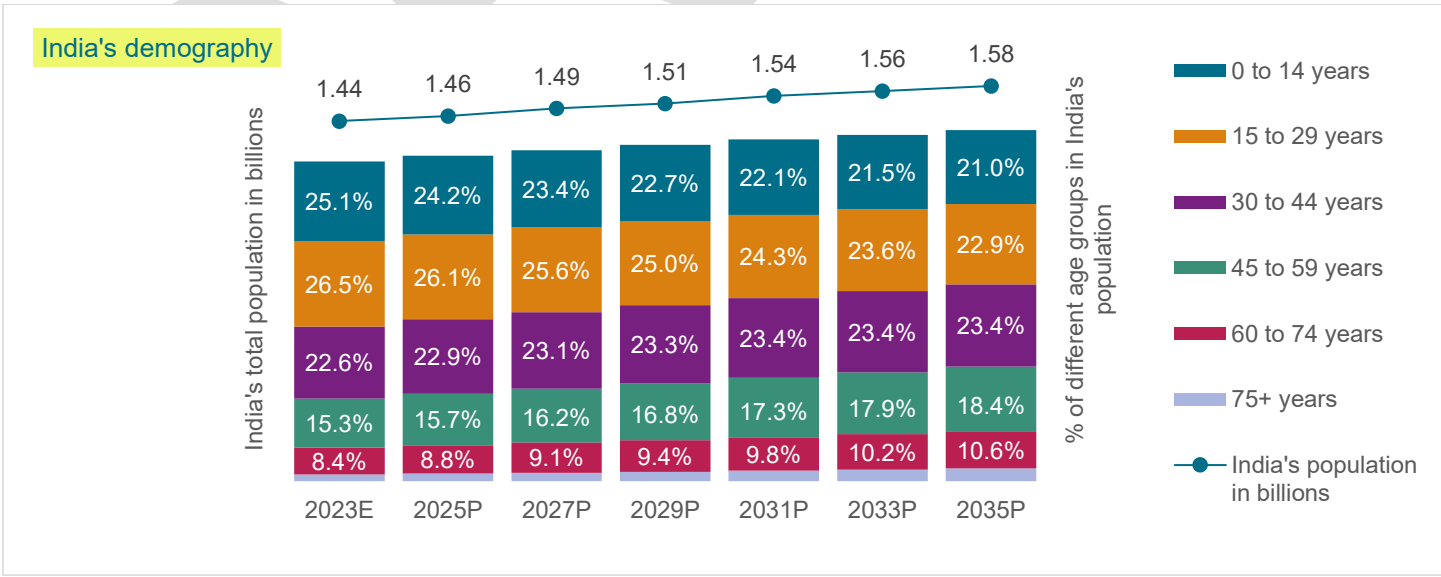
India’s working age population is projected to peak in 2034

According to the *World Population Prospects 2024* (WPP 2024), published by the United Nations in July 2024, India's population increased from 1.1 billion in 2001 to approximately 1.4 billion in 2023, registering a compound annual growth rate (CAGR) of around 1.4% during this period. Going forward, India's population is projected to grow at a CAGR of 0.8% between 2025 and 2030 and is expected to remain the world's most populous country throughout the century.

Furthermore, WPP 2024 highlights that approximately 100 countries and territories are expected to experience growth in their working-age populations (defined as individuals aged 20-64 years) through 2054. These countries and territories will have the opportunity to leverage their expanding working-age populations to accelerate economic growth and potentially reap demographic dividends. Notably, India is among them.

In 2023, India's working-age population stood at 849.9 million, accounting for 59.1% of the total population. This population is projected to peak at 967.7 million in 2034, when its share of the total population is expected to reach approximately 69.2%. This suggests that India has a multi-decade window of opportunity to accelerate economic growth by effectively harnessing the benefits of its favourable demographic profile.

India's population split by age groups, 2023-35P



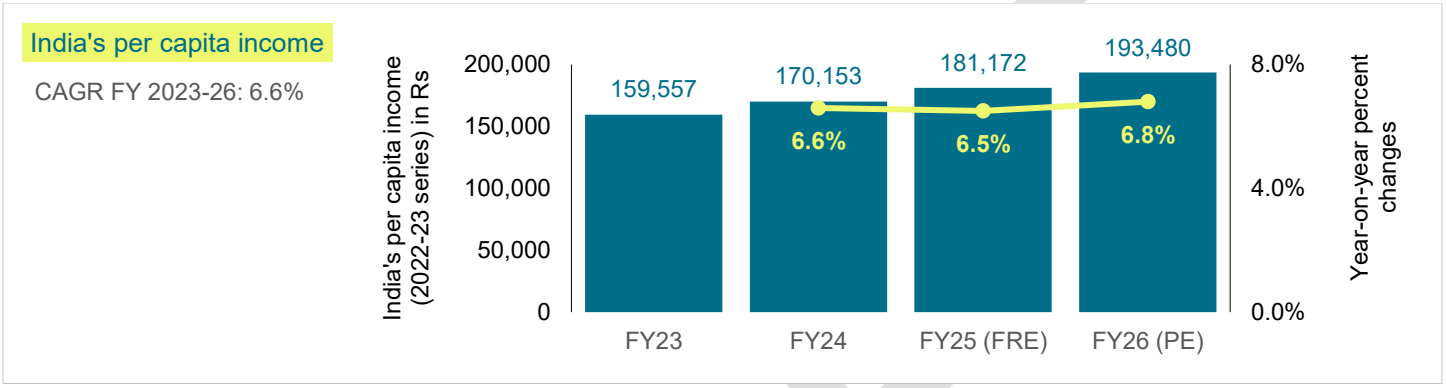
Note: E: Estimates, P: Projection

Source: United Nations, Department of Economic and Social Affairs, Population Division. World Population Prospects 2024

India experienced robust growth in per capita income in FY23-26

India’s per capita income, a broad indicator of living standards, grew at a CAGR of 6.6% between FY23 and FY26, from Rs 159,557 in FY23 to Rs 193,480 in FY26. Growth was led by better job opportunities, propped up by overall GDP growth.

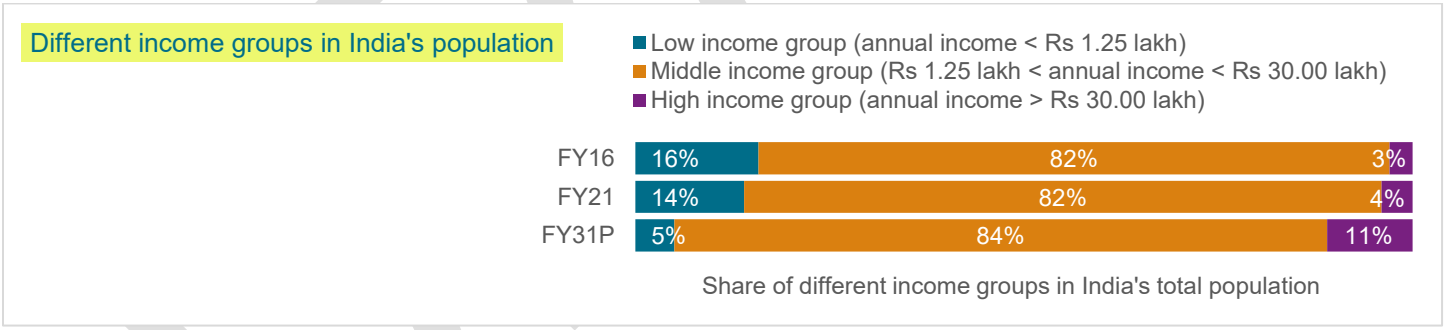
India's per capita income at constant prices (2022-23 series), FY23-26



Note: FRE: Final Revised Estimates, PE: Provisional Estimates
Source: Ministry of Statistics & Programme Implementation

Furthermore, the proportion of poor in India declined from ~16% in fiscal 2016 to ~14% in fiscal 2021. Conversely, the proportion of those in the middle- and high-income groups increased from ~85% to ~86%. By fiscal 2031, this share is expected to reach ~95%, supported by growth in per capita income.

India's population split by annual household income at 2020-21 prices



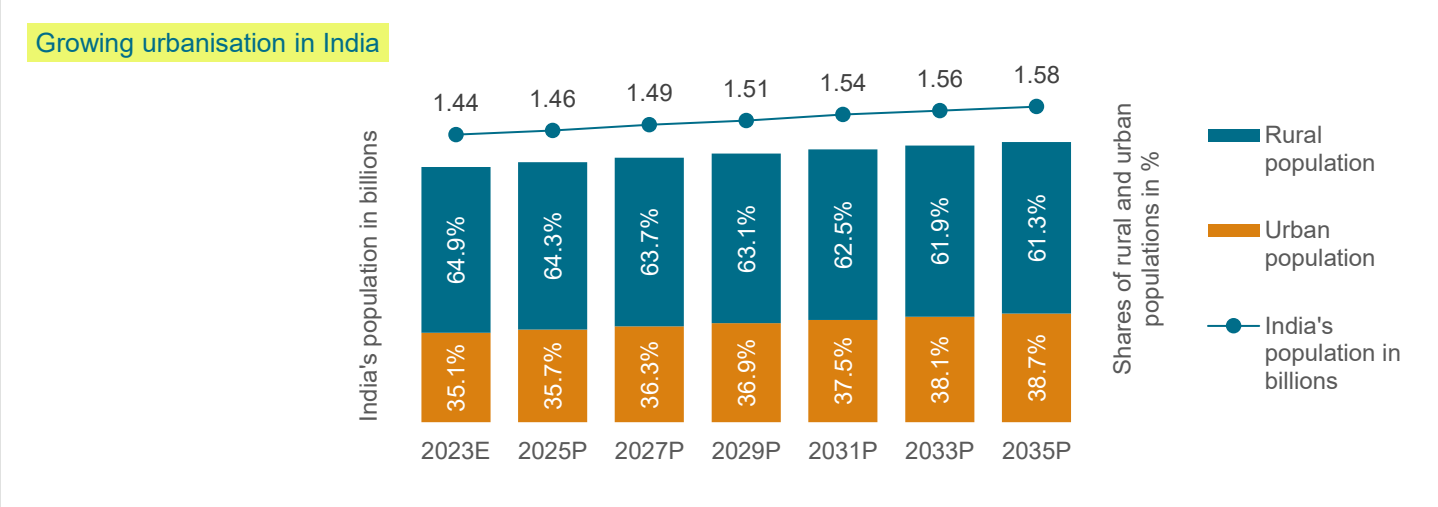
Notes:
1. The income split of the population is based on annual household incomes at 2020-2021 prices.
2. P – projection
3. Percentage values are rounded off.
Source: People Research on India’s Consumer Economy (ICE) 360° survey, Crisil Intelligence

India’s population is turning increasingly urban

India’s urban population has been consistently increasing, and the trend is expected to continue as India's economy grows. People from rural areas move to cities for better education, job opportunities, and quality of life. This internal migration may involve the relocation of an entire family or the relocation of a family's earning members or students.

In 2023, India's urban population made up 35.1% of its total population at an estimated 504.3 million. According to World Urbanization Prospects 2025, published by the United Nations in November 2025, India's urban population is likely to grow to 567.7 million by 2030, making up 37.2% of India's total population. This trend highlights the need to expand infrastructure and provision of basic services in urban areas to accommodate its growing population.

India population split by region, 2023-35P



Note: E: Estimates, P: Projection

Source: United Nations, Department of Economic and Social Affairs, Population Division. World Urbanisation Prospects 2025, Crisil Intelligence

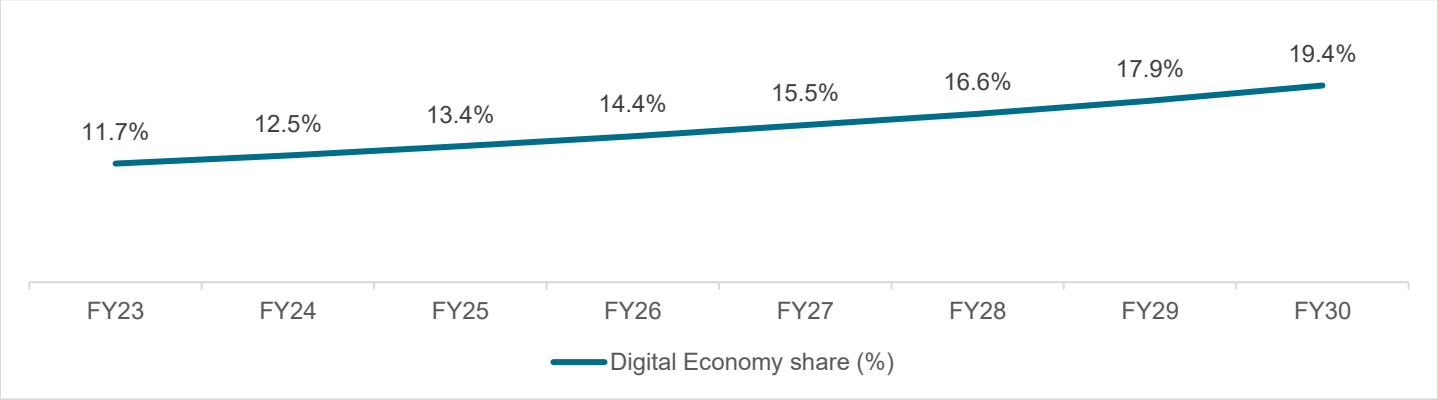
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Digital Economy

India has established itself as the world's third-largest digital economy

India is the fastest growing among the world's 10 largest economies, a trajectory increasingly supported by the accelerating pace of digital transformation. Within this broader growth narrative, India's digital economy is expected to strengthen its role as a key contributor to economic expansion, with its share in total Gross Value Added (GVA) projected to rise from 11.7% in FY23 to 19.4% in FY30. This represents more than a threefold increase over the seven-year period, outpacing overall economic growth and underscoring the digital sector's growing prominence as a driver of India's economic momentum. The sharp rise in contribution, coupled with the increasing share in GVA, suggests that digital-led sectors will account for an increasingly larger proportion of India's economic activity in the coming years, reinforcing the country's position as a leading global growth engine.

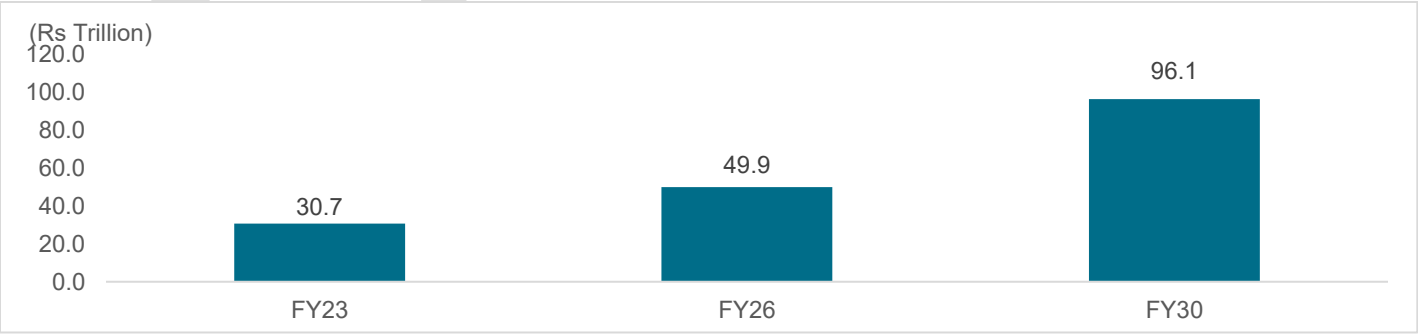
Projections of the Share of India's Digital Economy in Total GVA



Source: Meity report "Estimation and Measurement of India's Digital Economy", Crisil Intelligence

This structural shift is also reflected in the digital economy's contribution to GDP, which is projected to expand from Rs 30.7 trillion in FY23 to Rs 96.1 trillion by FY30. The growth trajectory suggests that the digital economy is expected to grow at a faster pace than the broader economy, reinforcing its position as a major engine of value creation and an increasingly important component of India's economic output over the medium term.

Digital economy contribution in GDP (Rs Trillions)



Notes: GDP at current prices for FY23 and FY26P has been considered as the base, while IMF growth projections through CY29 have been applied to estimate GDP for FY30 based on FY26 provisional figures

Source: Meity report "Estimation and Measurement of India's Digital Economy", Crisil Intelligence

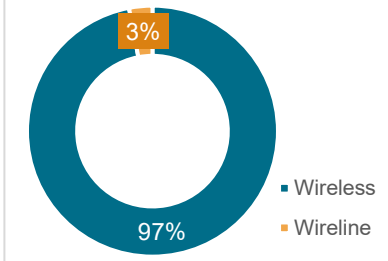
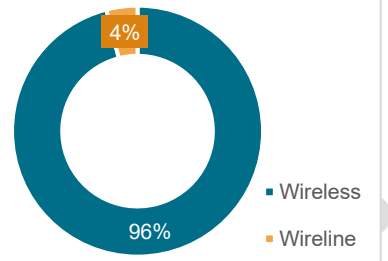
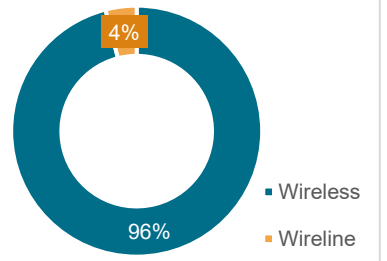
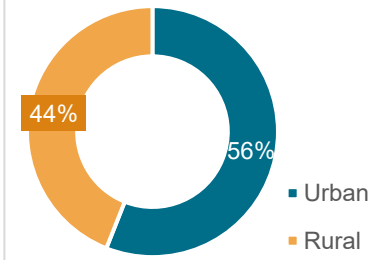
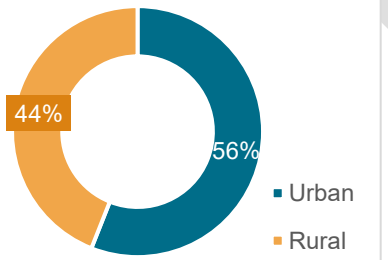
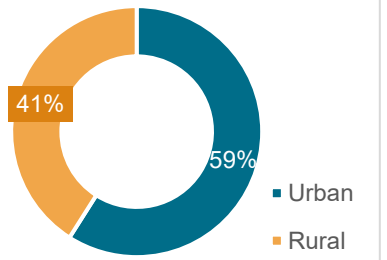
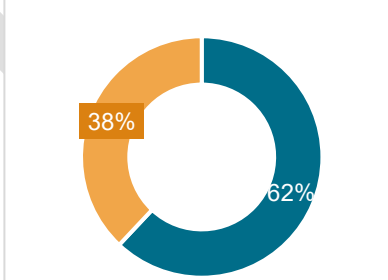
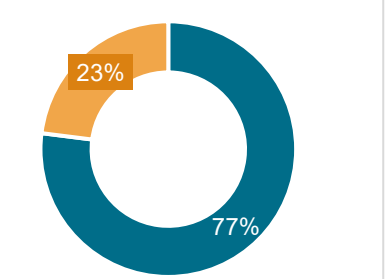
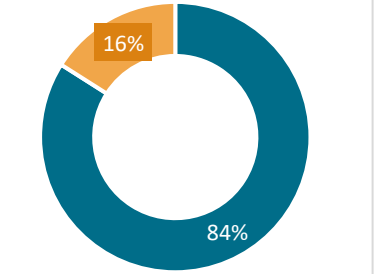
Increasing Broadband subscribers, smart phone penetration developing requisite support infrastructure and tariff hikes

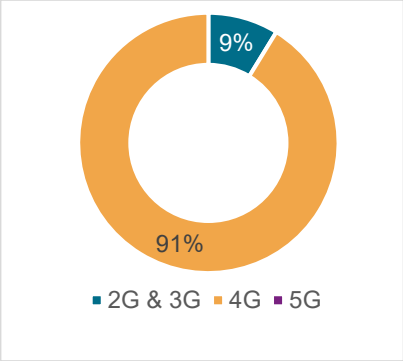
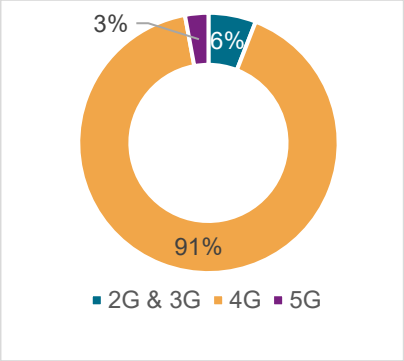
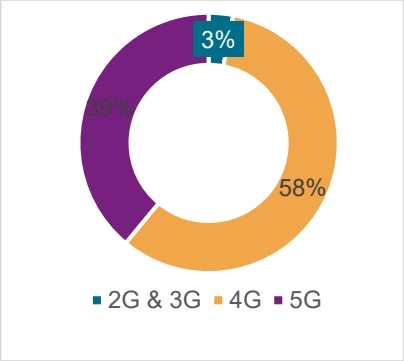
India's telecom landscape has undergone a fundamental shift from basic connectivity to a data-driven digital ecosystem.

- **Broadband and telecom subscriber growth**: Broadband subscribers are projected to increase from 687 million in FY20 to over 1.06 billion by FY26, while total telecom subscribers are expected to reach 1.33 billion during the same period. The rise in connectivity is being driven by widespread wireless broadband adoption, which accounts for nearly 96% of broadband subscribers, enabling greater access to digital services across urban and rural India.
- **Growing internet penetration:** As internet penetration deepens, digital platforms spanning e-commerce, OTT streaming, digital payments, social media, online education, healthcare, and enterprise applications are becoming increasingly embedded in everyday life, resulting in a sharp increase in data generation and consumption.
- **Rising smartphone penetration** Smartphones have become the primary device through which Indian consumers access digital services. Increasing affordability, domestic manufacturing, competitive pricing, and improved device capabilities have significantly expanded smartphone ownership in India. Modern smartphones support increasingly sophisticated digital applications including e-commerce, digital payments, video streaming, social networking, AI-powered productivity tools, and cloud-based enterprise applications. The transition from feature phones to smartphones is expected to continue increasing broadband traffic.
- **Evolving usage patterns:** The nature of usage has also evolved significantly, with India transitioning from a voice-centric market to a data-first economy. The share of data subscribers is expected to rise from 62% in FY20 to 84% by FY26, reflecting increasing reliance on digital services.
- **Network migration to 5G**: Simultaneously, the migration towards high-speed networks is accelerating, with 5G expected to account for nearly 39% of data subscribers by FY26, supported by continuing 4G adoption. This technology upgrade is enabling bandwidth-intensive applications such as HD video streaming, cloud gaming, IoT solutions, real-time collaboration tools, and cloud-based enterprise workloads, thereby significantly increasing the volume of data traversing telecom networks.
- **Rising data consumption per user:** The impact of these trends is evident in rising data consumption patterns. Average wireless data usage per subscriber is expected to grow from 11 GB per month in FY20 to nearly 26 GB per month by FY26, driven by growing digital engagement among consumers and enterprises.
- **Enterprise data generation:** Businesses across virtually every industry are accelerating digital transformation initiatives to improve productivity, operational efficiency, and customer engagement. Enterprises are increasingly relying on enterprise software, cloud computing, Internet of Things (IoT), digital collaboration platforms, hybrid work environments, and AI-powered technology solutions. These technologies require reliable high-capacity broadband connectivity with low latency and high network availability. Consequently, enterprise broadband is emerging as one of the fastest-growing segments of the telecommunications industry
- **AI-driven data infrastructure demand**: The rapid adoption of Artificial Intelligence (AI) and Generative AI (GenAI) is expected to further amplify data infrastructure requirements. Businesses are increasingly using large datasets to train and deploy AI models, while consumers are embracing AI-powered applications for content creation, search, personalization, and productivity. AI workloads are significantly more compute- and storage-intensive than traditional applications, requiring substantial processing power, data storage, and networking capabilities.
- **Government policies and schemes**: The Government of India has played a pivotal role in accelerating the development of the country's digital infrastructure through a series of policy initiatives, flagship programmes, and institutional reforms. Flagship initiatives such as Digital India, BharatNet, the National Broadband Mission (NBM), PM Gati Shakti, and the Smart Cities Mission have collectively accelerated the expansion of broadband connectivity. These initiatives are expected to continue driving substantial investments in telecom towers, optical fibre, data centres, cloud infrastructure, and next-generation communication technologies over the coming decade.

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Overall, the combined impact of rising broadband penetration, increasing 4G/5G adoption, growing data consumption, accelerating cloud migration, and expanding AI usage is creating a powerful tailwind for India's telecom industry. As data volumes continue to grow exponentially, demand for telecom services is expected to increase significantly, positioning them as a critical pillar of India's digital infrastructure and economic growth.

Key segments	FY20	FY23	FY26
Broadband subscriber base (in Millions, %) ^	Subscriber base: 687 million 	Subscriber base: 847 million 	Subscriber base: 1,066 million 
Telephone subscriber base split across urban and rural (in Millions)	Subscriber base: 1,178 million 	Subscriber base: 1,172 million 	Subscriber base: 1,331 million 
Split across data subscriber and non-data subscriber (in %)	Subscriber base: 1,178 million 	Subscriber base: 1,172 million 	Subscriber base: 1,331 million 

Key segments	FY20	FY23	FY26
Share of data subscribers across different technology (in millions)^^			
Average Wireless Data Usage per wireless data subscriber per month	11 GB	17.36 GB	25.70 GB

Notes:

^Wireline subscribers include Fixed Wired Access (DSL, FTTx, Ethernet/LAN, Cable Modem, ILL) & Wireless includes Fixed Wireless Access (5G FWA, Wi-Fi, Wi-Max, Radio/UBR, Satellite), Mobile Wireless Access (Handset/Dongle/M2Mbased-3G, 4G, 5G)

^^ Instead of FY20 the numbers used is for FY21

Source: TRAI, Crisil Intelligence

India's focus on long term digital infrastructure push

India's digital infrastructure push represents one of the most ambitious and accelerated national transformations driven by the twin engines of the National Broadband Mission (NBM) 2.0 (2025–30) and the Union Budget 2026–27's landmark incentives, the initiative builds on the foundation of Digital Public Infrastructure (DPI) such as the India Stack of Aadhaar, UPI, and open APIs , while aggressively scaling physical and compute layers to support data growth, AI adoption, and a USD 5-trillion-plus digital economy target.

At the core of the connectivity layer is NBM 2.0, launched in January 2025 as an evolution of the original 2019 mission. It has already delivered transformative results such as optical fiber cable (OFC) network length has more than doubled from around 19.35 lakh route km in 2019 to over 42.36 lakh route km as of December 2025, broadband subscribers have surged from 668 million to nearly 1.01 billion, and the median mobile broadband download speed witnessed a substantial increase, rising from 10.71 Mbps in 2019 to an impressive 131.47 Mbps in October 2025, average monthly data consumption per wireless data subscriber increased by 399 times to 25.7 GB in FY26, up from 61.66 MB in March 2014, one of the highest in the world. 5G rollout stands out as one of the fastest globally, with over 5.08 lakh base transceiver stations (BTS) deployed, achieving 99.9% district coverage and 85% population reach, serving approximately 450 million 5G users out of 1.2 billion total telecom subscribers. The mission explicitly targets fiberisation of towers, rural 5G expansion, satellite broadband for remote areas, and integration with power sector assets like Optical Ground Wire (OPGW). It also includes capacity-building for 5G use cases in education, healthcare, and agriculture, alongside the "Call Before u Dig" app to protect underground infrastructure.

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Complementing this is a massive data centre and cloud infrastructure boom, now explicitly recognised as critical national infrastructure in the Union Budget 2026–27. Furthermore, AI infrastructure is being treated as the next frontier of DPI.

Collectively, these developments position India's telecom industry as the backbone of the country's digital economy. Rapid fibre and 5G expansion under NBM 2.0 will drive sustained demand for network equipment, tower infrastructure, and fibre deployment, while rising data consumption fuels telecom revenue growth. The data centre and cloud boom, now recognised as critical infrastructure, opens avenues for operators to diversify into hyperscale connectivity and enterprise solutions. Meanwhile, AI infrastructure scaling under the IndiaAI Mission will demand high-bandwidth, low-latency networks. Together, these trends signal telecom's evolution from connectivity provider to a strategic enabler of India's digital and AI-driven economy.

Key government schemes and initiatives for India’s digital economy

Government initiatives	
Digital India	• An umbrella programme aimed at transforming India into a digitally empowered society and knowledge economy by improving digital infrastructure, expanding digital public services, and increasing digital literacy • Launched: 1 July 2015 • Target: projects across 10 sectors (agriculture, healthcare and wellness, education and skilling, entrepreneurship and manufacturing, emerging technology, procurement, trade & tax, social empowerment, digital infrastructure, financial inclusion, transport and logistics) • Implementation: 83 projects implemented across central ministries and state / UT governments • Fund allocation in FY25: Rs 4173.00 • Progress: 83 projects implemented

BharatNet	• A project aimed at bridging India's rural-urban digital divide by providing broadband connectivity to all Gram Panchayats (GPs) in the country
	• Launched: 2011 as the National Optical Fibre Network (NOFN)
	• Target: broadband connectivity to ~2.5 lakh GPs
	• Implementation: 3 phases
	  ○ Phase I (completed in December 2017): Optical fibre cables laid out to connect 1 lakh GPs
	  ○ Phase II(ongoing): Optical fibre cables being laid out to connect an additional 1.5 lakh GPs
	  ○ Phase III (ongoing): Optical fibre cables being laid to connect 2.64 lakh GPs in ring topology
	• Funding for phase I and II: Rs 42,068 crores
	• Progress
	  ○ Number of GPs ready-for-service: 2,18,347 (as of 19 March 2025)
	  ○ Optical fibre cable laid: 6,92,676 km (as of 13 January 2025)

National Broadband Mission 2.0	• An initiative with 7 targets to be achieved by 2030
	• Launched: 1 April 2025
	• Targets to be achieved by 2030, implementation and progress:
	  ○ Optical fibre connectivity with 95% per cent uptime in 2.7 lakh villages (achieved: 42,000 as of December 2025)
	  ○ Broadband connectivity to 90% of anchor institutions such as schools, anganwadis and panchayat offices (achieved: 68.8% as of February 2026)
	  ○ National average fixed broadband download speed of 100 Mbps (achieved: 61.55 Mbps as of February 2026)

Government initiatives	○ Reduction in average Right of Way application disposal time from 455 days to 30.4 days (achieved) ○ 100% mapping of fibre networks owned by government PSUs on PM GatiShakti National Master Plan Platform (achieved: 94% as of February 2026) ○ 60 rural internet subscribers per 100 population (achieved: 47.16 as of February 2026) ○ Use of sustainable energy in 30% of mobile towers (achieved: 12.38% as of February 2026)
PM GatiShakti National Master Plan (PMGS-NMP)	• An integrated infrastructure planning framework designed to improve coordination among multiple infrastructure sectors • Launched: October 2021 • Implementation and target: ○ A digital master planning tool to be created on a Geographic Information System (GIS) platform where data on projects of all relevant ministries / departments will be uploaded and dynamically mapped to provide real time updates and facilitate joint planning, designing and execution of infrastructure projects • Progress: Comprehensive database of ongoing and future projects of various Ministries has been integrated with the tool

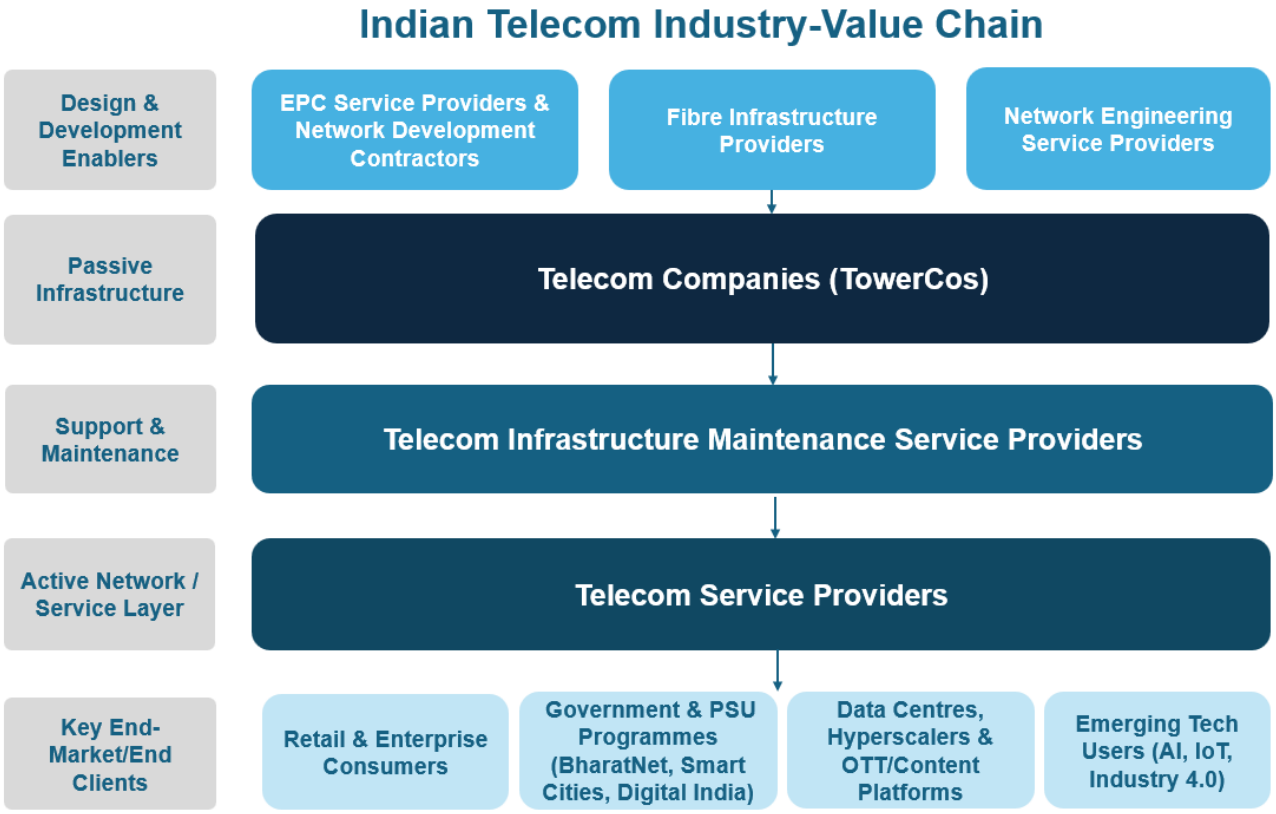
Source: PIB, Crisil Intelligence

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2. Assessment of Telecom and Telecom Tower industry in India

2.1. Overview of Telecom industry in India

The telecom towers value chain spans five broad layers — design & deployment enablers, passive infrastructure (towers), infrastructure maintenance, active network/service delivery, and the end-markets that ultimately consume connectivity. The schematic below maps the flow of products, services and key participants across this chain, followed by a descriptive summary of each component.



Value chain of telecom industry in India

Value chain components	Description
Telecom Service Providers (TSPs)	• They are network operators that own spectrum and core telecommunications infrastructure, enabling them to offer wireless and wireline connectivity services across consumer, enterprise, and government segments. • They represent the primary source of demand for telecom infrastructure, network solutions, and associated technology services.

Value chain components	Description
Tower Companies (TowerCos)	• Tower Companies (TowerCos) own, develop, and manage shared passive telecommunications infrastructure, including towers, shelters, power systems, and related site assets. • They lease this infrastructure to multiple telecom operators under long-term agreements, enabling efficient network deployment and reducing infrastructure costs.
Fibre Infrastructure Providers	• Organizations that design, deploy, own, and maintain optical fibre networks to enable backhaul, middle-mile, and last-mile connectivity, supporting broadband expansion, mobile network performance, and digital infrastructure development.
Network Deployment Contractors & EPC Service Providers	• Companies that plan and execute telecom infrastructure projects, including site acquisition, civil works, tower construction, network deployment, and fibre installation, on behalf of telecom operators and infrastructure owners.
Telecom Infrastructure Maintenance Service Providers	• Service providers responsible for the operation, maintenance, and management of telecom infrastructure assets, ensuring network reliability through activities such as preventive maintenance, fault resolution, energy management, and site security.
Network Engineering Service Providers	• Specialized firms that provide network planning, design, integration, optimization, commissioning, and operational support services to improve network coverage, capacity, performance, and service quality.
Key End-Markets / End Clients	• End Users comprise consumers, enterprises, government agencies, digital platforms, and industry sectors that depend on telecommunications infrastructure and connectivity services • Their growing need for reliable, high-capacity, and low-latency networks drives demand for advanced communication technologies and network expansion.

Key participants of telecom industry

Company	Telecom Service Provider	Tower Company	Fibre Infrastructure Provider	Network Deployment Contractor	EPC Service Provider	Infrastructure Maintenance Services	Network Engineering Services
Reliance Jio	✓		✓	✓		✓	✓
Bharti Airtel	✓		✓	✓		✓	✓
BSNL	✓		✓	✓		✓	✓
Indus Towers		✓		✓		✓	
Altius Telecom Infra		✓		✓		✓	
Sterlite Technologies			✓	✓	✓	✓	✓
HFCL			✓	✓	✓		✓
Larsen & Toubro (L&T)				✓	✓	✓	✓
GTL Infrastructure		✓				✓	
KEC International			✓	✓	✓	✓	✓

Note: Products offered by players is only indicative and not exhaustive
Source: Company reports, Crisil Intelligence

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Key trends in telecom customers in India

Telecommunication has been playing a pivotal role in India's economic growth. It is the backbone of many industries, including e-commerce, media and entertainment, finance, information technology (IT), healthcare, transportation and logistics. The sector facilitates seamless movement of data worldwide through wired or wireless channels and significantly influences economic progress. The telecom market is constantly evolving with the integration of cutting-edge technologies over the years. This has widened the coverage of telecom services globally and made them an indispensable part of the daily lives of consumers. Telecom proved to be an essential service especially during the Covid-19 pandemic, enabling people to remain connected amid worldwide lockdowns.

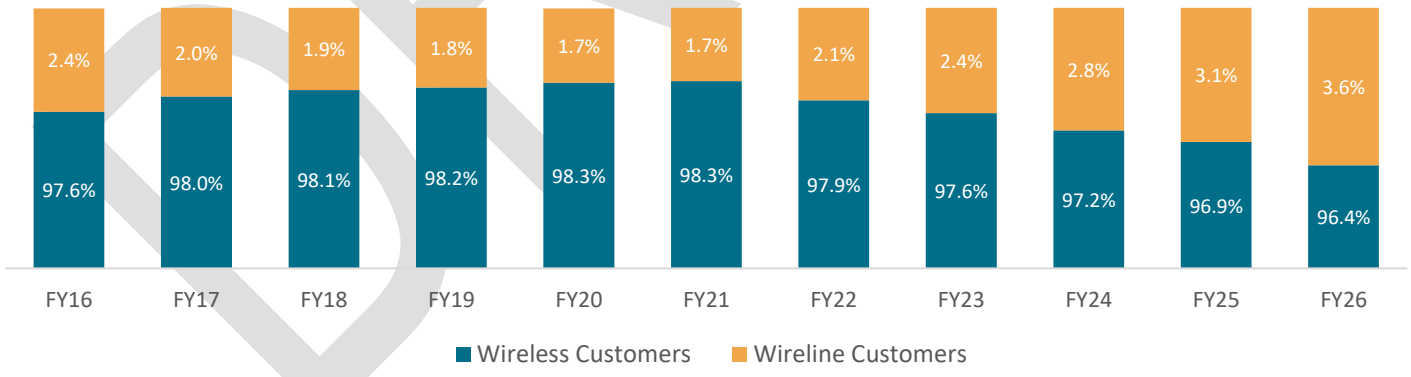
Indian telecom industry growth led by wireless services

India's telecom subscriber base has remained predominantly wireless, with wireless connections consistently accounting for over 96% of total subscribers during FY16-FY26. The wireless share increased from 97.6% in FY16 to a peak of 98.3% in FY21, before moderating to 96.4% in FY26. Over FY16-FY26, the wireless subscriber base recorded a CAGR of 2.18%, supported by rising smartphone penetration, affordable data tariffs, and widespread 4G network expansion.

In contrast, the wireline segment witnessed a decline in share from 2.4% in FY16 to 1.7% in FY21, reflecting the growing preference for mobile connectivity. However, the segment has rebounded in recent years, with its share increasing to 3.6% in FY26. The wireline subscriber base grew at a faster CAGR of 6.71% during FY16-FY26, driven by increasing adoption of FTTH services, rising demand for high-speed broadband, expansion of fibre networks, and government-led broadband initiatives such as BharatNet.

Despite the stronger growth in wireline connections, wireless services remain the primary mode of telecom access in India, accounting for 96.4% of total subscribers in FY26, while wireline services account for 3.6%. Going forward, wireless subscribers are expected to continue driving overall telecom growth, while wireline penetration is likely to improve gradually with ongoing FTTH deployments and fibre infrastructure expansion.

Share of wireless and wireline customer (%, FY16-26)



Source: TRAI, Crisil Intelligence

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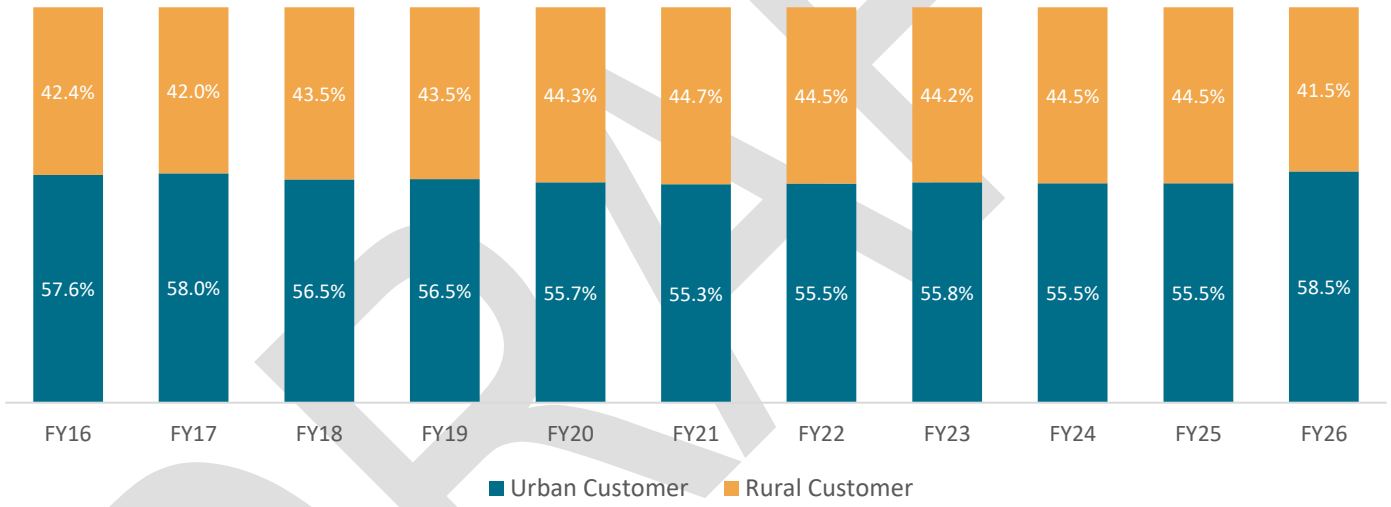
Urban-Rural mix remains stable, led by sustained urban growth

India's telecom subscriber base has maintained a relatively stable urban-rural mix over FY16-FY26, with urban customers consistently accounting for most subscribers. The urban segment contributed 58.5% of total subscribers in FY26, compared with 57.6% in FY16, supported by higher smartphone penetration, stronger data consumption, and increased adoption of digital services. The urban subscriber base grew at a CAGR of 2.48% during FY16-FY26.

The rural segment represented 41.5% of total subscribers in FY26 and recorded a CAGR of 2.1% during FY16-FY26. Subscriber growth in rural areas was supported by continued network expansion, improving affordability of devices and data plans, and government-led connectivity initiatives aimed at enhancing telecom access in underserved regions.

While urban markets continue to drive subscriber additions, rural India remains a significant growth avenue for telecom operators, supported by ongoing digital inclusion efforts and increasing internet adoption.

Share of urban and rural customer (%, FY16-26)



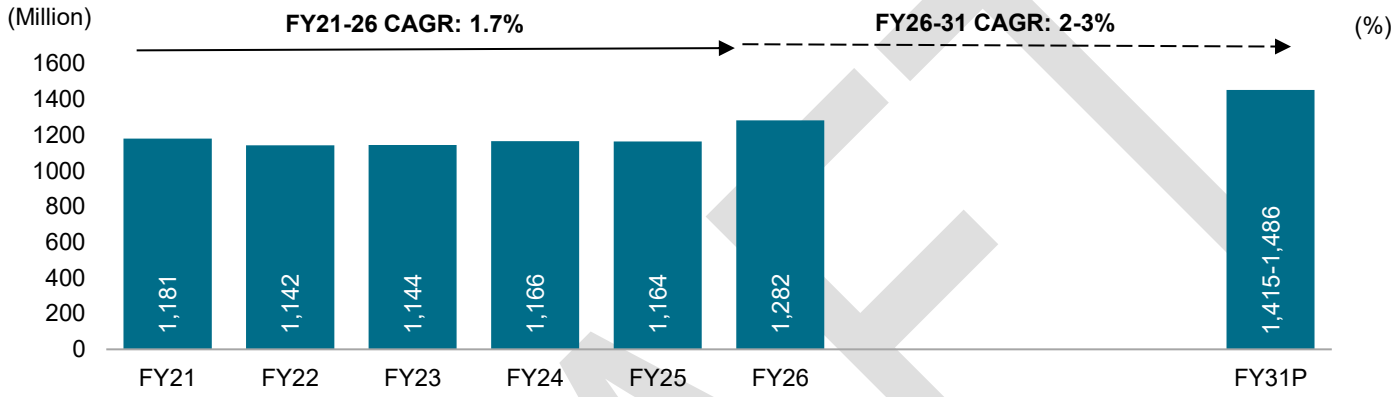
Source: TRAI, Crisil Intelligence

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Overview on outlook of wireless and wireline/broadband telecom customers in India

Crisil Intelligence expects the wireless subscriber base to grow at a CAGR of 2-3% during FY26-FY31, supported by rising smartphone penetration, improving affordability of mobile devices, wider 4G/5G coverage, and sustained demand for high-speed data and digital services. Increased consumption of video streaming, digital payments, social media, and other data-intensive applications is also expected to support subscriber growth.

Wireless telecom customer base (FY21-31P)

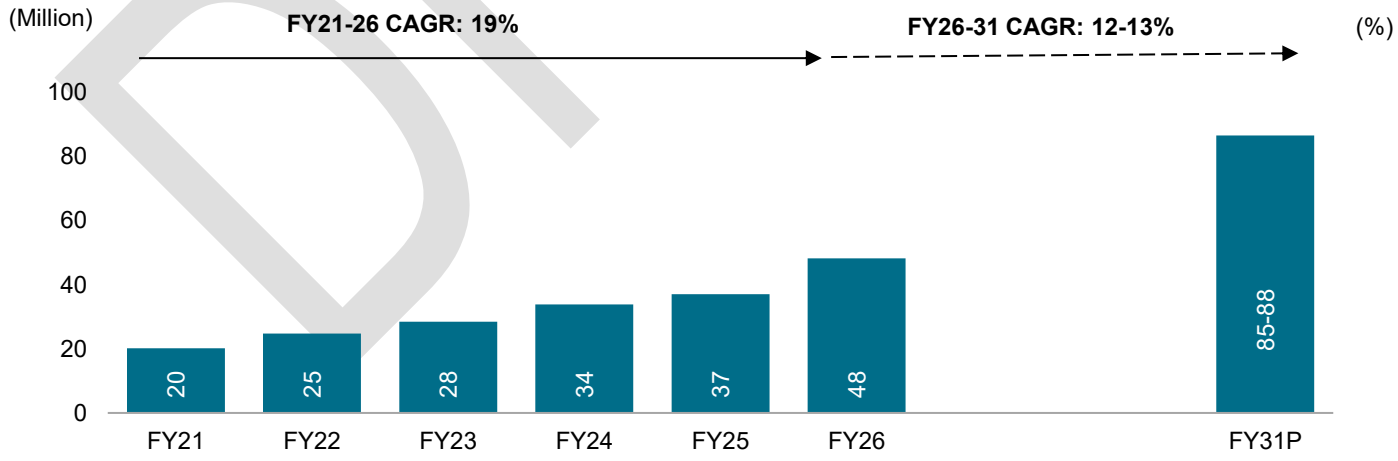


P: Projected

Source: TRAI, Crisil Intelligence

The wireline subscriber base is projected to grow at a CAGR of 12-13% during FY26-FY31, driven by the rapid expansion of Fibre-to-the-Home (FTTH) networks, increasing demand for reliable high-speed broadband, growth in remote working and digital entertainment, and rising internet adoption in Tier II, Tier III, and rural markets. Government-led initiatives such as BharatNet, continued fiber infrastructure investments by telecom operators, and growing demand from households, enterprises, data centres, and 5G backhaul are expected to further accelerate wireline adoption.

Wireline telecom customer base



P: Projected

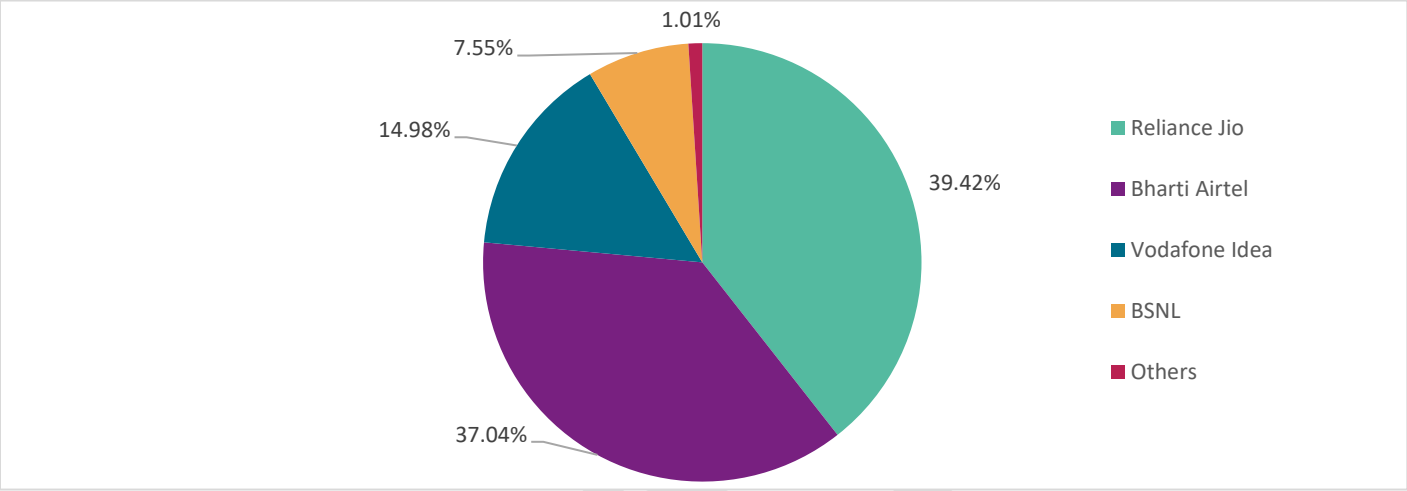
Source: TRAI, Crisil Intelligence

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Subscriber market share of the key service providers in the India

Amongst the key service providers, Reliance Jio, has made significant gains in market share, and along with Bharti Airtel, has continued to expand its customer base through affordable phones and attractive 4G and 5G bundle plans. As a result, these two players have increased their market share, primarily with superior data packs, plans and services. In FY26, Reliance Jio held a 39% market share, while Bharti Airtel had around 37%.

Subscriber market share of key players in India (wireless + wireline, as of March 2026)



Source: TRAI, Crisil Intelligence

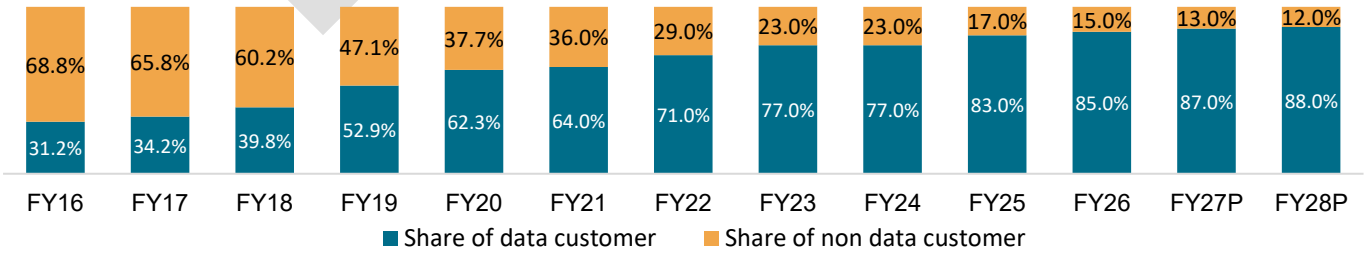
Telcos are focusing on upgrading the non-4G subscriber base from rural subscribers currently using legacy feature phones. Telecom players are likely to compete indirectly in the form of increased content bundling, tie-ups with smartphone players to manufacture low-cost phones, and increased sales push through distribution channels.

Data users and consumption grew multi-fold over the past decade

In FY26, data subscribers rose to 85% of the user base, supported by ongoing network and technology upgrades and a steady migration of non-data users to data services as internet demand increased. This shift was further accelerated by the increasing availability of affordable devices and low-cost data plans, which have expanded internet accessibility across user segments and encouraged greater digital adoption.

In FY28, Crisil Intelligence projects data subscribers will rise further to 88%, driven by continued technology enhancements, expanding internet use-cases, and ongoing conversion of remaining non-data users through affordable handsets and accessible data packs.

Share of data vs non-data customers (FY16-28P)



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Note: P-Projected
Source: TRAI, Crisil Intelligence

Data consumption growth to pick up pace with increased use cases of 5G

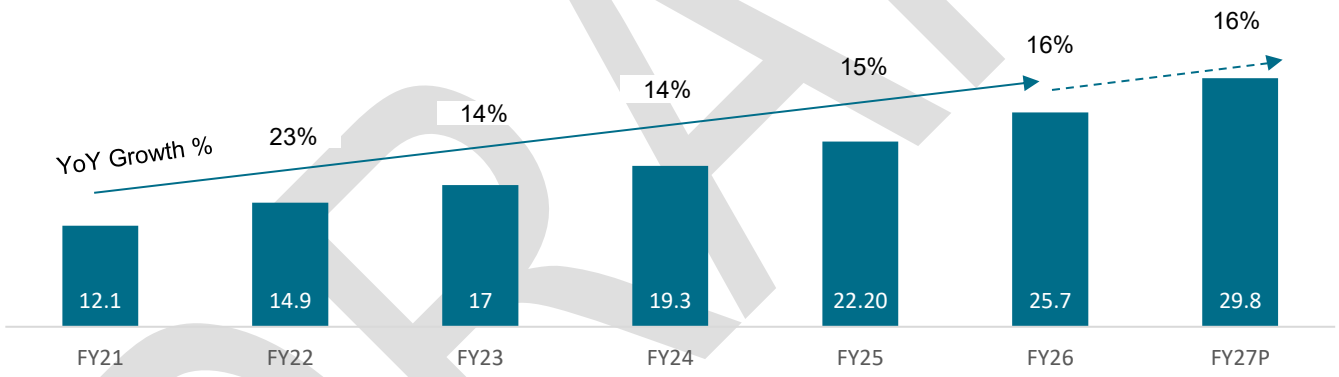
In FY26, as 5G coverage expands through small cell densification and speeds improve, further around 100 million subscribers upgraded from 4G to 5G. At the same time, the ongoing migration of 2G and 3G users to 4G, as well as the conversion of non-data subscribers to data subscribers, is anticipated to continue together driving further growth in mobile data consumption.

The booming online gaming industry increased social media usage for multimedia content sharing, and businesses and services shifting towards digital platforms and e-commerce are increasing the need for high-speed internet connectivity.

In FY26, data usage is at 25.7 GB/user/month, driven by rising smartphone adoption, increased consumption of higher-bandwidth applications (including OTT), and the continued expansion of high-speed mobile networks such as 4G and 5G, which enhance data transmission speeds. In FY27, data usage is expected to rise further to 29.8 GB/user/month, supported by continued 5G adoption, richer content consumption, and deeper penetration of data-heavy applications across consumer and enterprise use cases.

The adoption and expansion of 5G networks are the key drivers for the expected surge in data consumption by FY27.

Data usage (GB/user/month) trend (FY21-27P)



Note: P-Projected
Source: TRAI, Crisil Intelligence

Wireless internet penetration is projected to reach 80-81% of total population by fiscal 2031

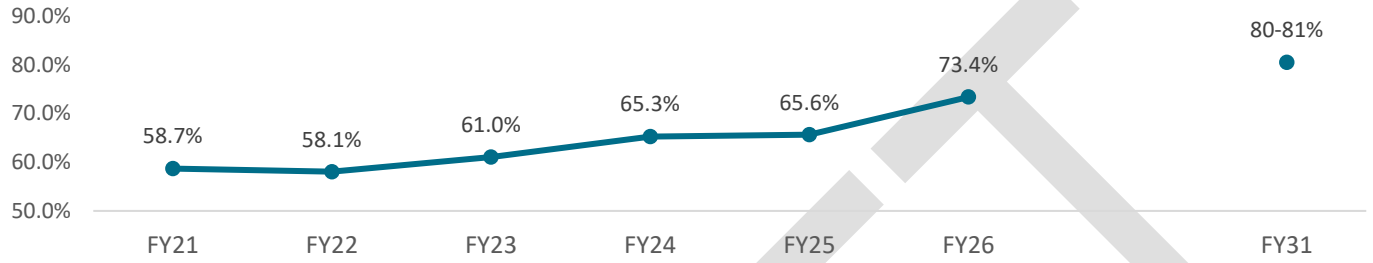
India's wireless internet user base has expanded steadily over the past few years, driven by increasing smartphone adoption, improving network coverage, affordable data tariffs, and rising digital consumption across both urban and rural regions. Wireless internet penetration increased from 58.7% in FY21 to 73.4% in FY26, supported by the rapid adoption of 4G services and ongoing 5G deployments across the country.

By FY31P, wireless internet penetration is projected to reach 80-81%, reflecting continued growth in internet adoption across the country. The increase is expected to be driven by deeper rural connectivity, wider 5G coverage, increasing smartphone affordability, and growing reliance on digital services across entertainment, commerce, financial services,

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healthcare, and education. The telecom industry is expected to continue benefiting from increasing data consumption per user, government-led digital initiatives, and sustained investments in network infrastructure. By FY31P, the majority of internet users are expected to be supported by advanced 4G and 5G networks, further enhancing connectivity and user experience across India.

Wireless internet penetration in India (%, FY21-31)



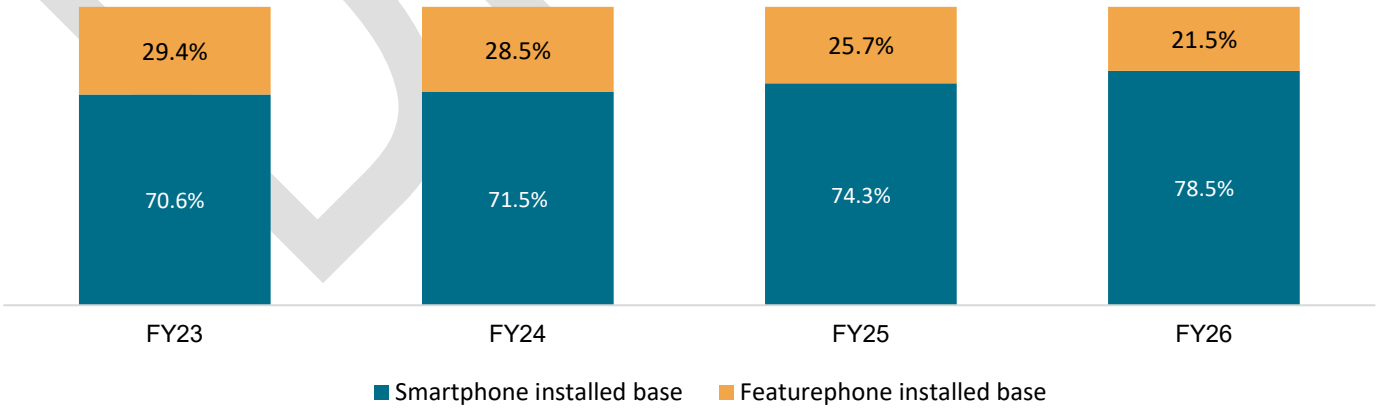
P: Projected
Internet penetration is per 100 population
Source: TRAI, Crisil Intelligence

Rising smartphone penetration

The Indian market has transitioned from a feature-phone-led user base to a smartphone-dominated one, with smartphones at 70.6% of the mobile phone installed base in fiscal 2023 and 74.3% in fiscal 2025.

Crisil Intelligence expects the share to rise to ~78.5% by fiscal 2026, with the feature-phone base narrowing to 21.5%. Growth has been driven by improving affordability of entry-level 5G handsets, wider consumer financing and EMI availability, and rapid 5G network rollout. Rising data consumption, deeper adoption of digital services such as UPI payments and video streaming, and replacement demand from an ageing 2G feature-phone base should sustain the shift through fiscal 2026.

Smartphone share in the Indian mobile market (FY23-26)



Source: Publicly available data on smartphone and mobile shipments through various research agencies, Crisil Intelligence

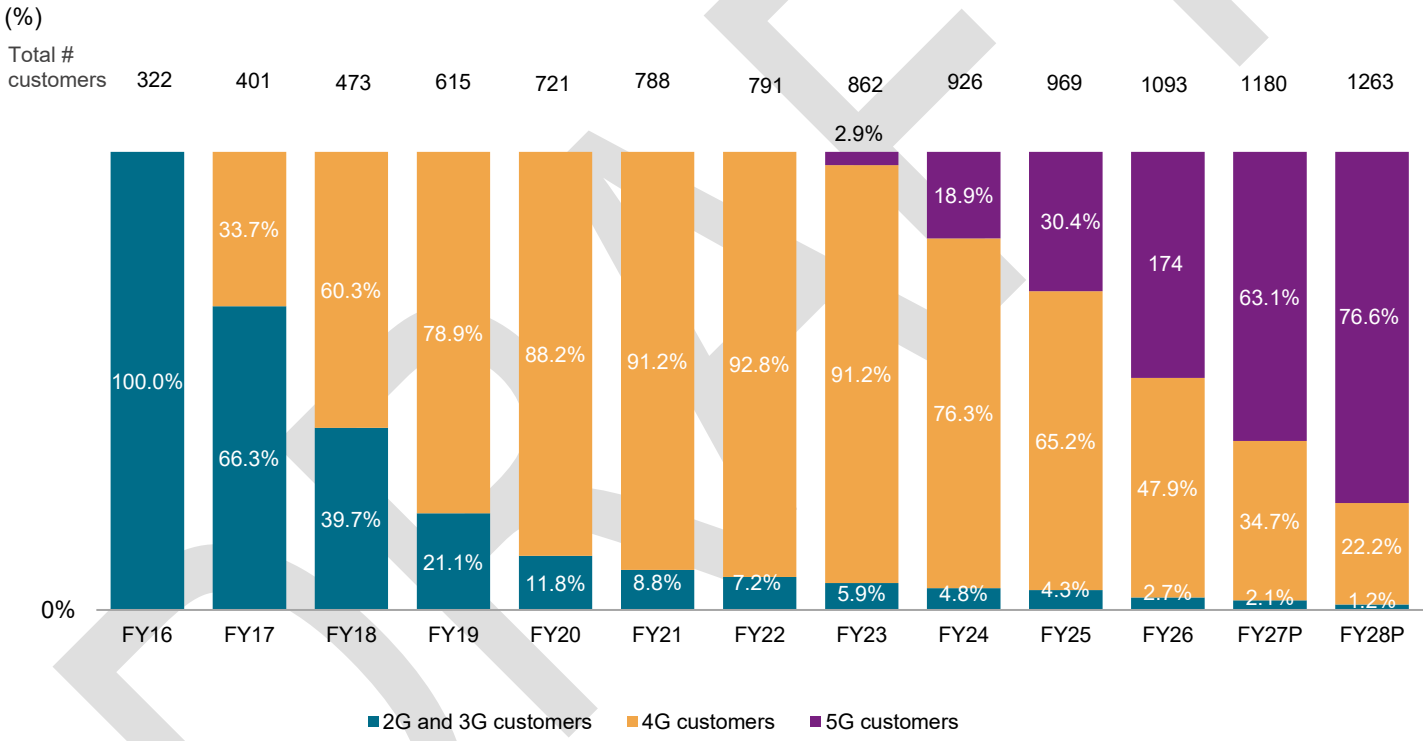
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5G adoption to rise, fuelled by affordable 5G device options

Crisil Intelligence estimates the number of 5G customers to have been ~745 million in fiscal 2027, constituting ~63% of the internet customer base. The 5G customer base is expected to grow, with the pace of conversion largely influenced by affordable pricing of 5G devices and continued handset replacement cycle. Offering 5G introductory services for free allows customers to experience high-speed data and encourages upgrades, playing a vital role in shaping the future trajectory of customers and data usage.

In fiscal 2028, Crisil Intelligence projects ~77% of total users to be 5G-enabled and 22% to use 4G, mainly in urban markets, surpassing ~1248 million users. Only a small fraction of data users will continue to rely on legacy 2G and 3G networks. Reinforcing this strong growth trajectory, Ericsson projects that India will surpass 1.1 billion 5G subscriptions by the end of 2031, representing approximately 81% subscription penetration, highlighting the country's rapid transition toward next-generation mobile connectivity.

Number of customers across 2G/3G/4G/5G data



Note: Operators launched 5G services in October 2022. There is an increase in the number of 5G customers as users adopt 5G-enabled smartphones, with 5G coverage becoming more ubiquitous. The number of 5G customers could differ as 5G coverage may be intermittent.

P: Projected

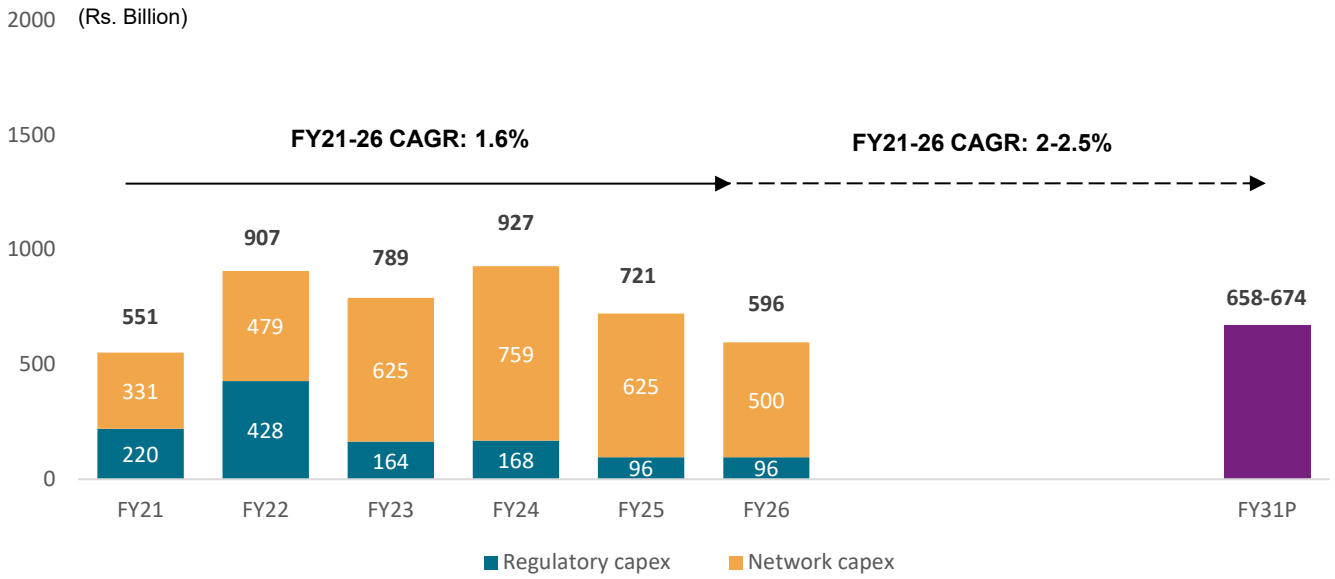
Source: TRAI, Crisil Intelligence

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Regulatory and network capex combined is projected to witness 2-2.5% growth from FY26 to FY31

Industry capex peaked at Rs. 927 billion in fiscal 2024 as operators front-loaded 5G rollouts, before moderating to Rs. 721 billion in fiscal 2025 and Rs. 596 billion in fiscal 2026, translating into a modest 1.6% CAGR over fiscals 2021-26. Regulatory capex normalised sharply from Rs. 428 billion in fiscal 2022, an auction year, to Rs. 96 billion in fiscals 2025 and 2026, leaving network capex the dominant component.

Regulatory and network capex in the telecom industry in India (FY21-31P)



Source: Crisil Intelligence

Crisil Intelligence expects combined capex to grow at a 2-2.5% CAGR to 658-674 by fiscal 2031. Network capex should see stable, moderate growth as the bulk of the 5G rollout is complete, with spending shifting to capacity augmentation, fibreisation and fixed wireless access. Regulatory capex should revive on fresh spectrum sales and early 6G deployment, which the Bharat 6G project targets commercially by 2030, lifting growth from fiscals 2030-31.

Overview of capex deployment towards network expansion, fibre deployment and 5G/6G infrastructure

Network expansion and capacity enhancement

Telecom operators have continued to invest in network expansion to cater to growing data consumption and rising subscriber traffic. Investments have been focused on enhancing network capacity, improving coverage in underserved regions, and strengthening overall service quality. As data usage continues to increase, operators are expected to undertake targeted network densification and capacity augmentation to support future demand.

Fibre deployment to support data growth and backhaul requirements

Fibre infrastructure remains a critical component of telecom capex, supporting both broadband connectivity and mobile network backhaul. Operators have accelerated fibre rollouts to improve network reliability, enhance transmission capacity, and support increasing data traffic. Continued investments in fibre-to-the-home (FTTH) and tower fiberisation are expected to strengthen digital infrastructure and facilitate efficient delivery of high-speed data services.

5G rollout driving network modernisation

A significant portion of industry capex in recent years has been directed towards 5G deployment, including radio network expansion, tower upgrades, spectrum utilisation, and transport network enhancement. While a large part of the initial 5G rollout has been completed, operators are expected to continue investing in network densification and coverage enhancement to improve service quality and support emerging enterprise and consumer use cases.

Gradual shift towards next-generation technologies

Beyond 5G, telecom operators are expected to gradually increase investments towards future-ready technologies, including network virtualization, cloud-native infrastructure, edge computing, and artificial intelligence-enabled network management. Early-stage investments in 6G research and ecosystem development are also expected over the medium term as the industry prepares for the next phase of wireless technology evolution.

India emerges as the second-largest global telecom market with over 1244 million mobile subscribers

Benchmarking of leading telecom markets indicates that India continues to be one of the most significant telecom ecosystems globally, with mobile subscriber additions supported by expanding digital connectivity and network infrastructure. India's telecom subscriber base increased from 1,001 million subscribers in CY2015 to 1,244 million subscribers in CY2025, representing a CAGR of 2.2% over the period. China is the largest telecom market with 1,869 million mobile cellular subscribers as of calendar year 2025.

With 1,244 million subscribers in CY2025, India maintained a substantial lead over other major telecom markets, including the United States (397 million), Indonesia (323 million), Russian Federation (278 million), Japan (234 million), and Brazil (216 million). The scale of India's telecom market reflects strong adoption of mobile services, increasing smartphone penetration, widespread network coverage, and continued investments in digital infrastructure.

While mature telecom markets such as the United States and Japan recorded moderate growth, emerging markets such as Pakistan (4.77% CAGR) and Bangladesh (3.52% CAGR) witnessed higher growth rates from a smaller subscriber base. In contrast, Indonesia and Brazil experienced a decline in telecom subscriptions over the decade, underscoring the resilience and sustained growth of India's telecom sector.

India has strengthened its position as a key global telecom hub, benefiting from its large population, favourable digital adoption trends, extensive 4G coverage, and rapid rollout of 5G services. The country's ability to sustain subscriber growth while maintaining one of the largest telecom customer bases globally highlights the long-term attractiveness of the Indian telecom market and its infrastructure ecosystem.

Mobile cellular subscriptions – India registered healthy growth among global peers

	Telecom customers in CY 2015	Telecom customers in CY 2025	CY 2015-2025 CAGR (%)
China	1292	1869	3.76%
India	1001	1244	2.20%
United States	332	397	1.80%
Indonesia	339	323	-0.49%
Russian Federation	227	278	2.03%
Japan	161	234	3.84%

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Brazil	258	216	-1.73%
Pakistan	126	201	4.77%
Bangladesh	131	186	3.52%
Nigeria	151	179	1.75%

Note: CY: Calendar year
Source: ITU, Crisil Intelligence

State-wise telecom subscriber base highlights strong connectivity across both urban and rural India

India's telecom sector has built a broad and diversified subscriber base, reaching approximately 1,330.6 million telecom subscriptions, comprising 778.8 million urban subscribers and 551.8 million rural subscribers. The distribution of subscribers across states highlights the extensive penetration of telecom services and the critical role of both metropolitan and rural markets in driving connectivity growth.

Uttar Pradesh is the largest telecom market in the country with 186.1 million subscribers, accounting for nearly 14% of India's total subscriber base, followed by Maharashtra (149.5 million), Karnataka (89.9 million), Tamil Nadu (84.1 million), Bihar (83.0 million) and West Bengal (82.8 million). These states collectively represent the largest telecom circles in India and form the backbone of the country's telecommunications ecosystem.

The analysis also reveals distinct differences in the composition of subscriber bases across states. Economically developed and highly urbanized states such as Maharashtra, Karnataka, Tamil Nadu, Gujarat, Haryana and Delhi derive a significant proportion of their telecom subscriptions from urban areas. Maharashtra has the largest urban subscriber base in the country with 107.1 million urban subscribers, followed by Uttar Pradesh (94.1 million), Karnataka (61.9 million) and Tamil Nadu (58.8 million), reflecting strong digital adoption, commercial activity and urban connectivity requirements.

At the same time, several states demonstrate the importance of rural telecom infrastructure in expanding digital inclusion. Uttar Pradesh leads with 92.0 million rural subscribers, followed by Bihar (52.6 million), Maharashtra (42.5 million), West Bengal (36.4 million) and Rajasthan (36.1 million). The sizeable rural subscriber base in these states underscores the increasing penetration of telecom services beyond urban centers and highlights the success of efforts aimed at expanding connectivity across rural and semi-urban regions.

Notably, states such as Bihar, Assam, Odisha and Himachal Pradesh have a relatively higher rural share of total subscriptions, indicating a strong dependence on rural telecom networks. In contrast, urban-centric regions such as Delhi, Chandigarh, Goa and Haryana exhibit a predominantly urban subscriber profile, consistent with their demographic and economic characteristics.

The state-level benchmarking highlights India's well-distributed telecom infrastructure landscape, with strong subscriber concentrations across both high-growth urban markets and densely populated rural regions. The balanced contribution from urban and rural subscribers provides a strong foundation for continued expansion of digital services, broadband penetration and next-generation telecom infrastructure across the country.

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State/UT wise subscriber base (wireline + wireless)

States/UTs	Total Telecom Subscription (million)		
	Total	Rural	Urban
Uttar Pradesh (UPE + UPW)	186.12	92.03	94.09
Maharashtra Incl. Mumbai	149.53	42.47	107.06
Karnataka	89.90	27.98	61.92
Tamil Nadu	84.13	25.30	58.84
Bihar	82.96	52.55	30.41
West Bengal Incl. Kolkata	82.84	36.37	46.46
Gujarat	74.02	27.00	47.02
Rajasthan	70.17	36.05	34.11
Madhya Pradesh	64.99	28.50	36.49
Andhra Pradesh	50.15	24.68	25.47
Delhi	46.70	0.63	46.07
Haryana	44.99	12.94	32.04
Kerala	44.53	18.99	25.55
Telangana	43.61	17.08	26.54
Odisha	39.39	24.09	15.31
Punjab	36.43	12.29	24.14
Assam	29.96	18.24	11.72
Jharkhand	27.22	14.80	12.42
Chhattisgarh	23.95	10.98	12.97
Jammu & Kashmir	13.72	6.63	7.09
Uttarakhand	13.09	6.33	6.76
Himachal Pradesh	9.70	6.32	3.38
Tripura	3.66	1.74	1.91
Meghalaya	3.03	1.92	1.11
Goa	2.48	0.68	1.8
Manipur	2.47	0.98	1.48
Chandigarh	1.89	0.04	1.85
Nagaland	1.65	0.88	0.77
Mizoram	1.52	0.57	0.95
Arunachal Pradesh	1.43	0.86	0.57
Puducherry	1.36	0.44	0.92
Dadra and Nagar Haveli and Daman and Diu	1.02	0.36	0.66
Sikkim	0.78	0.48	0.29
Ladakh	0.56	0.31	0.25
Andaman & Nicobar Islands	0.54	0.28	0.27
Lakshadweep	0.08	0.03	0.05
All India	**1330.58**	**551.79**	**778.79**

Note: TRAI data as of March 2026

Source: TRAI, Crisil Intelligence

Key emerging trends in the Indian telecom industry

The Indian telecom sector has evolved from being a connectivity provider to becoming a critical enabler of digital transformation, supporting AI, Industry 4.0, cloud computing, IoT, and digital public infrastructure. Rapid 5G deployment, increasing fiberisation of telecom infrastructure, growth of data centres, and network automation are driving substantial demand for tower deployment, network engineering, commissioning & integration, RF optimisation, and infrastructure maintenance services.

AI, IoT, Industry 4.0 and Data Centre Expansion

The Indian telecom sector is increasingly becoming the foundational digital infrastructure layer supporting Artificial Intelligence (AI), Internet of Things (IoT) and Industry 4.0 applications. The growing adoption of smart manufacturing

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connected assets, autonomous operations, digital twins, predictive maintenance and real-time analytics is driving demand for high-speed, low-latency and highly reliable connectivity. Telecom operators are therefore evolving beyond traditional connectivity providers and positioning themselves as enablers of enterprise digital transformation.

At the same time, rapid growth in cloud adoption, AI workloads, digitisation initiatives and data localisation requirements is accelerating investments in hyperscale and edge data centres across India. Data centre expansion is creating significant demand for fibre connectivity, network engineering, site deployment, power infrastructure and maintenance services. Government initiatives such as the IndiaAI Mission are expected to further accelerate the development of AI-ready digital infrastructure and strengthen the role of telecom networks in supporting next-generation enterprise applications.

5G Rollout and Network Densification

5G services have been rapidly expanded across the country, with network coverage reaching most districts and a significant number of 5G base stations deployed nationwide. As network deployment progresses, investments are increasingly directed toward densification and capacity enhancement to address growing data traffic demands and support applications such as Fixed Wireless Access (FWA), industrial automation, immersive digital experiences, and private enterprise networks.

Network densification requires the deployment of additional macro towers, small cells, indoor coverage systems and fibre backhaul infrastructure, particularly in urban centres and high-traffic locations. This trend is expected to drive sustained demand for tower infrastructure, network deployment, commissioning, integration and maintenance services over the next few years. Government initiatives such as the National Broadband Mission (NBM) 2.0, BharatNet and the GatiShakti Sanchar Portal are further supporting telecom infrastructure expansion by improving connectivity and simplifying Right-of-Way approvals.

Tower Fiberisation Trends

Tower fiberisation has emerged as a critical requirement for 5G network performance, as fibre provides the bandwidth, scalability and low latency necessary to support high-capacity mobile networks. With the growing deployment of 5G and increasing network traffic, telecom operators are prioritising fibre-based backhaul to improve network reliability and user experience.

The expansion of fibre infrastructure is being supported by government-led programmes such as the National Broadband Mission 2.0 and BharatNet, which continue to extend optical fibre connectivity across urban and rural India. As operators increase fibre penetration across tower networks and deploy a larger number of small cells, demand for fibre deployment, route planning, network engineering and telecom EPC services is expected to grow significantly.

Commissioning and Integration (C&I)

The increasing scale and complexity of telecom networks are driving demand for commissioning and integration services. Large-scale deployment of 5G equipment, fibre networks, cloud-native architectures and enterprise connectivity solutions requires seamless integration across multiple network layers and equipment vendors. Telecom operators are increasingly partnering with specialised service providers to accelerate rollout timelines while ensuring network performance and reliability.

The growing adoption of virtualised and software-defined network architectures is further expanding the scope of commissioning and integration activities, particularly in areas such as radio deployment, transport networks, core network

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modernisation and private 5G implementations. As network investments continue, commissioning and integration services will remain a key component of telecom infrastructure development.

Radio Frequency (RF) Optimisation

As telecom operators continue to expand and densify their 5G networks to accommodate growing data traffic, Radio Frequency (RF) optimization is becoming increasingly critical for maintaining network quality, coverage, and capacity. RF optimization involves the continuous assessment and adjustment of radio network parameters to improve signal performance, manage interference, and maximize spectrum efficiency. Effective RF planning and optimization enable operators to enhance network reliability, reduce congestion, improve coverage in high-density areas, and deliver a superior user experience across a wide range of 5G services and applications.

The industry is also witnessing growing adoption of AI-driven network analytics and automation tools for real-time network monitoring and performance optimisation. These technologies enable predictive fault detection, automated parameter tuning and network self-optimisation, helping operators improve operational efficiency while reducing network downtime. With the transition towards 5G-Advanced and AI-native networks, demand for RF optimisation, drive testing and network performance management services is expected to increase further.

Key growth drivers of the Indian telecom industry

Rising data consumption and growing smartphone penetration

The continued increase in smartphone adoption, digital service usage and video consumption has led to significant growth in mobile data traffic across India. Telecom users are increasingly consuming high-bandwidth applications such as video streaming, online gaming, digital payments, cloud applications and AI-enabled services, necessitating continuous network capacity augmentation by operators. The surge in data demand is prompting investments in spectrum utilisation, network densification, additional tower deployments and fibre backhaul infrastructure to maintain service quality and network performance. Average monthly wireless data consumption per subscriber has risen significantly, making India one of the world's largest mobile data markets.

Ongoing network modernisation and upgradation

Telecom operators are undertaking continuous network modernisation programmes to improve network efficiency, capacity, coverage and operational performance. Investments are being directed towards upgrading legacy infrastructure, deploying advanced 5G technologies, virtualising network functions and adopting cloud-native architectures. Operators are also increasingly leveraging automation and AI-enabled network management solutions to improve customer experience, optimise resource utilisation and reduce operating costs. These modernisation initiatives are creating sustained opportunities for network deployment, commissioning and integration, RF optimisation and managed services providers.

Expansion of digital infrastructure

The rapid growth of cloud computing, artificial intelligence, enterprise digital transformation and data localisation requirements is accelerating investments in hyperscale and edge data centres across India. Major technology companies and cloud service providers continue to expand data centre capacity, particularly in key hubs such as Mumbai, Chennai, Hyderabad and Noida. This expansion is driving demand for high-capacity fibre connectivity, network engineering services, edge infrastructure and telecom support infrastructure. As telecom networks increasingly serve as the backbone

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for AI and cloud ecosystems, data centre growth is expected to remain a significant driver for fibre deployment, tower infrastructure and related telecom services.

Key reforms and regulatory actions in the Indian telecom industry

Regulations	Development
Relaxation of spectrum cap	• In 2018, the spectrum holding cap was increased from 25% to 35% in a circle. The intra-band cap of 50% holding in a circle was removed, but 50% cap was also imposed on combined spectrum holdings in the sub-1 MHz band per circle
The Telecommunication Tariff (Sixty Third Amendment) Order, 2018	• Under this order, if tariff is found to be predatory, the service provider will be charged an amount not exceeding Rs 5 million for each service area, provided it holds a significant market power in the service area, i.e., at least 30% share in the service area
National Digital Communication Policy, 2018	• This policy facilitated the development of communication infrastructure and services to achieve inclusive social-economic growth in the country
International termination charge	• In February 2018, the TRAI reduced the ITC payable by an international long-distance operator (ILDO) to the access provider on whose network the call terminates from Rs 0.53 per minute to Rs 0.30 per minute. It was again revised in May 2020 – to a range, i.e., a minimum of Rs 0.35 and maximum of Rs 0.65 per minute
Apex court on AGR definition	• In October 2019, the Supreme Court ruled in favour of DoT with regard to definition of AGR revenues, resulting in telecom players being liable to pay dues of the past 14 years as per the order, including interest, penalty and interest on penalty
Moratorium on spectrum payments	• In 2019, the Indian government announced a moratorium of two years on deferred spectrum payments
Scrappage of IUC	• In January 2021, the TRAI scrapped the termination charges for local and national long-distance calls for all telecom operators
Spectrum auctions	• The DoT initiated the formal process of auctions, scheduled to be held in March 2021. The auctions included spectrum across all bands, except 5G
Apex court slashes incumbent's plea	• The Supreme Court rejected the plea of telecom operators of recalculating the AGR dues to arithmetic errors in 2021
Cabinet announces AGR relief package and other key reforms	• In September 2021, the Union Cabinet approved a landmark telecom reform package to improve sector viability and encourage investment. • Key measures included a four-year moratorium on AGR and spectrum dues, rationalisation of AGR by excluding non-telecom revenues, approval of 100% FDI under the automatic route, simplification of interest and penalty provisions on statutory dues, extension of spectrum tenure from 20 to 30 years, and removal of additional Spectrum Usage Charges (SUC) on spectrum sharing and future spectrum auctions.
SUC (Spectrum-Usage Charge)	• In June 2022, the DoT removed the 3% floor on SUC, as it announced the weighted average of SUC to be calculated by the sum of the product of spectrum holdings and applicable SUC rate divided by the telecom company's total spectrum holdings. No SUC will be applied on spectrum auctioned in 2022.
Digital Bharat Nidhi (DBN)	• Digital Bharat Nidhi (DBN), formerly Universal Service Obligation Fund (USOF), funds telecom connectivity in underserved and remote regions of India. Following the Telecommunications Act, 2023, USOF was renamed DBN to support universal digital access.

Regulations	Development
	• As of July 2026, DBN-supported initiatives have commissioned 25,085 mobile towers, extending coverage to 35,367 villages across the country.
5G auctions	• The DoT accepted the price cuts recommended by TRAI for the 2022 5G auctions. Also, the Cabinet permitted enterprises to run 'captive non-public networks'. Enterprises were allowed to take spectrum on lease from service providers to run private network.
Telecommunications Act, 2023	• Replaces colonial-era laws (the Indian Telegraph Act, 1885 and the Indian Wireless Telegraph Act, 1933) with a consolidated framework covering authorisation, spectrum assignment, right of way, national security and user protection. • Key sections were notified in a staggered manner from mid-2024, with further rules (including the 2026 Authorisation Rules) operationalising the shift from a licence-based to an authorisation-based regime. The Act separates telecom infrastructure ownership from the underlying property on which it sits, intended to reduce disputes when the property changes hands.
Right of Way (RoW) Rules, 2024 and the Gati Shakti Sanchar Portal	• The RoW Rules 2024, notified under the Telecommunications Act, require public entities to provide right of way on a non-discriminatory and non-exclusive basis and to run applications through the centralised Gati Shakti Sanchar Portal (launched 2022) rather than multiple disparate state/authority platforms.
Licence-to-authorisation regime shift (2026 Authorisation Rules)	• The Telecommunications (Authorisation for Provision of Principal Telecommunication Services) Rules, 2026 operationalise a statutory, pan-India or circle-wise, unified authorisation framework in place of the legacy licensing regime, marking one of the most significant overhauls of India's telecom regulatory architecture.
AGR dues restructuring for financially stressed operators	• The Department of Telecommunications has restructured Vodafone Idea's AGR payment schedule, including a multi-year moratorium followed by staggered annual payments extending to 2041, aimed at easing near-term cash pressure and improving access to institutional funding.
Review of Infrastructure Provider (IP-I) registration and Digital Connectivity Infrastructure Provider (DCIP) framework	• TRAI has floated consultation papers on reviewing the scope of Infrastructure Provider Category-I (IP-I) registration and on introducing a Digital Connectivity Infrastructure Provider (DCIP) authorisation, both directly relevant to how tower and fibre infrastructure providers are classified and regulated going forward.

Source: TRAI, DoT, PIB, DBN, Crisil Intelligence

Key challenges and risks in the Indian telecom industry

Challenge / Risk	Key Insights
Right of Way implementation gaps at state and local level	• Despite the RoW Rules 2016/2024 and the Gati Shakti Sanchar Portal, industry bodies report continuing state-to-state variation — long and unpredictable approval timelines, inconsistent documentation, high or arbitrarily varying fees, and occasional coercive action such as site sealing. • Several central ministries (roads, environment, railways, defence) have also been slow to fully align with central RoW guidelines, citing their own departmental rules, which continues to complicate pan-India rollout.
Sector-wide financial stress and AGR liabilities	• Outstanding AGR dues across telecom operators are estimated at over ₹1,770,000 million as of FY24-25, with Vodafone Idea alone accounting for approximately ₹89,952 million.

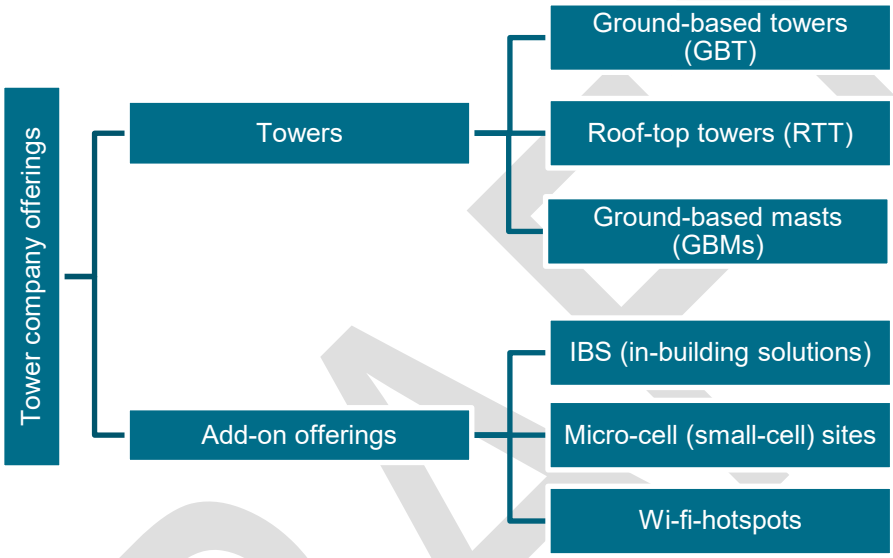
Challenge / Risk	Key Insights
	• Because towercos and infrastructure providers earn a meaningful share of revenue from Vi, continued financial stress at any major operator carries direct counterparty and receivables risk for the passive-infrastructure segment, even where near-term collections have stabilised.
Low tower fiberisation base relative to target	• Only a limited amount of Indian towers are fiberized, and cable-laying speeds would need to rise to close the gap on the originally envisaged timeline. • This shortfall constrains the backhaul capacity available to support 5G densification and future network technologies until closed.
High capex intensity and funding constraints	• Indian operators' capex-to-revenue ratio is well above the global median, reflecting the scale of ongoing 5G and capacity investment relative to sector revenues. • Financially weaker operators' constrained access to traditional bank funding — linked in part to AGR-related uncertainty — can indirectly slow the pace of network rollout and, by extension, demand visibility for EPC, fibre and maintenance providers.
Land, power and site-acquisition constraints	• Access to reliable power and suitable land parcels is flagged as a key constraint on both telecom tower and data-centre infrastructure build-out, even as operators and developers actively pursue new locations. • Site acquisition, statutory siting clearances and local public apprehension around new tower installations remain recurring operational hurdles for deployment contractors and towercos.
Urban–rural connectivity and monetisation divide	• Teledensity shows a pronounced urban-rural gap — roughly 154% in urban areas (reflecting multiple-SIM ownership) against about 61% in rural areas as of July 2026 — indicating that future subscriber and infrastructure growth is increasingly weighted toward lower-ARPU rural markets. • Extending towers and fibre into these markets typically carries a different risk-return profile than urban densification, a factor relevant to investment prioritisation across the value chain.

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2.2. Overview of telecom tower industry in India

The tower segment, traditionally divided into ground-based towers (GBT) and roof-top towers (RTT), has marginally diversified into IBS (in-building solutions), micro-cell (small-cell) sites, and Wi-Fi-hotspots due to an increase in data traffic and technological advancements. These new technologies, having begun to proliferate in the Indian sub-continent on a small scale, are expected to expand their presence in the future as telecom service providers (TSPs) look to densify their existing network coverage.

Telecom towers industry – Value Chain



Source: Crisil Intelligence

Additionally, within telecom towers, the industry can be further subdivided on the basis of active and passive infrastructure. Passive infrastructure forms the majority at around ~70% of the capital costs of setting up a wireless network in India and includes towers, shelters, power-regulation equipment, battery back-ups, diesel generator (DG) sets, air-conditioners, fire extinguishers and security cabins required at sites where telecom towers are installed.

Telecom towers are mainly of two types – i.e., ground-based or roof-top towers, RTT and GBT. RTT requires less space compared with GBT and has lower installation cost. However, its capacity is comparatively less than that of RTT.

Additionally, space limitations on each site and overall limited availability of land for tower installation have expanded the traditional tower products to ground-based masts (GBMs) that occupy lesser space relative to GBTs and RTTs.

Key participants of telecom tower industry

Companies	Participation as Core Node in Value Chain
Indus Towers Ltd.	Provides passive telecom infrastructure including towers, power, equipment shelters, and co-location services to telecom operators through a shared infrastructure model. Operates across all 22 telecom circles with 267,611 towers and 432,250 co-locations.

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Companies	Participation as Core Node in Value Chain
Altius Telecom Infrastructure Trust	Owns and manages telecom infrastructure assets comprising Summit Digitel, Crest Digitel, and former ATC India assets. Operates one of India's largest telecom tower portfolios with ~257,000 telecom sites.
GTL Infrastructure Ltd.	Deploys, owns, and manages shared passive telecom infrastructure. Leases tower capacity to wireless telecom operators under long-term contracts and operates as a neutral infrastructure provider.
Ascend Telecom Infrastructure Pvt. Ltd.	Provides passive telecom infrastructure on a Build-Lease-Operate basis including ground-based towers, rooftop towers, smart poles, small cells, fiberized sites, and infrastructure-sharing solutions.
BSNL Tower Infrastructure	Owns and leases telecom tower assets to telecom operators and supports tower-sharing arrangements for 4G and 5G network expansion.
Bharti Hexacom Tower Assets	Supports wireless network deployment in its operating circles through ownership and use of telecom infrastructure assets. Bharti Hexacom is identified among key operator customers utilizing tower infrastructure.
HFCL Ltd.	Provides telecom infrastructure solutions including fiber-optic networks, telecom equipment, network deployment, and connectivity infrastructure that enable tower backhaul and 5G expansion.
RailTel Corporation of India Ltd.	Provides nationwide fiber infrastructure and telecom network backbone services used for tower connectivity, backhaul, and broadband transport.
Nxtra by Airtel	Provides digital infrastructure including edge, fiber, and connectivity infrastructure supporting telecom network operations and service delivery.
Sterlite Technologies (STL)	Deploys fiber networks and digital infrastructure that connect telecom towers and support 4G/5G network densification and backhaul requirements.

Source: Crisil Intelligence

Tower additions to moderate as the 5G rollout cycle matures

Telecom service providers are continuously expanding and upgrading their networks to support rising data consumption and improve service quality, translating into sustained demand for tower infrastructure. The number of telecom towers is estimated to increase to ~1.04-1.07 million by fiscal 2031 from around 0.855 million in fiscal 2026, reflecting a CAGR of about 4-5%. The growth is expected to be supported by continued expansion of network coverage in rural areas, requiring the installation of additional towers, as well as ongoing efforts by operators to enhance network reach and capacity.

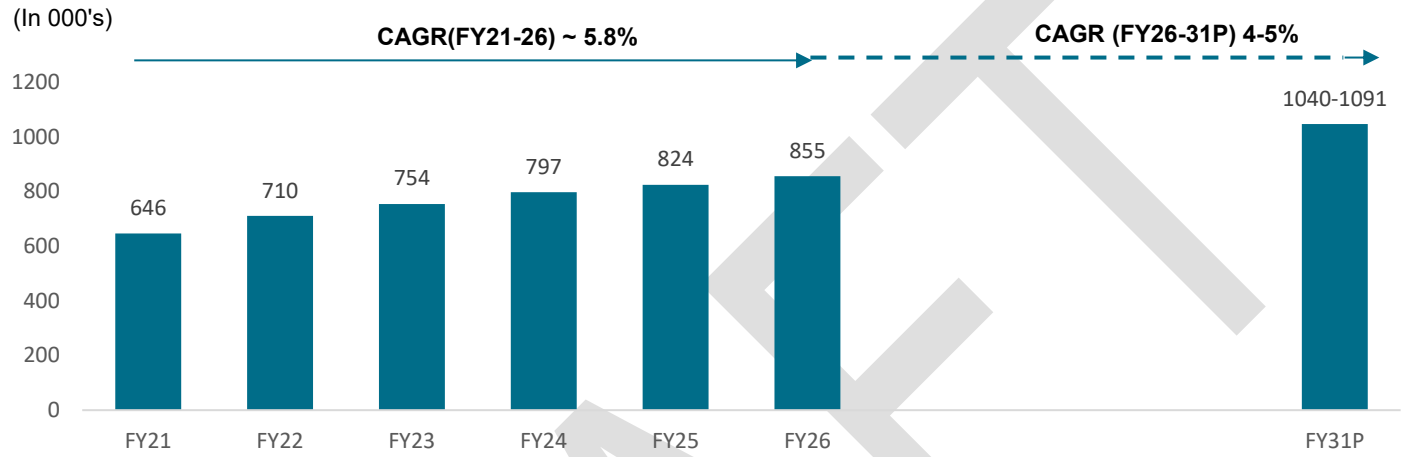
Over the past five years, growth in the telecom tower industry has been driven by increasing mobile data traffic, rapid deployment of 4G and 5G networks, the need to improve network quality and coverage, and deeper penetration of telecom services in rural and underserved regions. Additionally, telecom operators have continued to invest in network densification to support growing data demand and ensure seamless connectivity.

Rapid urbanisation is also supporting the tower industry. Growing population density in urban centres leads to higher communication traffic, necessitating additional tower infrastructure to improve connectivity, strengthen network performance and reduce congestion.

CRISIL Intelligence estimates the number of telecom towers to grow at a CAGR of 4-5% between fiscals 2026 and 2031.

While growth will continue to be driven by rural coverage expansion, increasing adoption of data-intensive services and network densification initiatives, the pace of tower additions is expected to moderate compared with the previous five-year period due to the maturation of the initial 5G rollout cycle and stabilisation in demand for new BTS (Base Transceiver Station) deployments, with operators increasingly focusing on optimising and enhancing existing network infrastructure and possible 6G deployments in the future.

Number of towers in India (FY21-31P)



P: Projected
Source: Crisil Intelligence

Industry tenancy ratio to improve on continued network investments

The telecom tower industry witnessed a moderation in tenancy ratio over the past few years, with the ratio declining to 1.42 times in FY25 from 1.47 times in FY23. While tenancy additions remained healthy, supported by 5G rollouts, network densification initiatives, and expansion of coverage in rural areas, a significant share of these additions occurred on single-tenant towers following consolidation in the telecom sector. As a result, the increase in tenancies did not fully translate into higher tower-sharing levels.

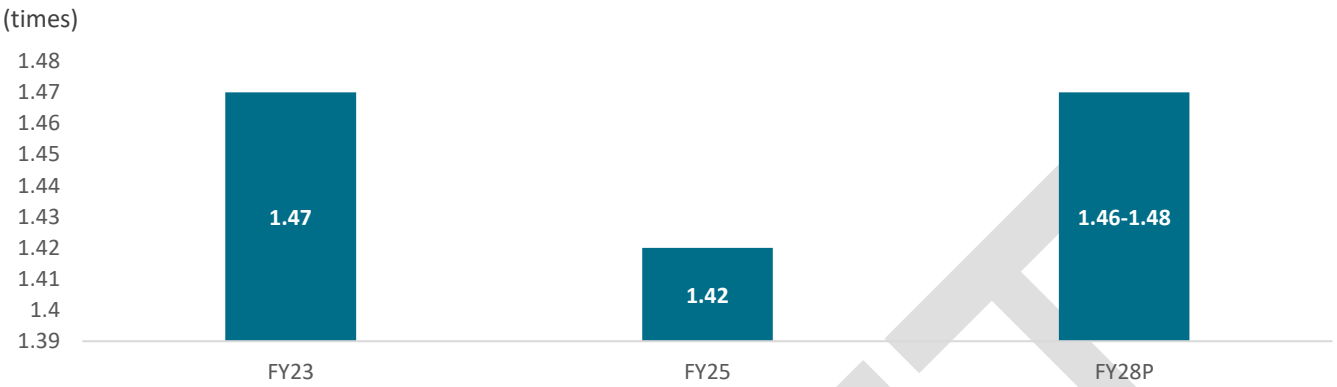
Going forward, tenancy growth is expected to be supported by a revival in capex by telecom operators aimed at expanding 4G networks and strengthening 5G coverage. Incremental tenant additions on existing tower sites, particularly in overlapping coverage circles, are likely to improve asset utilization and drive higher tower-sharing levels across the industry. CRISIL expects tenancy growth to accelerate to 5-6% over FY27 and FY28, supported by continued network expansion requirements.

Consequently, the industry tenancy ratio is projected to improve to 1.46-1.48 times by FY28, driven by increased co-locations on existing towers rather than large-scale additions of new tower sites. The improvement reflects growing infrastructure sharing among telecom operators as they focus on expanding network coverage and capacity in a cost-efficient manner.

The expected increase in tenancy ratio is likely to strengthen operating leverage for tower companies through better absorption of fixed costs and higher average revenue per tower. Improved infrastructure utilization, coupled with continued investments in tower upgrades and energy-efficient solutions, is expected to support healthier profitability and cash flow generation for the sector over the medium term.

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Telecom tower industry tenancy ratio trends (FY23-FY28P)



P: Projected
Source: Crisil Intelligence

GBTs to dominate tower industry, despite a decrease in their share

As of fiscal 2026, GBTs are estimated to be dominating the overall tower industry with a share of 51%, followed by RTTs at 28% and GBMs at 21%.

However, going forward, share of GBTs is estimated to decrease owing to high capex and space constraints. The cost of building a GBT is Rs 2.5-3.0 million, more than double that of building an RTT. However, GBTs can accommodate three-five tenants, whereas RTTs can only house two-three tenants. Monopole towers are ~75% cheaper than GBTs and can house 1-2 BTS. This fiscal the share of GBTs is expected to decline to ~49-50%, while that of RTTs is expected to be 30-31% and GBMs' 20-21%.

Segmentation of telecom towers based on installation type (FY26 and FY31P)



Notes: E – estimated; P – projected
GBMs: Ground based monopoles, GBTs: Ground based towers, RTTs: Rooftop towers
Source: Crisil Intelligence

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Passive telecom infrastructure market is projected to be between ~Rs 2,000-2,100 billion between fiscals 2026-31

Telecom tower companies set up an entire range of passive infrastructure to be used by telecom operators to offer services to their subscribers. Passive infrastructure refers to equipment such as towers, shelters, power regulation equipment, battery back-ups, diesel generator (DG) sets, air-conditioners, fire extinguishers and security cabins required at sites where telecom towers are installed.

Passive infrastructure does not play any role in carrying wireless signals, but it is a vital part of the network as it ensures the operationality of active components. Though passive infrastructure is independent of the type of communication technology being used, the extent of its installation is determined by the number of operators mounting their base stations at a particular site.

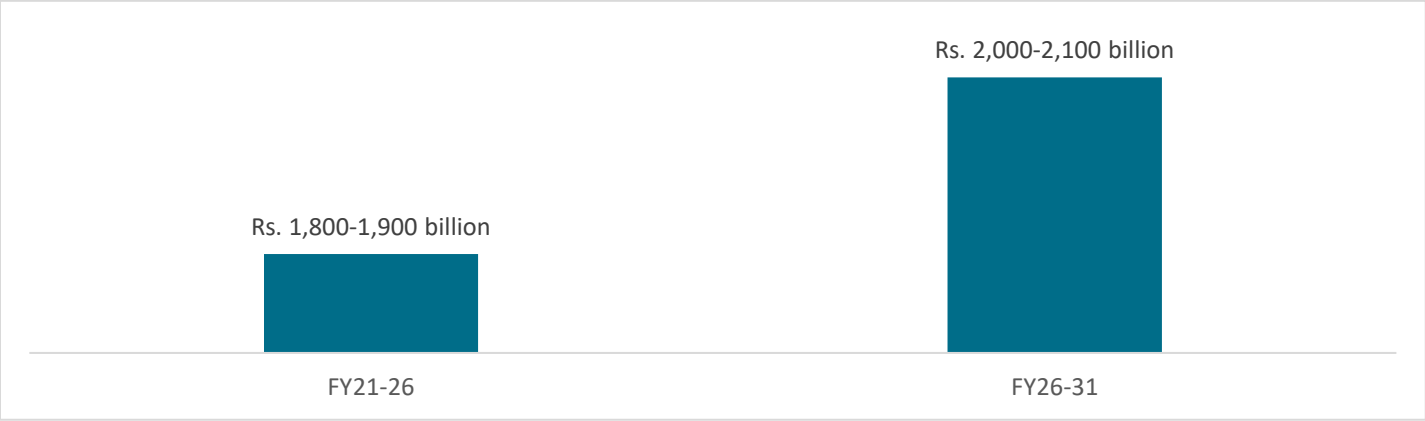
Some of the key passive infrastructure products are:

Product	Description
Shelter	An enclosure that houses the BTS and other equipment at tower sites. The shelter keeps the equipment at tower sites protected from the vagaries of the external environment and reduces the amount of sunlight coming into the room where the BTS is housed.
Power management system	The system performs the functions of handling power fluctuations, phase selection and lightning & surge protector
Air conditioning systems	It is used to cool down the temperature within the shelter.
Battery back-up	It provides back-up during short term disruptions of power supply
Diesel generator set	It provides back-up power supply in case of prolonged disruptions of electricity supply

Source: Crisil Intelligence

Between fiscals 2021-2026, passive telecom infrastructure market size in India is estimated at Rs 1,800-1,900 billion (cumulative) and is projected to increase moving forward to ~Rs 2,000-2,100 billion between fiscal 2026-2031.

Passive telecom infrastructure market in India



Source: Crisil Intelligence

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Active telecom infrastructure market is projected to be between ~Rs 3,500- 3,600 billion between fiscals 2026-31

Active infrastructure refers to the electronic equipment that transmits, receives and routes wireless signals, as distinct from the passive elements that merely support and protect it. It comprises the base transceiver station (BTS) and its associated radio and baseband units, antennas, feeder and jumper cables, backhaul transmission systems (microwave links and optical fibre) and the switching and controller elements of the network. Unlike passive infrastructure, active infrastructure is technology-specific, equipment deployed for 4G cannot be directly reused for 5G without upgrade or replacement, and each operator at a shared tower site installs its own active elements. Traditionally, active infrastructure has been owned and operated by telecom service providers, while tower companies restricted themselves to passive assets.

This distinction has been gradually narrowing. Following amendments to the infrastructure provider (IP-1) registration framework, tower companies are permitted to own, deploy and maintain a defined set of active elements, such as antennas, feeder cables and transmitters/receivers, and lease them to operators on a shared basis. Combined with active sharing permissions, this has opened a new revenue stream for tower companies beyond conventional site rentals and is expected to grow in relevance as operators seek to reduce capital intensity while densifying networks.

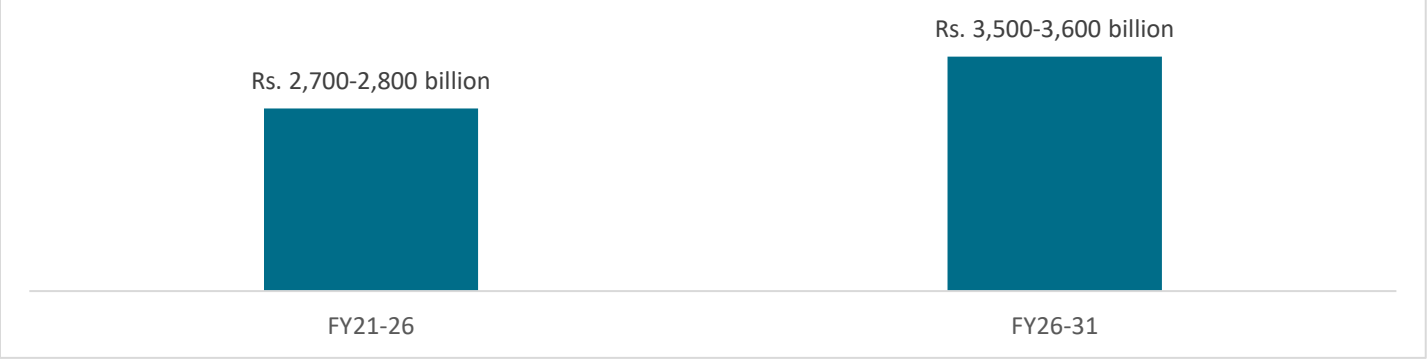
Some of the key active infrastructure products are:

Product	Description
Base transceiver station (BTS)	Equipment that transmits and receives radio signals between user devices and the network
Antenna	Radiates and receives radio frequency signals within a defined coverage area
Remote radio unit (RRU)	Tower-mounted unit that converts digital signals to radio frequency signals
Baseband unit (BBU)	Processes digital signals and connects the radio units to the core network
Backhaul equipment	Microwave links and optical fibre that connect the site to the core network

Source: Crisil Intelligence

Between fiscals 2021-2026, active telecom infrastructure market size in India is estimated at Rs 2,700-2,800 billion (cumulative) and is projected to increase moving forward to ~Rs 3,500-3,600 billion between fiscal 2026-2031.

Active telecom infrastructure market in India



Source: Crisil Intelligence

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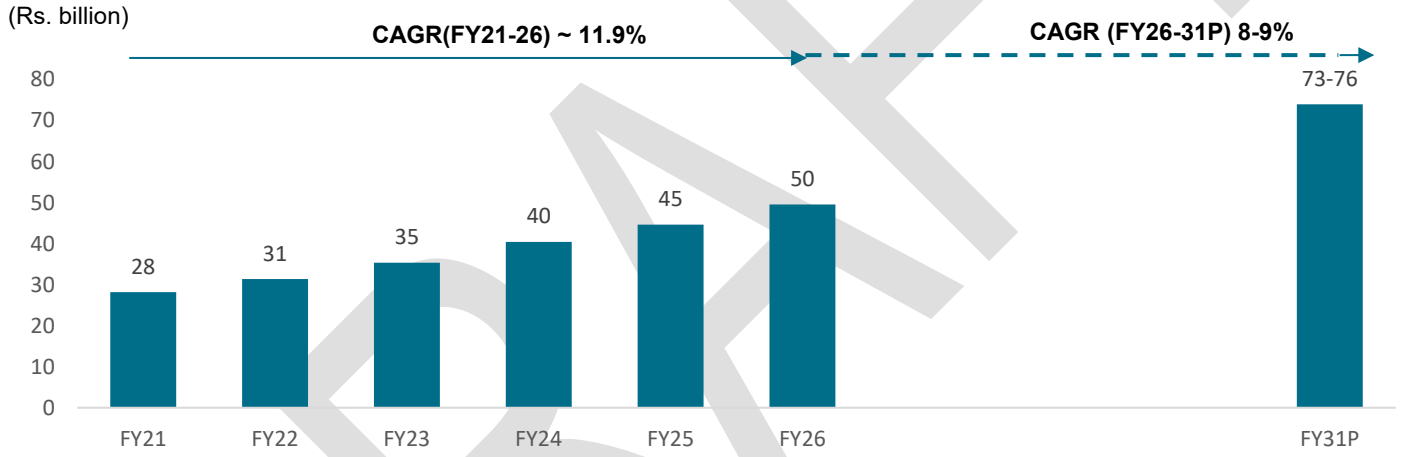
Market of maintenance of telecom towers to rise on back of tower additions

Tower companies incur a considerable amount of capex to maintain different towers and ensure their smooth functioning. A tower consists of various components that need regular servicing to increase the life of the tower and prevent disruptions. Hence, they incur capex to maintain and service the equipment such as DG sets, air-conditioners and electrical equipment.

Maintenance capex is usually incurred on towers (and related infrastructure) that are two-three years old. Further, the existing towers will likely warrant higher maintenance expenses. The allocation for repairs and maintenance is likely to rise in proportion with the rise in overall capex.

As of fiscal 2026, telecom tower maintenance industry stood at ~ Rs 50 billion, up from Rs 28 billion in fiscal 2021. During this period, the industry had registered a CAGR of ~11.9% majorly driven by high number of tower additions. Moving forward, industry growth is expected to moderate to 8-9% due to slow down in tower addition.

Telecom tower maintenance market size in India (FY21-31P)



Note: The aforementioned market size includes only maintenance expenditure incurred related to tower. It does not encompass operating expenses like rent, power and fuel, etc.

Source: Crisil Intelligence

The network life cycle refers to the full sequence of stages through which a telecommunication network, and each of its constituent assets, passes over its useful life, from initial conceptualisation to eventual retirement. It typically begins with network planning, where coverage and capacity requirements are assessed against information on the existing network and infrastructure, including exchanges and routers, transmission equipment and cables, and buildings and duct systems. Planning is followed by design and engineering, site survey and acquisition, securing statutory approvals and right of way, and procurement. The deployment stage then covers civil and electrical works, erection of towers and poles, laying of optical fibre, and the installation, integration, testing and commissioning of network equipment. Once commissioned, the network enters its longest stage, operation and maintenance (O&M), which is followed over time by optimisation, upgrades and technology migration, and finally decommissioning, dismantling or redeployment of assets that are no longer technically or commercially viable.

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Key success factors of the telecom tower O&M industry in India

Success factors	Description
Predictive and remote-led maintenance	• Shifting from reactive, visit-based upkeep to sensor-based remote monitoring, centralised network operations centres and AI-driven fault prediction. • Standardised preventive-maintenance workflows reduce site visits, speed up fault resolution and improve uptime against service-level commitments.
Energy management and green power transition	• The adoption of solar-hybrid infrastructure, lithium-ion batteries, and smart energy management solutions enables telecom operators to reduce energy-related operational risks, improve site availability, and deliver more sustainable O&M outcomes.
Skilled and safety-certified field workforce	• Building multi-skilled technician pools across passive infrastructure, power systems, fibre and active equipment, with certified work-at-height and electrical-safety training.
Densification and neutral-host capability	• Extending service scope beyond macro towers to small cells on street furniture, in-building solutions and fibre backhaul. • The RoW Rules 2024, TRAI's property digital-connectivity rating framework and the new Digital Connectivity Infrastructure Provider authorisation favour providers with this capability.
Site Resilience and asset security	• Hardening sites against floods, cyclones and heat stress through elevated power equipment, adequate battery backup, pre-positioned spares and fuel, and rapid-deployment units such as cells-on-wheels. • Secured battery cabinets, smart locks and intrusion alarms reduce theft-led outages.
Outcome-based contracting and ecosystem partnerships	• Moving to uptime- and KPI-linked contracts with transparent performance dashboards, backed by long-term partnerships with equipment OEMs, energy-solution providers and local field contractors. • Cluster-based operations and scale procurement enable competitive pricing without diluting service quality.

Source: Crisil Intelligence

SWOT analysis of the telecom tower O&M industry in India

S (strengths)	• **Expanding site base:** Nationwide 5G rollout (5,62,971 5G BTS as of June 2026) has enlarged the equipment base needing recurring maintenance. • **Shared infrastructure model:** Multi-tenant passive sites spread O&M costs across operators, improving per-site service economics. • **Recurring, contract-backed demand:** Long-tenure infrastructure service agreements create predictable, annuity-like O&M demand. • **Enabling regulatory framework:** Telecommunications Act, 2023 and RoW Rules, 2024 simplify permissions and penalise damage to critical telecom infrastructure. • **Proven enabling technologies:** Remote monitoring, IoT sensors, lithium-ion storage and solar-hybrid systems are commercially mature for site use.
W (weaknesses)	• **High energy intensity:** Energy is a major cost head; erratic rural grid supply sustains diesel dependence and costly fuel logistics. • **Skilled manpower gaps:** Shortage of certified technicians for climbing power systems and 5G equipment limits service quality and scale.

	• **Fragmented field execution:** Reliance on multi-tier local subcontractors leads to uneven workmanship, safety compliance and SLA adherence. • **Uneven RoW implementation:** A few states and several central departments are yet to fully align with RoW Rules 2024, delaying site access. • **Customer concentration:** O&M volumes depend on capex cycles of a small number of telecom operators, limiting pricing power.
O **(opportunities)**	• **5G densification:** Small cells on street furniture, enabled under the RoW framework, create demand for high-volume, low-footprint maintenance. • **6G readiness:** The Bharat 6G Vision targets deployment by 2030, and DoT has released a 6G spectrum roadmap. Future 6G site upgrades and densification will create a long-term O&M pipeline for tower infrastructure • **In-building and neutral-host services:** TRAI's building connectivity ratings and the 2026 DCIP authorisation extend O&M scope to in-building and active assets. • **Rural and government-funded networks:** Around 24,000 towers commissioned under Digital Bharat Nidhi-funded projects need long-term O&M in remote terrain. • **Rising tenancies:** Tenancy additions are expected to accelerate over FY27–FY28, raising equipment load and O&M value per site.
T **(threats)**	• **Climate and disaster risk:** A DoT–CDRI study mapped hazard risk across 0.77 million towers by Jan 2025; floods, cyclones and heat drive outages and restoration costs. • **Theft and vandalism:** Theft of batteries, cables and power equipment raises downtime, replacement and security costs at unmanned sites. • **Pricing and margin pressure:** Calibrated operator capex and cost optimisation can compress O&M rates and shift risk via penalty-linked SLAs. • **Rising compliance obligations:** 2026 network rules mandate in-India storage of network systems, data and logs, on top of EMF and battery-waste norms. • **Community resistance:** EMF-related public apprehension, despite norms at one-tenth of ICNIRP limits, can trigger site-access disputes and relocations.

Source: Crisil Intelligence

Key government regulations

No provision for input tax credit

Government released sector-specific rates under the goods and services tax (GST) in May 2017. Under the GST regime, towers are not getting the benefit of input tax credit as everything attached to the earth is considered an immovable property. Given the inability to pass on the impact of GST to telecom players, the tower players may witness a negative impact on their bottom line.

An order by the Delhi High court in 2018 had allowed central value added tax (CENVAT) credit on telecom towers and parts, including prefabricated shelters, which were in dispute. The tax authorities was of the view that on the ground of 'immovable' nature of equipment, the tower firms did not qualify for input tax credit.

National Digital Communications Policy 2018

The DoT released the draft national telecom policy, rechristened National Digital Communications Policy (NDCP) 2018, for consultation on May 1, 2018.

Key provisions in the draft policy related to towers and allied services are:

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- It facilitates fibre-to-the-tower programme to enable fiberisation of at least 60% base stations thereby speeding up the migration from 2G/3G to 4G/5G
- Extends incentives and exemptions for the construction of telecom towers
- Promotes deployment of solar and green energy for telecom towers
- Creates a broadband readiness index for states/ union territories to attract investments and address and accelerate right of way (RoW) challenges

Currently, less than one-fourth of the towers are fiberised in India compared with more than three-fourth in major economies, such as China and the US. Fiberisation will quicken expansion of the Internet of Things (IoT) ecosystem to 5 billion connected devices.

On 11 August 2022, the DoT had sought TRAI's recommendations on creation of a new category of license, Telecom Infrastructure License (TIL); the terms and conditions for according such license; applicable license fee etc. under Section 11(1) (a) of the TRAI Act 1997. In response, the regulator released recommendations on telecommunication infrastructure sharing, spectrum sharing and spectrum leasing on 24 April 2024.

Ambiguity in RoW implementation impacts tower rollouts

However, RoW has been an issue for the telecom sector participants in India. Delays because of variable and complex procedures across states, non-uniformity in levies and obtaining approvals from the forest department, railways and National Highway Authority of India have greatly impacted planning and rollouts of towers and fibre laying across the country.

RoW rules introduced in November 2016 are yet to bring benefits to the telecom sector owing to lack of clarity and hesitancy of some states. The rules should have expedited the deployment of underground (optical fibre) and over ground (mobile towers) infrastructure in India. They rationalise administrative expenses for fibre across the country to a maximum of Rs 1,000 per km and for overhead towers at a maximum of Rs 10,000 per application.

Additionally, as per the Right of Way (Amendment) Rules, 2023, licensees are allowed to deploy telecom infrastructure over a private property without approval from the concerned government authority. This will boost tower additions going forward and hasten the creation of 5G infrastructure in the country.

According to the dashboard on the RoW portal, as of May 2024, 34 states/union territories have been on-boarded, with 53,364 applications received so far, out of which 19,330 were approved, 17,042 rejected, 21,564 pending, and 1,854 sent back. This is creating huge impediments in installation of mobile towers and, in turn, affecting quality of service according to the Tower and Infra Providers Association (TAIPA).

Infrastructure status accorded to telecom towers

The government accorded infrastructure status to telecom towers in 2012, which meant the segment will get all the benefits the infrastructure sector enjoys, including priority electricity connection. Also, to avoid any disruption in communication, it was specified that BTSs could not be sealed or electricity supply to them disconnected without approval of the respective telecom enforcement, resource and monitoring cell of the DoT in case of radiation-related issues.

Regulations regarding health impact spread of towers

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Different state government agencies follow different approval procedures for setting up telecom towers. Also, the state governments have certain reservations when granting approvals for telecom towers in residential areas on account of health concerns. This could delay expansion plans of tower companies.

The DoT fixes standards for exposure limits of radio frequency field emissions from BTSs, monitors their compliance, addresses all radiation-related technical issues and seeks Standing Advisory Committee for Frequency Allocation's (SACFA) clearance for frequency allocation.

Multiple government bodies have placed restrictions on new tower constructions, on grounds that they pose health hazards and congest the skyline. Operators emitting more than approved levels of radiation are fined Rs 1,000,000 per BTS. According to the new rules, tower companies have to submit a compliance certificate within 15 days of switching on a telecom tower. In addition, many towers, especially in urban areas, face danger of being declared illegal. This poses a major challenge for tower companies while considering investments in new towers.

Capex to surpass Rs. 300 billion in FY27

The Indian telecom towers industry experienced rapid growth in capital expenditure (capex) from FY16 to FY21, driven by the massive rollout of 4G services and network expansion, resulting in the addition of over 1.1 million base transceiver stations (BTS). However, the growth pace slowed down from FY21 to FY26, with approximately 984,400 BTS added during this period. Looking ahead, the industry is expected to add around 364,000 BTS over FY27-FY28, primarily driven by the expansion of 5G networks.

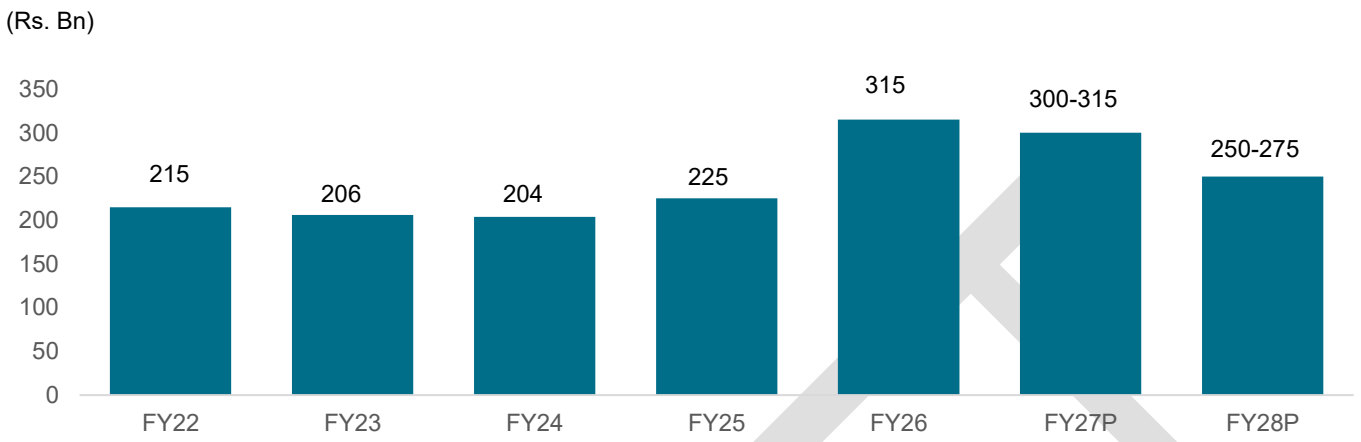
As telecom companies focus on replacing 2G and 3G tenancies with 4G tenancies, the growth of 4G BTS is slowing down. In contrast, 5G BTS is expanding rapidly to support the growing 5G subscriber base and providing enhanced data usage and network performance. The deployment of 5G technology requires denser BTS networks, which limited conventional, massive Ground Based Tower (GBT) construction capex growth in FY26. Nevertheless, telecom players are likely to adopt alternative technologies such as small cells and MIMO to augment capacity.

The need for speedy 5G deployment led to the installation of additional towers and BTS, resulting in increased construction capex. One of the top three players has already opted for a standalone 5G deployment mode, which has resulted in higher capex. Another player is expected to opt for the standalone mode of deployment by FY27.

Crisil Intelligence expects operators to focus on improving tenancies on existing towers and invest in tower fiberisation to improve quality of services and cater to evolving requirements of the tenants. Thus, we expect a cumulative capex of ~Rs 600 billion over FY27 and FY28.

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Capex in telecom tower sector (FY22-28P)



Note: P - Projected
Crisil's forecast is based on the expansion of operators, estimated mix of ground-based towers (GBTs) and rooftop towers (RTTs), capex required to build a tower, and incremental capex needed to maintain it. But it does not include the capex incurred by telcos to build their captive towers.
Source: Crisil Intelligence

The telecom tower business is capital-intensive as it entails setting up towers, upgrading them to accommodate new tenants, and improving efficiency by upgrading to more efficient technology/power sources. Companies incur an upfront capital cost for the construction of mobile towers. The cost of this depends on the type of tower, such as GBT or RTT, or monopole. The cost of building a GBT (Rs 2.5-3.0 million) is more than double the cost of building an RTT. Monopole towers cost ~75% lesser than a GBT and can house 1-2 BTSs. Apart from construction capex, players also incur capex in maintenance, the addition of tenants, and making sites diesel-free after installation.

The capital required to set up a tower depends on its type and height. The main capex heads are:

- Construction and tower cost, which constitutes ~45% of the total capital cost for a GBT and ~20% for an RTT
- Cost of equipment such as shelters, air-conditioners, diesel generators, batteries, and electrical equipment such as voltage stabilisers, switched-mode power supplies and cables
- Pre-operative expenditure such as expenses for local approvals, municipal deposits, and civil works for the gate and fence

Capex cost of GBT

Construction / Equipment	% of Capex
Tower & Construction Cost	45-50%
Electrical works	14-18%
Diesel Generator	8-12%
Shelter	8-12%
Battery	5-7%
Air Conditioners	2-3%
Others	5-8%

Note: Above share is indicative and can change based on the year
Source: Industry, Crisil Intelligence

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Capex cost of RTT

Construction / Equipment	% of Capex
Tower & Construction Cost	17-23%
Electrical works	25-30%
Diesel Generator	8-10%
Shelter	8-12%
Battery	12-15%
Air Conditioners	6-10%
Others	3-7%

Note: Above share is indicative and can change based on the year
Source: Industry, Crisil Intelligence

Construction capex

Capital expensed by tower companies to set up new towers is classified as construction capex. With a need for speedy 5G deployment, we expect the pace of tower additions to grow going ahead, which will warrant the share of construction capex to remain constant. Most tower additions will be done in rural areas as the telcos would look to expand their rural subscriber base against an already saturated urban subscriber base (urban teledensity is on a decline). Additionally, tower density (per sq km) in urban areas is more than 0.18 towers (with metros having over 20 towers per sq km) versus less than 0.14 in rural areas.

Upgradation capex to account for a majority share in the pie

The number of 2G, 3G and 4G BTSs is expected to remain flat further going forward as operators will push subscribers towards 5G with 2G & 3G BTS expected to be completely slow down by FY25. Moreover, 4G BTS additions will also likely slow down as major two players announced their intent to limit 4G additions and focus on 5G. Incremental 4G BTSs will only be installed in sites that previously housed 2G/3G BTSs. However, with the telecom services industry leader preferring a standalone mode of launch, the share of upgradation capex will get impacted.

Maintenance capex

It is usually incurred on towers (and related infrastructure) that are two to three years old. Our industry interactions suggest a tower requires a maintenance expense of Rs 55,000-60,000 every year. Further, the existing towers will likely warrant higher maintenance expenses, the current amount allocated by tower players on repairs and maintenance is likely to rise in proportion to the rise in overall capex.

Key growth drivers of the Indian telecom tower industry

Drivers	Description
Expansion of 4G and 5G Networks	The nationwide rollout of 5G services is significantly increasing the demand for telecom infrastructure. Telecom operators require denser networks with additional tower sites and small cells to deliver high-speed connectivity, low latency, and enhanced coverage. Continued investments in network modernization and 4G coverage enhancement further support tower tenancy growth.

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Rising Mobile Data Consumption	India is among the world's largest consumers of mobile data. Growing adoption of video streaming, online gaming, social media, digital payments, and cloud-based applications is driving exponential growth in data traffic. To handle this increasing demand, telecom operators need expanded and upgraded tower infrastructure.
Increasing Smartphone Penetration	Affordable smartphones and declining data tariffs have accelerated internet adoption across urban and rural areas. The growing number of connected users necessitates additional network capacity and coverage, creating sustained demand for telecom towers.
Rural Connectivity and Digital Inclusion	Government initiatives aimed at improving rural broadband access and bridging the digital divide are driving tower deployment in underserved regions. Programs such as BharatNet and various rural connectivity projects are increasing the need for telecom infrastructure in remote locations.
Growth of IoT and Enterprise Connectivity	The proliferation of Internet of Things (IoT) devices, smart cities, connected manufacturing, logistics tracking, and industrial automation is increasing demand for reliable and extensive wireless networks. This trend supports long-term expansion of telecom tower assets and edge infrastructure.
Data Center and Edge Infrastructure Development	As cloud adoption and digital services expand, telecom tower companies are increasingly diversifying into data centers, fiber networks, and edge computing infrastructure. The convergence of telecom towers with digital infrastructure ecosystems presents new growth opportunities and revenue streams.

Source: Crisil Intelligence

Key challenges and risk factors

RoW yet to bring benefits to telecom tower industry

Introduced in November 2016, the RoW rules did not bring any benefit to the telecom sector as they lacked clarity and many states remain hesitant to comply. The rules could have been a key enabler for expediting the deployment of underground (optical fibre) and overground (mobile towers) infrastructure in the country. They aim to rationalise administrative expenses across the country to a maximum of Rs 1,000 per km for fibre and a maximum of Rs 10,000 per application for overhead towers.

However, delays as a result of variable and complex procedures across states and non-uniformity in levies greatly impacted the planning and rollouts of towers and fibre laying across the country. The NDCP 2018 advocates establishment of a National Digital Grid by creating a National Fibre Authority; establishing Common Service Ducts and utility corridors in all new cities and highway road projects; creating a collaborative institutional mechanism between the Centre, states and local bodies for common RoW; standardising costs and timelines; and removing barriers to approvals. However, the implementation will remain a key monitorable. In April 2022, the DoT launched a centralised RoW portal, Sugam Sanchar (translated as accessible connectivity), which will provide single-window clearance for stakeholders to apply and track applications. According to the dashboard on the portal, 34 states/ union territories have been onboarded, with 53,364 applications received so far, of which 27,942 have been approved, 15,287 rejected, 7,553 pending, and 2,582 sent back.

Loading of sites hurt revenue generating potential of towers

A loaded site implies that a single telecom operator has installed more than one BTSs on a single tower. Telecom tower players offer discounts to telecom service providers to install multiple BTSs on the same tower. A loaded BTS commands a much lower rent (~50% of the actual rent that a single tenant pays), and hence, impacts revenue generation for the tower company.

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Going forward, the industry is expected to witness loaded sites to account for a higher proportion of incremental tenancies, as operators look to improve the quality of service to retain subscribers. This will be done by installing capacity BTSs at sites that already have coverage BTSs. Capacity BTSs help reduce congestion in select areas and improve network efficiency. However, they will mostly be loaded on to existing BTSs, thus hurting the revenue generation of tower players.

Consolidation, entry of a new captive player hurt industry

Consolidation of telecom players is a key risk for tower companies as it results in the loss of overlapping tenancies. Although, this risk is somewhat offset by consolidation among the tower companies.

Consolidation in the telecom industry has not only resulted in a shift in the bargaining power in favour of the TSPs but also in a loss of certain tenants/ tenancies. As a result, telecom players are bargaining aggressively for competitive rates for new tenancy additions. Entry of captive tower companies with sizable towers is expected to have pressured rent revenue and margin in the industry.

Zoning may cause speed bumps in tower rollouts

Multiple government bodies are placing restrictions on the construction of telecom towers (a practice called zoning) as they are considered a health hazard. Mobile tower radiation in India is governed by guidelines drawn from recommendations of the International Commission on Non-Ionising Radiation Protection. All operators are required to get their BTSs certified for radiation. Operators emitting more than the approved levels of radiation must pay a fine of Rs 1,000,000 per BTS.

There is still uncertainty about which all areas are permitted for tower installation. Towers are not allowed to be installed on government buildings, hospitals, defense areas, etc. Controversies about health hazards with respect to the emissions from towers compound the difficulties.

Active Infrastructure sharing

Traditionally, telecom players shared only towers (passive infrastructure). However, with newer concepts such as radio access network sharing and after the DoT permitted active infrastructure sharing in 2008, operators may increasingly begin sharing BTSs, back haul and even base service stations (BSCs). This has led to significant savings in terms of capital and operating expenditure for operators but has also reduced the tenancy for tower players. In NDCP-2018, there was a proposal to expand coverage of Infrastructure Providers Category-I (IP-1) infra sharing and its outcome remains a key monitorable. This has enabled a significantly enhanced scope of services for IP-1 and provides passive as well as active infrastructure services to enhanced service providers, including TSPs.

However, sharing active infrastructure is a technically complex process, as network planning can vary significantly across operators and locations. Globally, too, active infrastructure sharing has not been very successful.

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3. Assessment of Horizontal Directional Drilling (HDD) in India

3.1. Overview of structure of HDD industry in India

Horizontal Directional Drilling (HDD) is a steerable, trenchless method employed for the installation of underground pipes, conduits, and cables along a predetermined bore path, eliminating the need for continuous trench excavation. HDD is widely utilized across a range of critical end-use segments, including the installation of underground optical fibre cable (OFC) ducts, city gas distribution (CGD) pipelines, cross-country pipeline crossings, pressurised water mains, and underground power cables.

Its significance to the telecom and telecom tower industry lies in its role as the enabler for underground fibre deployment, which serves as the essential backhaul medium for tower fiberisation, 5G densification, and rural broadband programmes.

Key benefits of HDD compared with open-cut trenching are summarised below:

Parameter	HDD	Open-cut trenching
Cost	Typically involves higher installation cost than conventional trenching; however, total project costs can be lower in urban areas when road restoration, pavement reinstatement, traffic management and road-cutting charges are considered.	Generally, offers the lowest installation cost in open and uncongested areas. However, in urban environments, restoration of roads, footpaths and landscaping, coupled with municipal reinstatement charges, can significantly increase overall project costs.
Construction Feasibility Across Site Conditions	Particularly suited for crossings and constrained locations such as highways, railways, rivers, water bodies, congested urban corridors and environmentally sensitive areas where surface excavation is restricted, undesirable or impractical.	Generally preferred in open, accessible and less congested areas where continuous excavation can be undertaken with limited physical, environmental or traffic-related constraints.
Surface disruption	Requires excavation only at strategically located entry and exit pits, enabling underground utility installation with minimal disruption to traffic flow, businesses, public utilities and pedestrian access.	Requires continuous excavation along the alignment, resulting in greater disruption to road users, businesses and public access throughout the construction period, along with subsequent pavement restoration requirements.
Environmental Impact	Smaller surface footprint and limited disturbance to vegetation, water bodies and existing infrastructure. Suitable for crossing environmentally sensitive areas. Drilling fluid management and monitoring of inadvertent fluid returns ("frac-outs") remain important considerations.	Involves extensive excavation and reinstatement, leading to greater disturbance of soil, vegetation and surface features. Waterbody crossings may require temporary diversion, dewatering or other mitigation measures.
Asset protection	Drill paths can be guided beneath existing utilities and infrastructure, subject to accurate utility identification and mapping, potentially reducing conflicts with existing assets and lowering the risk of future third-party damage through deeper installation.	Continuous excavation increases interaction with existing underground utilities and infrastructure, requiring greater utility coordination, relocation planning and asset protection measures during construction.

Source: Crisil Intelligence

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Value chain of the HDD industry

The value chain of HDD operates across three broad segments, with demand ultimately derived from the capital expenditure cycles of end-user asset owners.

Upstream: Equipment OEM and suppliers

The value chain originates with original equipment manufacturers, authorised dealers and component suppliers that manufacture and supply the core operating assets deployed by contractors. This includes HDD rigs across mini, midi and maxi capacity classes, downhole tooling such as drill pipes, bits, reamers, hole openers, swivels and stabilisers, and guidance systems ranging from walkover locators for shallow urban bores to wireline and gyroscopic steering tools for long or deep crossings. Fluid management equipment comprising mud pumps, mixing units and solids control or recycling systems forms an equally critical input.

Midstream: Planning, Design and Execution

Project development begins with design consultants, survey firms and geotechnical agencies, which undertake route surveys, existing utility mapping using ground penetrating radar and electromagnetic locators, soil and rock investigation, bore path design, pullback load calculations, drilling fluid programme design and statutory permitting support. The quality of work at this stage is a critical determinant of project outcomes, as inadequate subsurface investigation is a leading cause of cost overruns, bore abandonment and third-party utility damage claims.

In the execution phase, EPC or turnkey contractors typically hold the principal contract with the asset owner and assume responsibility for detailed engineering, procurement, subcontractor coordination, quality and safety compliance and stakeholder interface management. HDD drilling contractors perform the specialised trenchless scope, covering site establishment, pilot boring with continuous steering control, reaming to the required borehole diameter and pullback of ducts, pipe or cables, followed by pressure and proving tests and as-built documentation. Specialist subcontractors support ancillary activities such as pipe fusion, welding and non-destructive testing, cable blowing and splicing, bore tracking, drilling fluid disposal and site restoration.

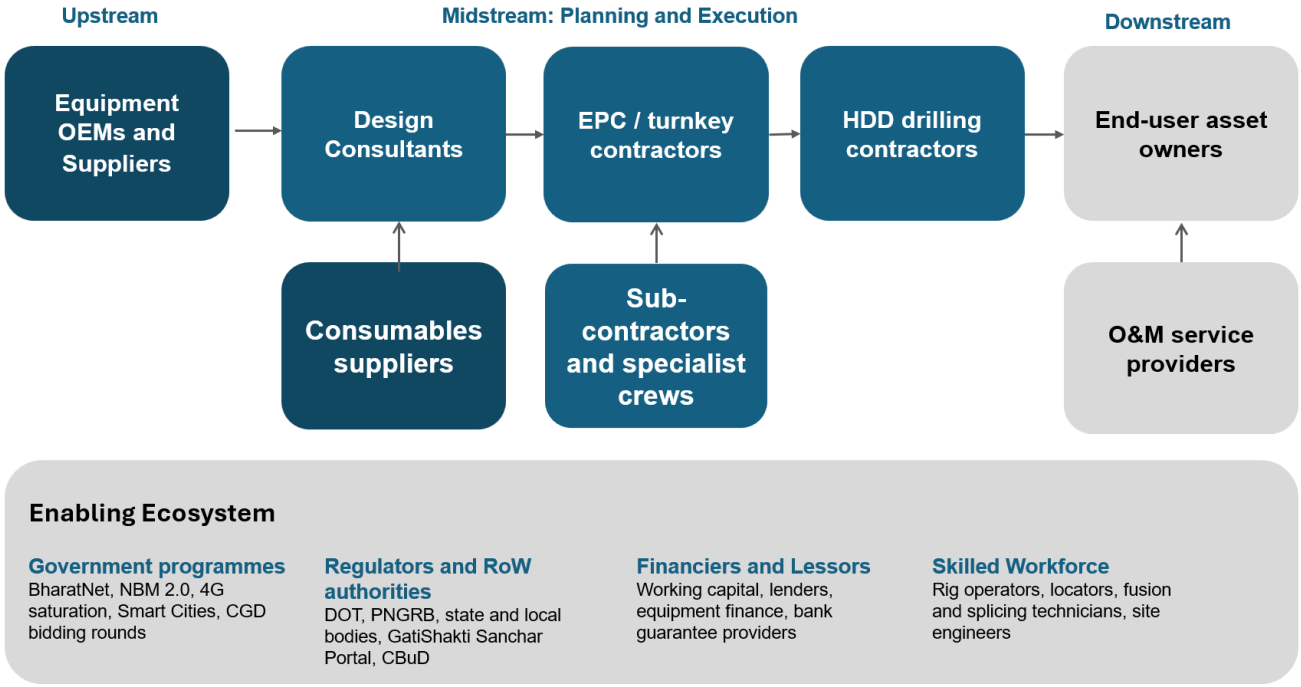
Downstream: Asset Owners and Operations and Maintenance

Demand across the chain originates from end-user asset owners, including telecom operators and fibre infrastructure providers, power utilities and transmission licensees, oil and gas companies and city gas distribution entities, water and sewerage utilities and urban infrastructure agencies such as municipal bodies, metro rail authorities and highway and railway agencies. Following commissioning, O&M service providers undertake inspection, condition monitoring, fault localisation, duct cleaning, repair, rehabilitation and capacity augmentation, generating relatively stable annuity-type revenues that scale with the growing installed asset base.

The wider ecosystem is enabled by government infrastructure and connectivity programmes that anchor long-term demand, right-of-way and regulatory authorities whose permitting timelines represent a principal source of schedule risk, financing institutions and equipment lessors that lower entry barriers for smaller operators, and the availability of trained operators, locators and mud engineers, which remains a structural constraint on capacity expansion.

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Value chain of HDD industry



Key stakeholders of the HDD industry

Upstream	• **Equipment OEMs and Suppliers:** Suppliers of HDD rigs (mini, midi and maxi classes), drill pipe, drill bits and reamers, transmitters and walk-over or wireline locating systems, mud pumps and mud recycling units, and pipe fusion machines. OEM pricing, lead times and after-sales support directly affect contractor capex and fleet availability.
Midstream: Planning and Execution	• **Consumables suppliers:** Suppliers of HDPE PLB ducts and micro-ducts, MDPE and steel pipe, bentonite, polymers and drilling additives, and optical fibre cable while drilling fluid and tooling wear parts are borne by the HDD contractor and represent key variable cost alongside employee/ worker expenses and fuel. • **Design Consultants:** Conduct route surveys, utility mapping, geotechnical studies and bore design. • **EPC / Turnkey Contractors:** Manage end-to-end project execution, procurement and contractor coordination. • **HDD Drilling Contractors:** Execute pilot boring, reaming and pullback operations for trenchless installations. • **Sub-contractors & Specialist Crews:** Provide specialised services such as fusion, splicing, tracking and restoration.
Downstream	• **O&M Service Providers:** Maintain installed networks through inspections, repairs and fault restoration. • **End-user Asset Owners:** Own infrastructure assets and drive project demand through capex investments.

Source: Crisil Intelligence

HDD industry spans organised and unorganised contractors, differentiated by scale and contracting mode

The Indian HDD industry is a services industry organised around ownership and operation of rig fleets. It is highly fragmented, with a long tail of single-rig and small-fleet operators serving local telecom and city gas distribution (CGD) work, alongside regional contractors operating multi-rig fleets across multiple states, and a small group of organised contractors with pan-India presence, multi-utility capability and in-house allied services such as fusion, blowing and splicing. Organised contractors are increasingly engaged directly by telecom operators, infrastructure providers and CGD entities under framework or rate contracts, while the unorganised segment mostly works as sub-contractor to EPC firms or to the organised contractors themselves.

Demand is intermediated to a significant degree by EPC and turnkey contractors. In telecom, the optical fibre EPC contractor is typically awarded a route or a circle by the asset owner and then either self-performs the drilling or sub-contracts it to specialist HDD firms, retaining design, material supply, fibre blowing, splicing, testing and commissioning. In CGD, authorised entities generally award steel and MDPE pipeline laying contracts, with HDD used as one of several construction techniques for installing pipeline sections and crossings. In oil and gas pipelines, HDD crossings are frequently carved out as separate specialist packages because of the equipment and engineering involved.

The industry is asset-intensive relative to its revenue base, with contractors' competitive positioning shaped by factors such as fleet size and composition, equipment utilisation, crew productivity, operational efficiency, and the ability to mobilise resources quickly across geographies. Working capital requirements are significant, as billing is typically milestone-based and linked to route completion, testing, commissioning milestones, and right-of-way (RoW) closure.

HDD applications span key end-use segments, including telecom

The application of HDD spans multiple infrastructure sectors, where it is used to install underground pipelines, conduits, and cable networks while minimizing surface disruption. Some of the key applications of HDD are as follows:

- **Telecommunications segment:**

It is one of the key end use segments of HDD, particularly for the deployment of fibre optic cables and underground conduit networks. As governments and telecom operators continue to expand broadband coverage, HDD can also be used to install fibre infrastructure beneath roads, railways, urban corridors, and other obstacles where open excavation would result in significant disruption. The method is also relevant for fibre-to-the-home (FTTH), fibre-to-the-premises (FTTP), and fibre backbone projects requiring underground connectivity across populated areas

Furthermore, a key driver within this segment is the fiberisation of telecom towers. Fiberisation refers to the process of connecting existing mobile towers and base transceiver stations to optical fiber backhaul networks, replacing legacy copper and microwave links that are limited in bandwidth capacity. The process entails the laying of fiber optic cables from central network nodes or fiber points of presence to individual tower sites, often traversing considerable distances through urban, suburban, and semi-rural geographies. Fiberisation programs necessitate the installation of fiber conduits at scale, with routes frequently passing beneath roads, intersections, railway lines, and congested utility corridors where conventional open-cut trenching would result in disruption to surface activities and existing underground utilities. In such cases, HDD can serve as a relevant installation method. HDD is employed in fiberisation programs for road crossings, dense urban corridors, and other sections of fiber routes where trenchless installation offers operational and logistical advantages over conventional trenching

- **Oil and gas segment:**

HDD is utilized for the installation of transmission pipelines, distribution networks, gathering lines, and pipeline crossings where conventional trenching may be impractical or environmentally sensitive. Typical applications include river crossings, wetlands, protected habitats, highways, rail corridors, and densely developed areas where minimizing surface disturbance is critical.

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HDD is also employed for offshore-to-onshore shore approaches, enabling pipelines to be routed beneath beaches, coastal zones, and nearshore environments while reducing impacts on coastal ecosystems and existing infrastructure

- **Power transmission and distribution segment:**

HDD facilitates the installation of underground electrical cable systems, particularly where overhead infrastructure is impractical or undesirable due to land-use constraints, environmental considerations, urban development requirements, or regulatory mandates.

Utilities utilize HDD for cable crossings beneath rivers, highways, rail corridors, airports, and densely congested areas. The method is also employed for grid interconnections associated with renewable energy projects, battery energy storage systems, substations, and industrial developments where underground cable routing is required.

- **Others:**

Beyond telecommunications, oil and gas, and power infrastructure, HDD finds application across a range of other sectors, including water and wastewater infrastructure, urban utility corridors, smart city projects, environmental remediation activities, etc. In these applications,

HDD is utilized to install water pipelines, sewer networks, stormwater systems, multi-utility conduits, and other underground infrastructure while minimizing disruption to existing roads, communities, and environmentally sensitive areas. HDD may also be used for horizontal wells in environmental remediation projects, including groundwater monitoring and contaminant extraction activities.

Overview of working capital cycle for the industry

The HDD industry operates a working capital cycle shaped by the project-based nature of its contracts and the capital-intensive character of its operations. The industry is capital intensive, as operations depend on specialized machinery, including drilling rigs, mud recycling systems, locating equipment, etc. The acquisition of such assets requires substantial upfront investment, which may increase reliance on external financing, thereby influencing liquidity planning. However, some contractors may adopt leasing or rental arrangements in place of outright purchase, as leasing reduces the initial capital outlay, converts a portion of fixed costs into periodic obligations, and transfers a share of maintenance and obsolescence risk to the lessor. The determination between ownership and leasing affects the composition of the working capital cycle, since ownership increases fixed asset intensity and depreciation charges, whereas leasing introduces recurring obligations within operational cash outflows.

The operating cycle commences with the procurement of raw materials and consumables, including drilling fluids, drill pipes, and cutting tools, together with expenditure on fuel and equipment maintenance. Inventory is maintained at levels sufficient to support ongoing and forthcoming projects.

Accounts receivable constitutes a significant component of the cycle. Payments are generally linked to project milestones or completion stages, and presence of retention clauses may further extend the collection period. Furthermore, contracts relating to public infrastructure and utilities frequently carry longer payment terms than those in the private commercial segment. On the payables side, suppliers of materials and service providers extend credit terms that partially offset the receivables period. However, a timing mismatch may arise between outflows for wages, fuel, and equipment and inflows from payments received, thereby creating a funding requirement during project execution.

Overall, the working capital profile of the HDD industry is influenced by the interplay between capital investment requirements and the timing of operational cash flows. However, working capital intensity varies significantly across companies. Factors such as project size and duration, customer mix (government, utility, telecom, oil & gas, or private sector), contract structure, milestone-based payment schedules, retention money provisions, mobilisation advances, geographic spread of projects, extent of subcontracting, equipment ownership versus leasing strategy, and the scale of operations all affect working capital requirements. In addition, companies with diversified service portfolios and exposure to multiple infrastructure segments may exhibit working capital profiles that differ materially from contractors focused solely on

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HDD activities. Consequently, cash conversion cycles can vary substantially across market participants depending on their business model, project portfolio, bargaining power with customers and suppliers, and stage of project execution.

For reference, the median cash conversion cycle (CCC) of selected companies with exposure to the HDD segment, calculated at the overall company level, stood at (158) days in FY25, compared with (118) days in FY24.*

Working capital days/ Cash conversion cycle (CCC)

CCC	FY24	FY25
CCC (median)*	-118	-158

*Note: *The above estimates have been prepared based on the reported financials of the selected companies i.e. Pratap Technocrats Private Limited, SG Encon Limited, Kalpataru Projects International Limited, Adani Infra (India) Limited, Corrtech International Limited, Mansi Ganga Builders and Engineers Private Limited, Dilip Buildcon Limited, Ace Pipeline Contracts Private Limited, Trenchless Engineering Services Private Limited and EnProCon Enterprise Limited. The financial data considered is at the overall company level and not specifically attributable to the HDD business segment/product category. Further, the peer set included for the analysis is indicative and not exhaustive.*

Source: Company filings, Crisil Intelligence

3.2. Key growth drivers of the industry

Government policies and programmes across infrastructure and end use segments

Government expenditure programmes constitute the principal source of underlying demand for HDD services, since outlays incurred within these schemes, directly underdetermine the quantum of underground utility installation undertaken. In the infrastructure segment, AMRUT provides for augmentation of urban water supply and sewerage systems, the Jal Jeevan Mission for household tap connections and associated distribution networks, the Pradhan Mantri Krishi Sinchayee Yojana for piped water conveyance, and the Smart Cities Mission for placement of telecom, power, water and sewerage utilities below ground within existing rights of way. In the telecom segment, the Digital India programme establishes the framework for expansion of digital connectivity, while BharatNet provides for optical fibre connectivity to gram panchayats and, under its amended scope, to habitations below the panchayat level. The National Broadband Mission and National Broadband Mission 2.0 prescribe targets in respect of optical fibre route kilometres, tower fiberisation and household broadband connections.

These programmes translate into HDD demand since the works contemplated are executed along existing road alignments and congested urban corridors where surface excavation is restricted by municipal conditions governing road cutting and traffic movement. Streamlined right of way approvals under the Indian Telegraph Right of Way Rules further support execution timelines and capacity utilisation for contractors.

Selected government schemes

Scheme	Description
BharatNet	India's flagship rural broadband programme. As of August 2026, the CAG reported 0.219 million Gram Panchayats (96.7% of the revised target of 0.226 million Gram Panchayats) had achieved service-ready status, while connectivity had been extended to over 0.215 million Gram Panchayats. The programme remains a major driver of fibre deployment and network maintenance requirements.
Amended BharatNet Programme (ABP)	Upgrades are underway for 14,294 Gram Panchayats, including ring-topology conversion, new fibre deployment across more than 30,000 villages, and demand-based connectivity expansion, supported by an investment of approximately Rs. 56.91 billion. As of June 2026, 43,908 km of OFC had been laid and 0.013 million Gram Panchayats upgraded, indicating substantial remaining rollout scope.

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Scheme	Description
National Broadband Mission (NBM) 2.0	Targets operational OFC connectivity to 0.27 million villages by 2030, 95% network uptime, broadband connectivity to 90% of anchor institutions, and reduction of RoW approval timelines to 30 days. As of March 2026, average fixed broadband speed reached 61.55 Mbps and broadband connectivity covered 2.18 million anchor institutions.
Telecommunications Act, 2023 & RoW Rules, 2024	Introduced a streamlined Right-of-Way (RoW) framework that improves the predictability of telecom infrastructure deployment through standardised processes, deemed approval provisions, and a formal approval mechanism for network roll-out.
GatiShakti Sanchar Portal	GatiShakti Sanchar Portal supports the National Broadband Mission's objective of reducing RoW approval timelines and improving coordination for telecom infrastructure deployment through a unified digital approval framework.
Call Before u Dig (CBuD)	National utility-protection platform that facilitates coordination between excavation agencies and underground asset owners through utility mapping, alerts, and pre-excavation checks, supporting safer underground construction and reducing utility damage risks.

Source: Government sources, Crisil Intelligence

Tower fiberisation

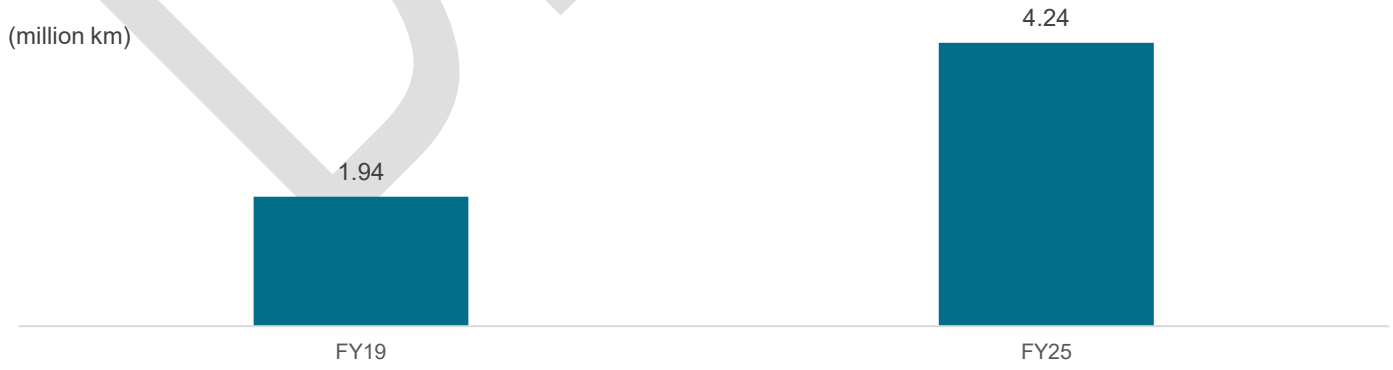
Fiberisation of telecom towers involves connecting tower sites to optical fibre networks to provide high capacity backhaul connectivity, either replacing or supplementing microwave links. The need for fibre backhaul is being driven by the rollout of 5G services, fixed wireless access (FWA) and ongoing network densification, all of which require significantly higher network capacity and lower latency. Accordingly, the National Broadband Mission identifies fibre deployment and enhanced fibre connectivity as key enablers for expanding broadband access and supporting the development of next-generation digital infrastructure in India.

As telecom infrastructure constitutes a key end-use segment for HDD services, continued investment in optical fibre network expansion is expected to support demand for HDD, especially in specific sections such as highway, railway and waterbody crossings, congested urban corridors, and other locations where trenchless construction offers operational or environmental advantages over conventional excavation methods.

Optical Fibre Network EPC growth

The expansion of India's optical fibre infrastructure continues to be a key driver for the optical fibre EPC and HDD industries. According to Department of Telecommunications, India's optical fibre network grew from 1.94 million route kilometres in 2019 to 4.24 million route kilometres in 2025, reflecting sustained investments in telecom and digital infrastructure.

India’s Optical Fibre Network



Source: PIB, Crisil Intelligence

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Demand for fibre deployment is being driven by multiple end-use segments, including 5G network expansion, tower fiberisation, fibre-to-the-home (FTTH) rollouts, enterprise and data centre connectivity, and government-led rural broadband initiatives under the National Broadband Mission (NBM) 2.0 and the Amended BharatNet Programme. The long-term outlook remains favourable, with NBM 2.0 targeting operational fibre connectivity to approximately 0.27 million villages by 2030, creating significant opportunities for additional fibre deployment.

The evolving nature of fibre deployment is also likely to positively influence HDD demand. A growing share of network expansion is taking place in urban and peri-urban areas, along telecom tower connections, FTTH networks and transport corridors, where conventional open-cut trenching is often constrained by traffic, right-of-way and other site considerations. In such conditions, trenchless construction methods may be adopted more extensively, which could position HDD contractors to benefit from the continued expansion of India's fibre infrastructure.

Overview of key optical fibre deployment programmes

Programme/ Scheme	Service provider	Description
BharatNet III project (Jammu & Kashmir leg)	Sterlite Technologies Ltd. consortium with Dilip Buildcon Limited	Contract was valued at Rs. 26 billion (Rs.16.25 billion in capex and Rs. 9.75 billion for operations & maintenance)
T-Fiber (Telangana Fiber Grid Corporation Ltd.)	Sterlite Technologies Ltd.	Deployment of 0.064 million km of OFC network covering 3,000 Gram Panchayats across 11 districts; project value of approximately Rs. 18.0 billion
PowerTel	POWERGRID Teleservices Ltd.	100,000+ km telecom network deployed using Optical Ground Wire (OPGW) on transmission lines across India
MahaNet-I	Sterlite Technologies Ltd.	Project aims to connect 4,045 Gram Panchayats across eight districts in Vidarbha. Initial disclosed project value was Rs. 15.12 billion.
BharatNet (formerly National Optical Fibre Network) project	RailTel Corporation of India Ltd.	Project aimed at connecting 0.25 million Gram Panchayats through optical fibre infrastructure with a minimum bandwidth of 100 Mbps, enabling e-governance, digital services, and internet connectivity in rural India.

Source: Company public filing, Government sources, Crisil Intelligence

Expansion of city gas distribution and pipeline networks

Alongside telecom, city gas distribution (CGD) has is also a key source of demand for (HDD in India. According to the Petroleum and Natural Gas Regulatory Board's (PNGRB) April 2025 report, the authorisation of 307 geographical areas has extended CGD coverage substantially, with authorised entities committing to a minimum work programme of 0.54 million inch-kilometres of pipeline. A portion of this committed pipeline is likely to be laid using HDD, as trenchless methods are typically deployed where open-cut trenching is restricted or impractical, with the extent varying by project, terrain and site conditions.

Beyond the distribution segment, PNGRB, which is empowered to authorise entities to lay, build, operate and expand natural gas pipelines, has authorised a transmission network of ~ 34,233 km, of which 25,429 km were operational as of June 2025 and the balance remains under construction. The progressive completion of this network is expected to positively influence HDD demand, as HDD may be required in specific segments such as rail and river crossings or locations with traffic and other site constraints, subject to project-specific conditions.

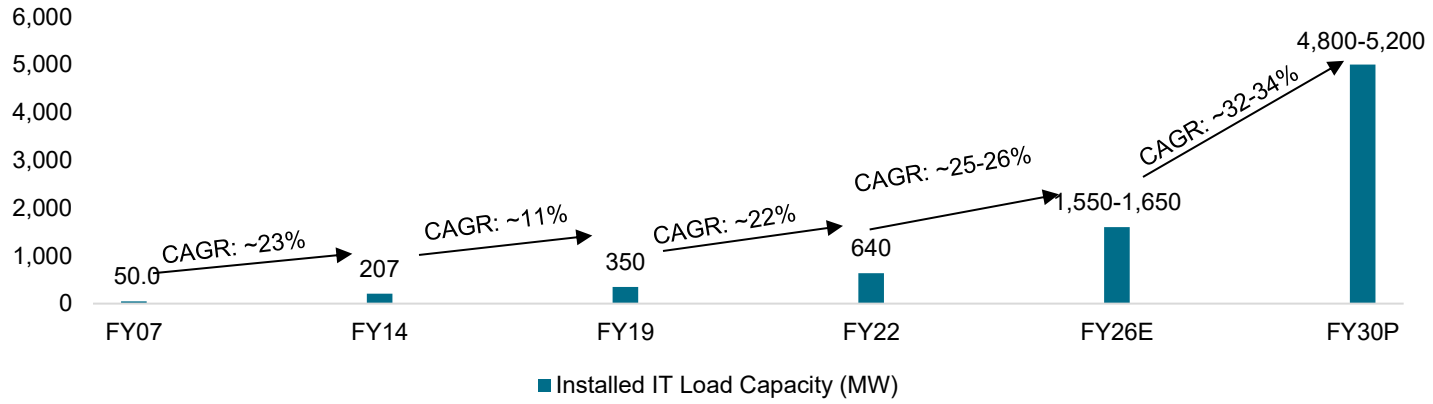
Furthermore, the demand will also be supported by an evolving regulatory environment. The Natural Gas and Petroleum Products Distribution Order, 2026, issued in March 2026, seeks to streamline permissions for last-mile pipeline laying and associated facilities, which may help ease commonly cited constraints around right-of-use and road-cutting approvals from multiple civic authorities. This will positively influence execution timelines and compliance with authorisation obligations, thereby supporting greater visibility of the resulting order flow.

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Expansion of data centre capacity in India

The data centre industry has emerged as a critical component of the digital economy, underpinning cloud computing, AI, 5G connectivity, IoT applications and a widening range of digital services. In India, installed capacity has expanded more than threefold since FY19 to reach ~1,550 to 1,650 MW by FY26, and is projected to increase further to ~4,800 to 5,200 MW by FY30, translating into a CAGR of 30-32%, supported by rising internet penetration, increasing cloud adoption, and data localisation requirements.

Data centre capacity in India -In MW (fiscal 2007-30P)



Note: E – Estimated; P – Projected
Source: Crisil Intelligence

The composition of demand is also expected to change, with AI workloads estimated at ~5 to 10% of installed capacity in FY26 and projected to account for ~35 to 40% by FY30, the balance comprising conventional cloud, enterprise and colocation workloads.

Split of Data centre capacity as per AI workload and non-AI workload:

	AI Workload	Non-AI Workload
FY26E	5-10%	90-95%
FY31P	35-40%	60-65%

Note(s): E: Estimated, P: Projected
Source: Crisil Intelligence

Consequently, capex towards new data centre development is estimated to increase from ~Rs 778 billion during FY22 to FY26 to ~Rs 3,900 to 4,300 billion during FY27 to FY31, implying a nearly five to sixfold increase in construction linked investment. The resultant increase in construction activity, together with the associated requirement for fibre and underground power cable connectivity at each facility, is expected to have a positive bearing on allied drilling activity, including HDD, over the medium term.

Projected Data centre construction Capex

Data centre Capex Investment	FY22-26	FY27-31P
Data centre Capex Investment (Rs. Billion)	778.0	3,900 - 4,300

Notes: The above figure includes only the capex towards new Data centre construction inclusive of land
Source: Crisil Intelligence

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Replacement and modernisation of ageing underground utility infrastructure

Beyond the creation of new networks, demand for HDD services may also be supported by the replacement and modernisation of existing underground utilities. Water supply, sewerage, gas and electricity distribution networks in older urban areas, as well as legacy telecommunication networks, may require replacement or upgradation over a period of time, which could translate into demand for HDD services depending upon the specific requirements of the works undertaken.

3.3. Key challenges and entry barriers in the industry

Key challenges and risks

Key risks/ challenges	Description
Cyclicality in end-use industries	• Demand for HDD services is derived from the capital expenditure cycles of end-use sectors, including telecommunications, oil and gas, and city gas distribution. Accordingly, any deferment or curtailment of capital outlay in these sectors can affect order inflow. • Furthermore, order books remain dependent on the quantum and timing of disbursements under government schemes, as well as on the pace at which projects are tendered and awarded, thereby limiting revenue visibility over the near term. • Additionally, even where orders are secured, execution timelines can be affected by uncertainties relating to geological and soil conditions encountered at project sites, which may necessitate re-alignment of bores, additional mobilisation and cost escalation.
Technological disruptions	• The sector may be exposed to substitution risk arising from alternative trenchless methodologies, including micro-trenching, robotic and guided boring systems, and other emerging drilling technologies, the wider adoption of which could reduce the addressable market for conventional HDD deployment. • Consequently, operators are required to undertake periodic upgradation and replacement of rig fleets and ancillary equipment in order to retain technical qualification and cost competitiveness. • Furthermore, since such upgradation entails recurring capital outlay, any inability to fund or complete the same within the timelines expected by customers can result in loss of pre-qualification eligibility, with a consequent effect on order book visibility.
Regulatory challenges	• Commencement of work at each site is conditional upon receipt of Right of Way approvals and clearances from statutory, municipal and utility authorities. As such approvals often involve time-consuming procedural formalities, mobilisation at site can be delayed beyond the schedule envisaged at the time of bidding. • Furthermore, as permission frameworks, levies and restoration charges differ across states and local bodies, contractors may be required to absorb additional compliance costs and timelines, thereby increasing cost pressures. • Additionally, the sequential nature of such approvals can result in idling of rigs and deployed personnel between sites, thereby extending execution timelines and elongating working capital cycles. • Apart from the above, non-adherence to prescribed environmental and safety conditions, including those governing drilling fluid disposal and protection of sub-surface utilities, may attract monetary penalties, claims for damages or suspension of work.
Structural challenges	• The industry is fragmented, with the presence of a large number of unorganised operators that generally compete on the basis of price. This constrains the ability of participants to pass on cost increases to customers and may sustain pressure on realisations.

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Key risks/ challenges	Description
	• Consequently, in the absence of adequate pricing flexibility, escalation in input costs and equipment downtime arising from delays may have to be absorbed within contracted margins, with a corresponding effect on profitability. • Furthermore, dependence on a limited pool of skilled employees like rig operators and supervisory personnel can constrain the ability of participants to undertake execution across multiple sites concurrently, thereby restricting participation in larger contracts.

Source: Crisil Intelligence

Key entry barriers

Entry barrier	Description
Technical qualification	• Technical qualification requirements create a significant entry barrier, as tenders typically mandate prior project experience, minimum execution track records, and financial eligibility criteria. More complex applications, such as long-distance or pipeline crossings, may additionally require specialised engineering capabilities, certifications, and insurance cover.
Customer empanelment	• Major telecom operators, infrastructure providers, and utility companies generally award work through empanelled contractor networks. Obtaining and maintaining empanelment requires demonstrated technical capability, operational performance, financial strength, and compliance with safety and quality standards, giving established players a competitive advantage. • As empanelment processes can be periodic and time-consuming, entities that are not already empanelled may have limited access to available opportunities.
Execution capability	• Timely completion of bores under varying soil and site conditions requires demonstrated execution capability, including project planning, survey and utility mapping, and the ability to manage restoration obligations. • Hence, established contractors benefit from proven project management systems, compliance understanding, regional presence, supervisory teams, and the financial capacity to support large-scale execution.
Skilled workforce	• Operations require trained rig operators, supervisory staff and survey personnel, availability of which can be limited. • Consequently, new entrants may face challenges in recruitment and retention, and in building the operating experience required to execute projects within contracted timelines.
Equipment requirements	• Execution depends upon ownership or assured access to capital-intensive equipment, comprising drilling rigs of varying capacity, mud recycling units and HDPE fusion equipment. Deployment of such assets entails significant upfront investment together with recurring maintenance and spares expenditure, which can constrain entry by smaller entities. • While smaller participants may seek to lease or hire equipment on a project-specific basis in order to limit capital outlay, such arrangements can result in dependence on third-party lessors for timely availability and serviceability of assets, while also affecting cost structures.
Geographical reach	• Projects in the HDD segment are generally spread across multiple states and are often awarded on a package or region-wise basis. Accordingly, the ability to mobilise rigs, crew and support infrastructure across dispersed locations can influence competitiveness at the tendering stage. • Furthermore, mobilisation over longer distances entails transportation, logistics and site establishment costs, together with lead time for obtaining local permissions. Participants without an established presence in the relevant region may therefore incur higher costs or require longer mobilisation periods, which can affect bid competitiveness.

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Entry barrier	Description
	• Additionally, familiarity with prevailing soil profiles, local approval processes and availability of local manpower and vendors can support timely execution. Entities operating across multiple states may consequently be better positioned to bid for and execute geographically spread contracts, and to redeploy assets between regions as demand shifts.

Source: Crisil Intelligence

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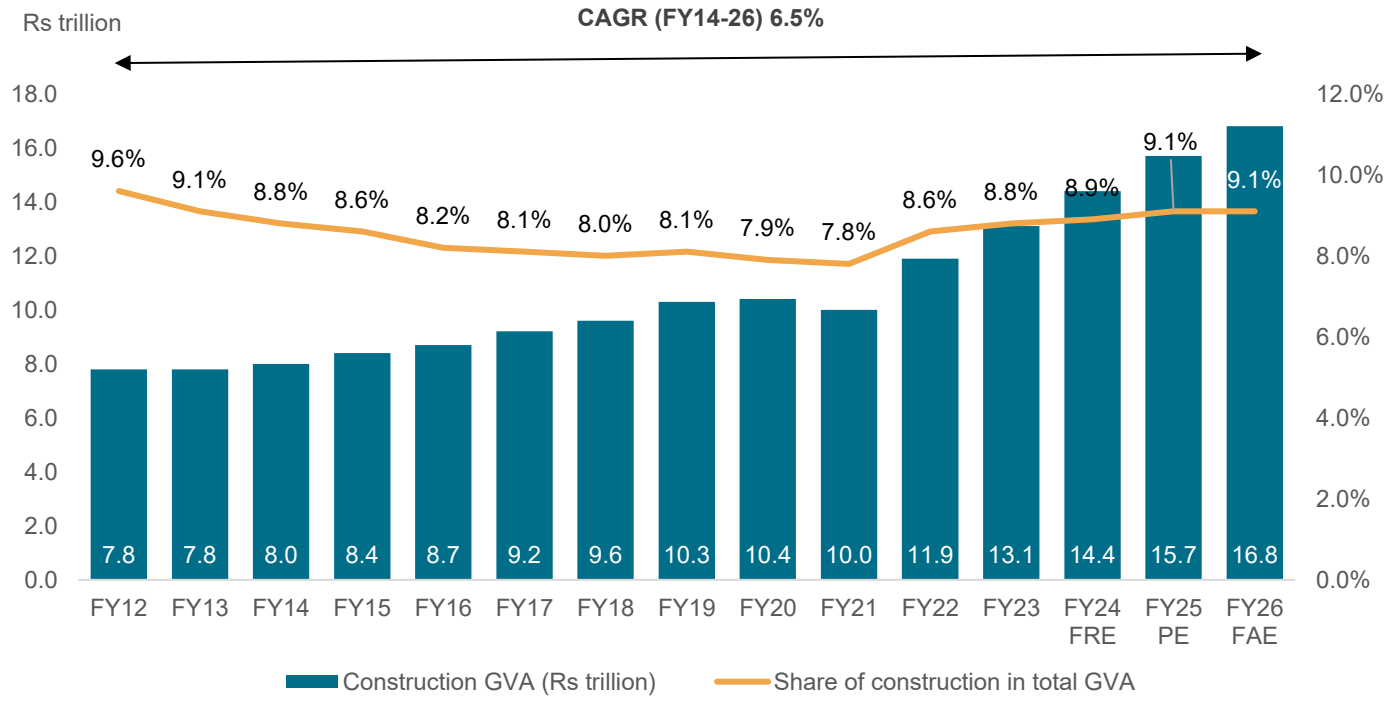
4. Overview of construction industry in India

4.1. Construction sector's share in overall GVA estimated to have risen further in fiscal 2026

Construction GVA is a critical indicator of economic activity since it represents the value generated by the construction sector, which includes activities related to building infrastructure, real estate and other construction projects.

In India, construction GVA increased to Rs 16.8 trillion in fiscal 2026FAE from Rs 8.0 trillion in fiscal 2014, which was 6.5% CAGR. Several factors contributed to the growth, including economic expansion, the government's commitment to infrastructure development, particularly roads, railways and energy projects, and increase in foreign direct investment, which boosted private sector investment. Furthermore, increasing demand for affordable housing, driven by rising urbanisation and an expanding middle-class population, has also played a significant role in elevating construction GVA. However, in fiscal 2021, the country's GVA was under pressure amid challenges heaped by the pandemic. In fiscal 2022, though, the share of construction GVA in the overall GVA rebounded to 8.6%, increasing further to 8.8% in fiscal 2023. As per the provisional estimates for fiscal 2025, construction GVA is around Rs 15.7 trillion, thereby contributing to 9.1% of overall GVA.

Share of construction GVA (FY12-FY26)



FAE—First advance estimate, FRE – Final revised estimate, PE – provisional estimates
Source: MoSPI, Crisil Intelligence

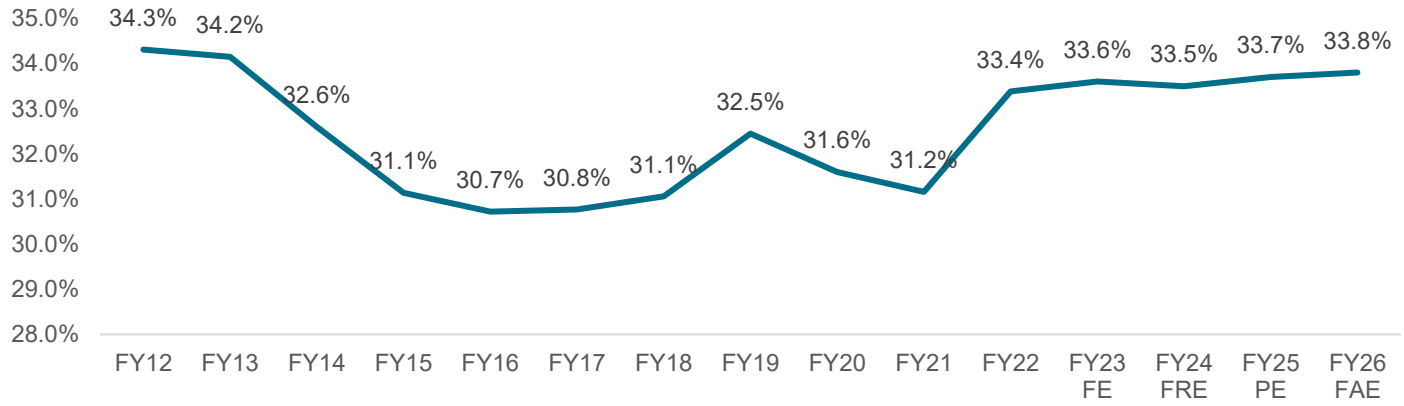
4.2. India’s gross fixed capital formation as % of GDP to have further improved in fiscal 2025

Gross fixed capital formation (GFCF) measures the level of investment in creating physical assets and infrastructure, which plays a crucial role in fostering economic growth and development. Gross fixed capital formation includes land improvements (fences, ditches, drains, and so on); plant, machinery, and equipment purchases; and the construction of roads, railways, and the like, including schools, offices, hospitals, private residential dwellings, and commercial and industrial buildings.

GFCF % of GDP (CY2023)

This is a sharp reversal from fiscals 2020 and 2021, when the GFCF had fallen to 31.6% and 31.2% of GDP, respectively, as investments in physical assets were impacted by disruptions in supply chains and business operations owing to the pandemic. It, however, recovered to 33.4% of GDP in fiscal 2022 and 33.6% of GDP in fiscal 2023, attributed to factors such as easing of pandemic-related restrictions, the government's focus on infrastructure development, economic reforms and increase in urbanisation, which boosted demand for affordable housing. As per the first advance estimates for fiscal 2026, GFCF as % of India’s GDP to remain at 33.8%.

GFCF as % of India’s GDP (FY12 - FY26)



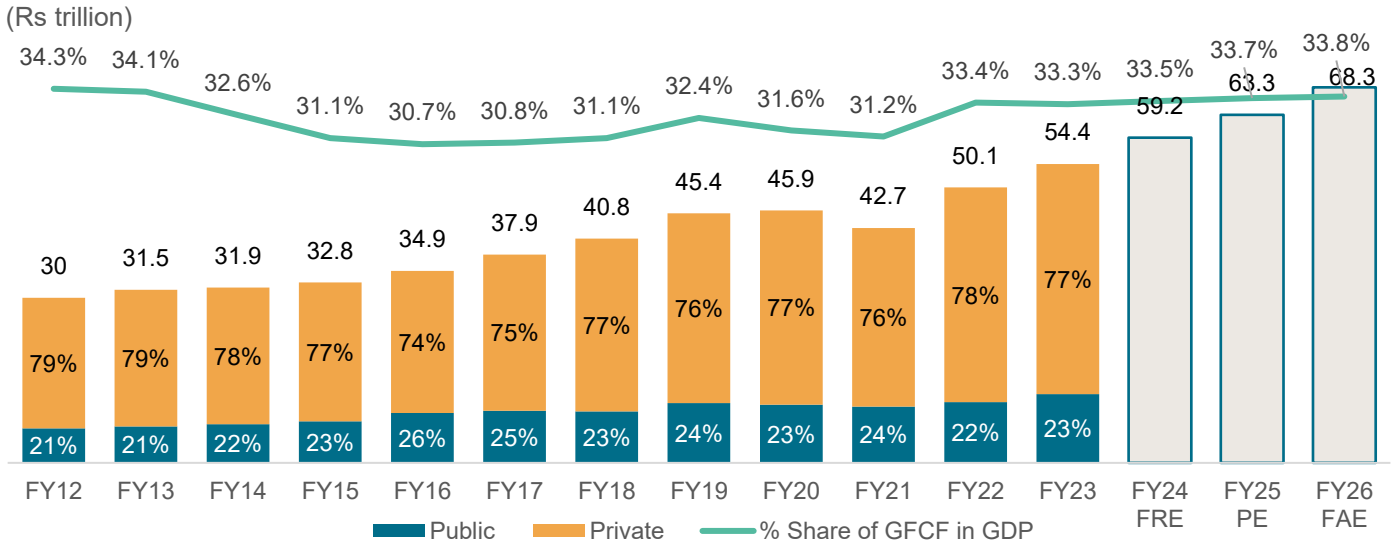
Note: FE: Final Estimates; FRE: First Revised Estimates; FAE: First Advance Estimates; PE: Provisional Estimates;
Source: First Advance Estimates of Annual GDP for 2025-26, MoSPI, Crisil Intelligence

A large part of the rise in fiscal 2023 was because of dwellings, other buildings and structures, which had a significant ~55% weightage in the GFCF. Key factors contributing to the vertical’s dominant share were economic growth, the government's commitment to infrastructure development, particularly in roads, railways, and energy projects, and increase in FDI, which boosted private sector investment. A growing middle class and increasing urbanisation contributed significantly to the rising demand for housing and commercial spaces, thereby spurring investment in the construction sector.

4.3. Private sector is a major contributor to GFCF

The distribution of GFCF between the private and public sectors has been relatively constant in India, with the private sector consistently the predominant contributor. In fiscal 2023, the private sector accounted for ~77% of total GFCF.

Share of public and private sectors in GFCF



PE – provisional estimate, FRE: First Revised Estimates, FAE: First Advance Estimates,
Note: Private fixed capital formation includes household sector
Source: MoSPI, Crisil Intelligence

4.4. Investments in construction sector

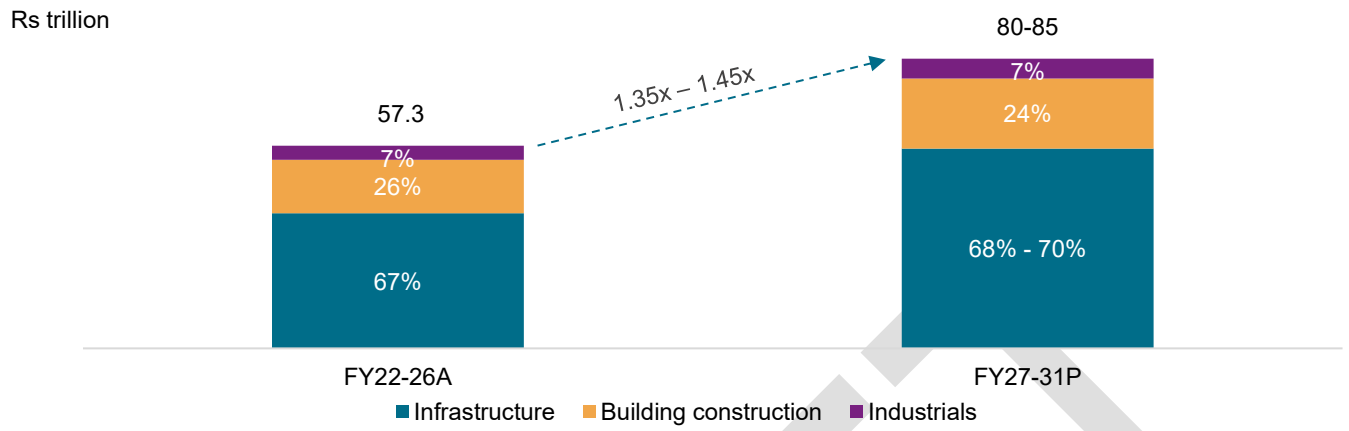
The construction industry in India is expected to grow steadily at an annual rate of 6-8% between fiscal years 2026 and 2030. This growth will be mainly driven by increased spending on infrastructure projects such as roads and railways, supported by both central and state government investments.

In fiscal year 2025, construction capital expenditure has risen by 7% compared to the previous year, reaching Rs. 12.7 trillion. This increase aligns with the government's emphasis on infrastructure development, as seen in the rising budget allocations aimed at achieving the goals outlined in the National Infrastructure Pipeline (NIP). Previously, the construction sector faced challenges like policy delays in infrastructure and low industrial investments. Residential construction also declined due to weak demand, affordability issues, and a sluggish economy. However, recent government initiatives have revitalized construction activity, especially in infrastructure.

The share of infrastructure projects is expected to stabilise in the ~68-70% range in the next five years as against ~67% for FY21-25, as Infrastructure investments are seen growing faster than the other two segments due to the Government's focus on Infrastructure under the NIP, NMP and the Gati Shakti initiative. The Central government's focus on roads, urban infrastructure and railways will boost infrastructure investments. Roads, railways, irrigation & Power sectors will continue to drive the bulk of these investments. Building & construction and industrial segments are expected to witness muted growth.

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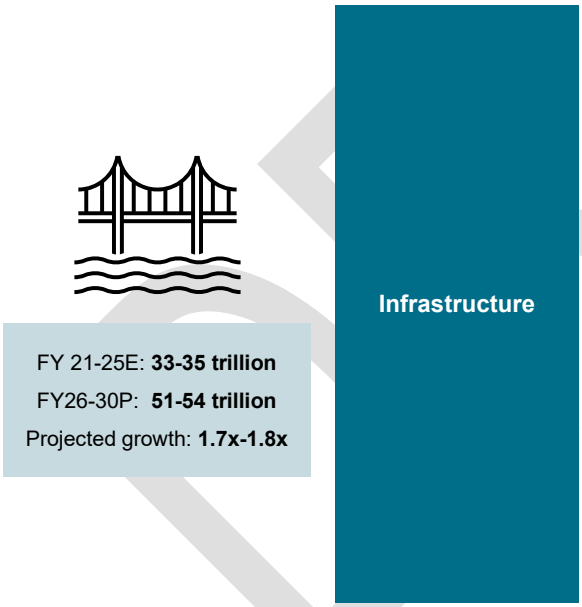
Break-up of the domestic construction sector



Note: A - Actual, P – Projected
The numbers in the above chart represents cumulative investments for the specific period
Source: Crisil Intelligence

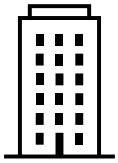
Overview of investments across building, Infrastructure and Industrial in overall construction segment

Share of infrastructure segment is estimated to increase further



- Infrastructure investments are seen growing faster than the other two sectors due to the government's focus under the National Infrastructure Pipeline (NIP), National Monetization Pipeline (NMP) and the Gati Shakti initiatives. Total construction investments in this sector is expected to attract investments of ~Rs 51-54 trillion between FY26-30P, up from Rs 34-36 trillion between FY21-25.
- Moving forward, the share of infrastructure projects is expected to stabilise in the ~68-70% range in the next five years (FY26-30). Private sector involvement in infrastructure, which has been increasing, is poised to intensify with the government's renewed emphasis on the build-operate- transfer (BOT) model in roads. The power sector continues to attract substantial private investment, driven by a sharper focus on non-fossil fuel energy generation. The government's National Monetisation Pipeline is also expected to play a key role in boosting private sector participation by facilitating its greater involvement in infrastructure development.

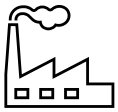
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FY 21-25: **13-14 trillion**
FY25-30P: **19-20 trillion**
Projected growth: **1.4x-1.5x**

Building

- Crisil Intelligence estimates Building & Construction sector to see stagnant growth with real estate segment showing a slowdown in demand along with rising inventory levels in key cities. The increase in execution of deferred projects and government schemes such as PMAY is expected to provide the required boost to the sector.
- Between FY26-30P, the sector is expected to rise to Rs 19-20 trillion from an investment of Rs 13-14 trillion between FY 21-25



FY 21-25: **4-4.5 trillion**
FY26-30P :: **4.8 – 5.5 trillion**
Projected growth: **1.2x-1.3x**

Industrial

- Based on an analysis of eight key sectors, Crisil Intelligence estimates construction investment in the industrial sector at Rs 4.8-5.5 trillion between FY26-30P, compared to Rs 4.5-5 trillion spends seen in FY21-25. The rise in investment is projected due to inclusion of the PLI scheme in the capex investments of the industrial sector.
- Crisil have only considered 3 capex-intensive sectors in case of PLI scheme, viz., auto and auto components, textiles and specialty steel for inclusion in our estimates.

Note: A - Actual, P – Projected
Infrastructure vertical includes warehouse
Building construction includes residential, commercial and non-commercial verticals
Source: Crisil Intelligence

Building construction to grow 1.2-1.3x between fiscals 2027 and 2031

The building construction segment is largely dominated by investments in the residential real estate space with a share of ~90% as of fiscal 2026. Long-term investment in building construction is projected to increase at an average annual rate of 3-5% between fiscals 2027 and 2031, in line with growth in residential demand.

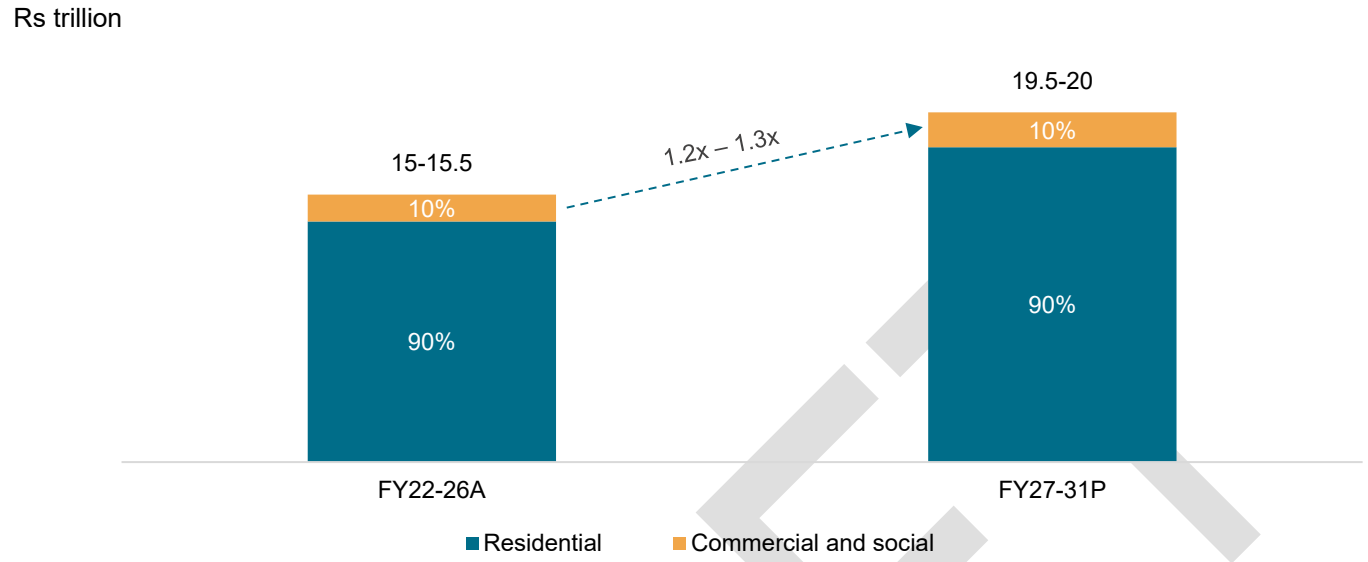
One of the primary drivers of growth in the building construction segment is the office sector, which saw a significant surge in gross leasing between January and September 2024. This represents a significant increase compared with the same period in 2023. The demand for office space is driven by both global and local occupiers, who are expanding their operations and consolidating their facilities to enhance their market presence.

Technology companies are leading the charge, accounting for one-fourth of total office leasing, followed by flexible space operators and banking, financial services and insurance (BFSI) firms. India's top office markets have experienced a notable surge in rentals, driven by robust demand and the simultaneous infusion of high-end, quality supply. After a dip during the pandemic, rentals have seen considerable growth since 2024, surpassing pre-pandemic levels.

The growth in the office sector is expected to continue, with investment in office spaces projected to increase 1.2-1.3x between fiscals 2027 and 2031, driven by the growing demand for quality office spaces and their limited supply in key markets. As a result, the building construction segment is likely to see significant activity in the coming years, aided by the office sector's strong growth prospects and increasing demand for commercial and social infrastructure construction.

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Share of major segments building construction spending (%)

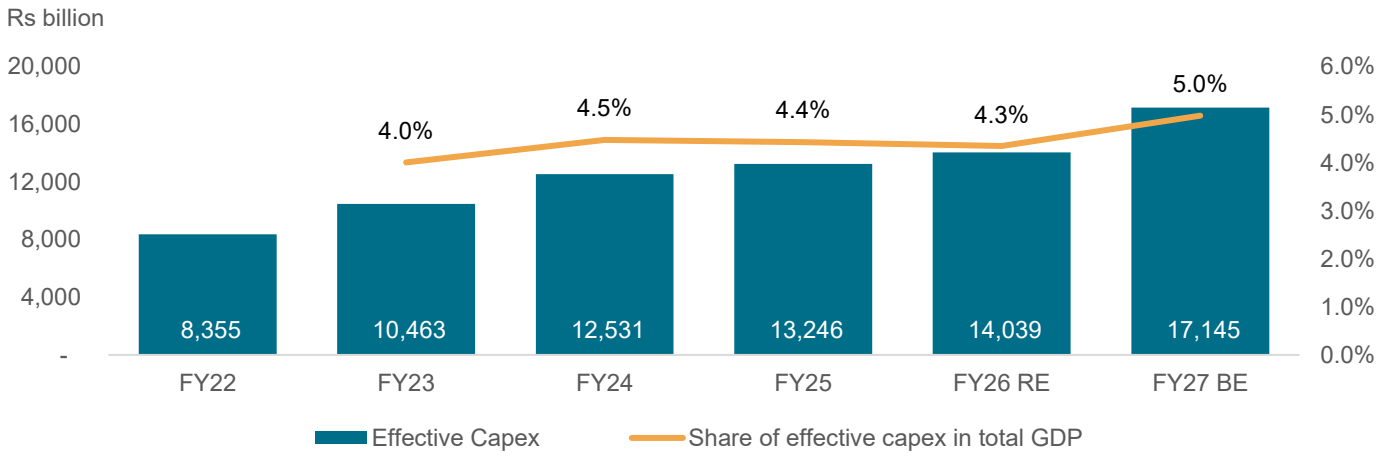


Note: A: Actual; P: Projected
Source: Crisil Intelligence

Central effective capex as a percent of total GDP is estimated to grow at ~5% in FY27

Central effective capex has risen from Rs 8,355 billion in fiscal 2022 to Rs 14,039 billion in fiscal 2026 (RE). The steepest expansion came in fiscals 2023 and 2024, at 25% and 20%, lifting the share of effective capex in GDP from 4.0% to 4.5%. This was the peak of the post-pandemic public investment push, anchored by the National Infrastructure Pipeline and PM Gati Shakti, with roads and railways absorbing most allocations and the interest-free 50-year capex loan window channelling spending through states. For construction, this meant healthy but decelerating order inflows, with contractors leaning on existing backlogs rather than fresh awards.

Share of effective capex in the real GDP of India (2022-2023 series)



Source: Union budget of India, Crisil Intelligence

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Effective capex is budgeted at Rs 17,145 billion for fiscal 2027, up 22.1% over fiscal 2026 (RE) and the sharpest jump in four years, taking the GDP share to 5.0%. The increase is led by infrastructure ministries, whose budgetary capex of Rs 11.9 trillion is up 17.7% year-on-year, indicating the incremental allocation is concentrated in construction-intensive heads. Key drivers include the next phase of highway and expressway corridors, rolling stock and network expansion in railways, metro and urban infrastructure under AMRUT and allied schemes, and transmission capacity tied to the energy transition. Continued grants-in-aid to states should support sub-national execution, historically the swing factor in converting allocations into spending.

Budgetary capex for infrastructure ministries is Rs 11.9 trillion, up 17.7% from fiscal 2026

Infrastructure capital expenditure (capex) for fiscal 2027 (BE) is 17.7% higher than fiscal 2026 RE—an increase largely driven by investments in logistics, power and affordable housing. Logistics cost in India is around 8% of GDP, according to estimates of the Department for Promotion of Industry and Internal Trade. It is imperative to bring down this cost to make transportation of goods efficient. With this in mind, the budget focuses on transportation sectors and has set aside a significant 53% of the total infrastructure capex for roads, railways, waterways and aviation

The budget allocation for the roads sector is up 8.3% increase over fiscal 2026 RE. Specifically, the National Highways Authority of India (NHAI) has received a 10% boost in allocation from the ministry. Additionally, the Gross Infrastructure Allocation (GIA) contribution towards road works has grown 5.2% over fiscal 2026 RE

Budget allocation for infrastructure sector

	Rs trillion	FY26RE	FY27BE
Capex - Infrastructure Ministries	Gross Budgetary Support GBS)	5.7	6.2
	Internal and external budgetary resources (IEBR)	2.3	2.6
	Grants allocation for capital creation (GIA)	2.1	3.1
	Total Capex- Infrastructure Ministries	**10.1**	**11.9**
Capex- Other Ministries	Gross Budgetary Support GBS)	5.2	6.0
	Internal and external budgetary resources (IEBR)	2.0	2.2
	Grants allocation for capital creation (GIA)	1.0	1.8
	Total Capex- Other Ministries	**8.3**	**10.1**
Grand Total		**18.4**	**22.0**

Note: 10 infrastructure ministries included: Road transport and highways, Housing and urban affairs, civil aviation, power, railways, shipping, rural development, water resources, New and renewable energy, Department of atomic energy

RE- Revised estimates, BE-Budgeted estimates

Source: Budget documents, Crisil Intelligence

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4.5. Overview of Oil Refining & Marketing industry

The Oil Refining & Marketing (R&M) industry forms a critical part of the downstream oil and gas value chain, converting crude oil into refined products such as petrol, diesel, ATF, LPG, and petrochemical feedstocks, and distributing them through retail, industrial, aviation, and commercial channels. Industry performance is primarily driven by refining margins, fuel demand, crude oil price trends, and regulatory requirements related to fuel quality and emissions.

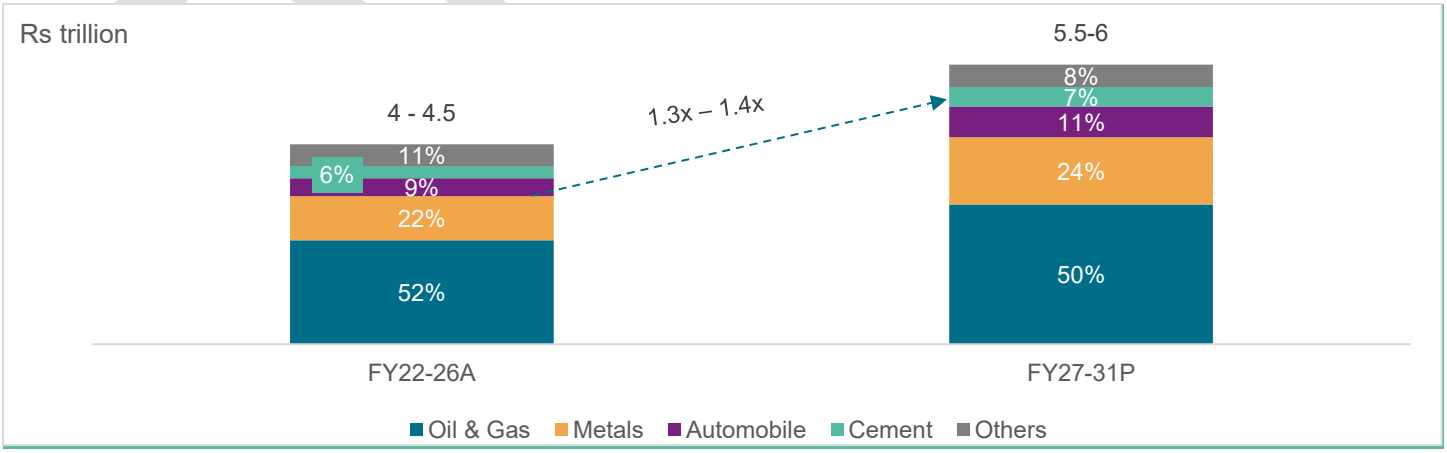
The sector continues to invest in capacity expansion, refinery modernization, petrochemical integration, and cleaner fuel technologies to improve operational efficiency and meet evolving energy demand. In parallel, companies are diversifying into low-carbon fuels and energy-transition initiatives to strengthen long-term growth prospects.

Investments in Oil & Gas segment to drive the industrial construction sector

Industrial construction capex is expected to be primarily driven by the oil and gas sector, led by investments in the refining and marketing segment, followed by contributions from the metals, automobiles, and cement sectors. Industrial construction capex peaked in FY25, driven by a sharp increase in investments in the automobile sector, alongside sustained momentum in the oil & gas and metals segments. However, capex is expected to normalize in FY26 and FY27 as investment activity reverts to more sustainable levels following the elevated spending witnessed in FY25.

Based on an analysis of eight key sectors, Crisil intelligence estimates construction investment in the industrial segment at Rs ~5 – 5.6 trillion between fiscals 2027 and 2031, rising ~1.3 – 1.4x times over spends seen in fiscals 2022 to 2026. Investment growth is expected to be led by the metals sector, where upcoming capital expenditure will largely focus on brownfield expansions aimed at enhancing existing production capacities and improving operational efficiencies. Furthermore, the growth is driven by capacity addition in refineries. In FY 2026, India's refining capacity stands at 258 MMtpa and refineries are undertaking capital expenditure to expand their capacities. Over FY 2026 to 2030, 30-50 MMtpa (Million metric tonne per annum) of refining capacities are expected to be commissioned bringing the overall refining capacity to 290-310 MMTpa by FY 2030. The rise in investments is projected due to inclusion of PLI scheme in the capex investments of industrial sector. While the PLI scheme entails 13 sectors, we have only considered 3 capex intensive sectors viz. Auto and auto components, Textiles and Specialty steel for inclusion in our estimates.

Share of major segments Industrial construction spending



Note: A: Actual; P: Projected

Source: Crisil Intelligence

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Key growth drivers for the Industry

Demand for petroleum products to grow at modest pace of 1-3% in FY 2026 and at healthy rate of 3-5% in FY 2027

Petroleum product consumption is expected to grow at healthy rate of 3-5% in FY 2027 with increase in transportation fuel growth further boosted by demand from industrial fuels such as Naphtha. Petroleum product consumption is expected to reach 240-245 MMTpa (million metric tonne) in FY 2026, reaching a new all-time high, breaching the high of FY 2025 of 239 MMTpa, owing to growth of MS, Diesel and LPG fuels.

Growth in consumption will be driven by transportation fuels such as MS, HSD and ATF, at 3-5% CAGR over the next five fiscals, supported by sustained economic growth, rising per capita income levels and increasing vehicle ownership, which are expected to drive mobility demand, freight transportation and air travel. However, higher growth prospects are capped by shift-away in petrol and diesel vehicles, improving efficiencies, blending of biofuels and increase in fuel-efficient aircraft, which are expected to displace demand in the long run.

In FY 2026, the transportation sector is expected to drive a 3-5% increase in petroleum product consumption, underscoring the ongoing reliance on fossil fuels for powering vehicles, airplanes, and ships. Despite global efforts to transition to cleaner alternatives, fossil fuels are expected to remain dominant in the transportation sector. This growth is however offset by decline in industrial fuels by 6-8% largely due to decline in petcoke and naphtha consumption owing to decline in price competitiveness of both the products.

After a slow growth of 0-1% in FY 2025 due to lower road construction activity, bitumen demand is expected to normalize and improve in FY 2026 and FY 2027. The previous year's slow growth was attributed to the impact of general and state elections on road construction projects. Overall, the outlook for petroleum product consumption remains strong, but it also emphasizes the need for a more sustainable and environmentally friendly approach to energy production and consumption.

Transportation fuels

In FY2026, consumption of transportation fuels is expected to have improved by 3-5% on-year on the back of increased vehicular movement and industrial activity, increase in freight movement leading to MS fuel growth by 6-8%, diesel by 2-4% and moderate growth of 1-3% in ATF fuel.

Household (LPG)

In FY 2026, LPG fuel is expected to have shown a healthy growth of 8-9% largely driven by commercial LPG segment followed by high refill rate in domestic LPG segment in both PMUY and non-PMUY connections.

Industrial fuels

In FY 2026 industrial fuels have dragged the overall demand growth with decline in naphtha consumption by 12-14% and petcoke consumption decline by 4-6% due to reduced price competitiveness.

Bitumen

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In FY 2025, bitumen consumption declined by 5.4% on-year following general and state elections scheduled during the fiscal leading to muted off-take of road implementation, this is post witnessing an exponential growth of 40% and 27% on-quarter during the third and fourth quarters of FY 2024 as the road construction was increased pre- election season, respectively. However, with increased construction activity, bitumen demand growth is expected to be healthy at 6-8% in FY 2026.

Capacity expansion and modernisation initiatives to meet future demand

Capacity expansion and modernization initiatives are expected to remain a key growth driver for the Oil Refining & Marketing industry. As domestic demand for petroleum products continues to increase, supported by economic growth, urbanization, rising mobility requirements, and industrial development, the industry is investing in expanding refining infrastructure and upgrading existing facilities to ensure adequate supply availability and operational efficiency. India's installed refining capacity currently stands at approximately ~267 MMTPA, providing a strong foundation to meet growing domestic fuel demand while maintaining its position as a major refining hub.

In addition to capacity augmentation, refiners are undertaking modernization projects focused on improving crude processing flexibility, enhancing product yields, increasing energy efficiency, and strengthening compliance with evolving environmental and fuel-quality standards. These investments enable the production of cleaner transportation fuels, optimize refinery operations, and improve overall asset utilization.

The industry is also witnessing increased emphasis on refinery-petrochemical integration, residue upgradation, process automation, and digitalization initiatives aimed at improving profitability and operational resilience. Such measures help refiners diversify revenue streams, improve margin stability, and adapt to changing demand patterns in the energy sector.

Furthermore, ongoing greenfield and brownfield expansion projects are expected to strengthen supply security, support future demand growth, and reduce infrastructure bottlenecks across the petroleum value chain. Combined with modernization efforts, these investments are likely to enhance the competitiveness of the domestic refining sector and support the industry's long-term growth trajectory.

Push towards petrochemical integration and value-added product mix by refiners

The Oil Refining & Marketing industry is increasingly focusing on petrochemical integration and the production of value-added products to enhance profitability and reduce dependence on traditional transportation fuels. With long-term demand growth for conventional fuels expected to moderate due to improving fuel efficiency, alternative fuels, and increasing electrification of mobility, refiners are strategically diversifying their product portfolios toward petrochemicals and specialty products, which generally offer higher margins and more resilient demand growth. This shift is expected to support earnings stability and improve returns on capital employed across the refining sector.

Petrochemical integration enables refiners to maximize value extraction from crude oil by converting a larger proportion of feedstock into higher-value petrochemical products rather than transportation fuels. Rising demand from end-use sectors such as packaging, consumer goods, construction, automotive, pharmaceuticals, textiles, and industrial manufacturing is driving growth in petrochemical consumption, creating significant opportunities for integrated refining and petrochemical operations.

In addition, refiners are increasingly investing in process upgrades, residue conversion facilities, and advanced refining technologies to improve product yields and increase the share of high-value products in their output mix. Such initiatives enhance operational flexibility, improve gross refining margins, and enable refiners to better respond to evolving market

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demand patterns. Petrochemical integration also helps mitigate the impact of cyclicality in fuel markets by providing greater diversification across revenue streams.

The growing emphasis on producing cleaner fuels, specialty chemicals, petrochemical intermediates, and other value-added products is expected to strengthen the competitiveness of the domestic refining sector over the long term. Consequently, increasing refinery-petrochemical integration and diversification towards higher-value product portfolios are likely to remain important strategic drivers for growth, margin enhancement, and long-term sustainability within the Oil Refining & Marketing industry.

Government focus on energy security and reduction of import dependence

The Government of India's continued focus on strengthening energy security and reducing import dependence is expected to support long-term growth in the Oil Refining & Marketing industry. Given the country's high reliance on crude oil imports to meet domestic energy requirements, policy measures are increasingly focused on enhancing supply security, expanding domestic refining capabilities, strengthening strategic petroleum reserves, and diversifying sources of crude procurement. These initiatives are aimed at mitigating risks arising from geopolitical uncertainties, supply disruptions, and crude oil price volatility in international markets.

A key component of this strategy is the expansion of strategic petroleum reserve (SPR) infrastructure. India has already developed strategic crude oil storage facilities with a capacity of 5.33 million metric tonnes (MMT), while additional SPR projects with a combined capacity of 6.5 MMT have been approved to further strengthen emergency storage capacity and enhance energy resilience. These reserves act as a buffer against potential supply disruptions and contribute to improving the country's energy security framework.

The government is also pursuing crude sourcing diversification and infrastructure development initiatives to reduce concentration risks associated with imports from specific regions. Simultaneously, continued investments in refining capacity, logistics infrastructure, and downstream value addition are expected to improve the sector's ability to efficiently meet the country's growing petroleum product demand.

In addition, policy initiatives promoting alternative fuels, biofuels, natural gas, energy efficiency, and domestic energy production form part of a broader strategy to reduce dependence on imported fossil fuels and strengthen long-term energy sustainability. These measures are expected to support a more resilient energy ecosystem while creating opportunities across the refining and marketing value chain.

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4.6. Overview of solar power industry

The solar power industry is a key segment of the renewable energy sector, focused on generating electricity through photovoltaic (PV) modules and concentrated solar technologies. Growth in the industry is driven by declining technology costs, supportive government policies, increasing sustainability commitments, and rising demand for clean energy. The sector encompasses utility-scale solar parks, commercial and industrial (C&I) installations, and residential rooftop systems, contributing significantly to the global energy transition.

The industry continues to attract substantial investments aimed at expanding renewable energy capacity, enhancing grid integration, and improving energy storage capabilities. Advancements in solar module efficiency, battery storage solutions, and transmission infrastructure are further strengthening the sector's long-term growth prospects.

Overview of pan-India solar installed capacity base along with year-wise status of solar projects across various stages of development

Anticipated total capacity additions of 230-270 GW are projected for the period spanning fiscal years 2027 to 2031. These additions will primarily result from the initiation of projects allocated under various state policies, SECI schemes, and tenders issued by central public sector undertakings in the utility segment. PM Suryaghar yojana and green open access policies are expected to drive the rooftop and open access segments, respectively. It is essential to emphasise regulatory attention to facilitate these capacity expansions, alongside ensuring sufficient land availability, timely execution of grid infrastructure, and the capability of industry participants to secure cost-effective financing.

Fiscal 2027 growth to build on record fiscal 2026 additions

The first quarter of fiscal 2027 witnessed an addition of ~6.9 GW of ground mounted solar capacity. A majority of the additions in Q1 of fiscal 2027 were in Rajasthan and Gujarat. Some of the major additions came in the form of a pent-up pipeline allocated over calendar years 2022 and 2023.

These additions rode on a wave of record-breaking additions of 35 GW of ground-mounted solar capacity, including the hybrid component, seen in fiscal 2026. Early market estimates suggest that over 75% of the additions were driven by competitively bid solar projects, while the rest was contributed by open access. The rising base of capacity enlisted in the Approved List of Models and Manufacturers (ALMM), 203 GW as of July 2026, provided strong support to developers.

Key projects commissioned in Rajasthan and Gujarat, which alone contributed to a majority of the capacity in fiscal 2026 and Q1 fiscal 2027

Scheme name	States	Capacity (MW)
SECI Pan India Solar-Wind Hybrid Tranche-III, 1,200 MW, Dec-2020	Gujarat	263
SECI Pan India Solar-Wind Hybrid Tranche-IV, 1,200 MW, Aug-2021	Gujarat	300
RUVNL Rajasthan Solar, 1,000 MW, May-2023	Rajasthan	400
GUVNL Gujarat Solar Tranche-XX, 800 MW, Jul-2023	Gujarat	1600
NHPC Pan India Solar-Wind Hybrid, 1,500 MW, Feb-2024	Rajasthan	74
NHPC Pan India Solar, 2,000 MW, Apr-2020	Rajasthan	651
SECI Pan India Solar Tranche-IX, 2,000 MW, Jun-2020	Rajasthan	600
RECPDCL Pan India Solar, 500 MW, Apr-2023	Gujarat	200

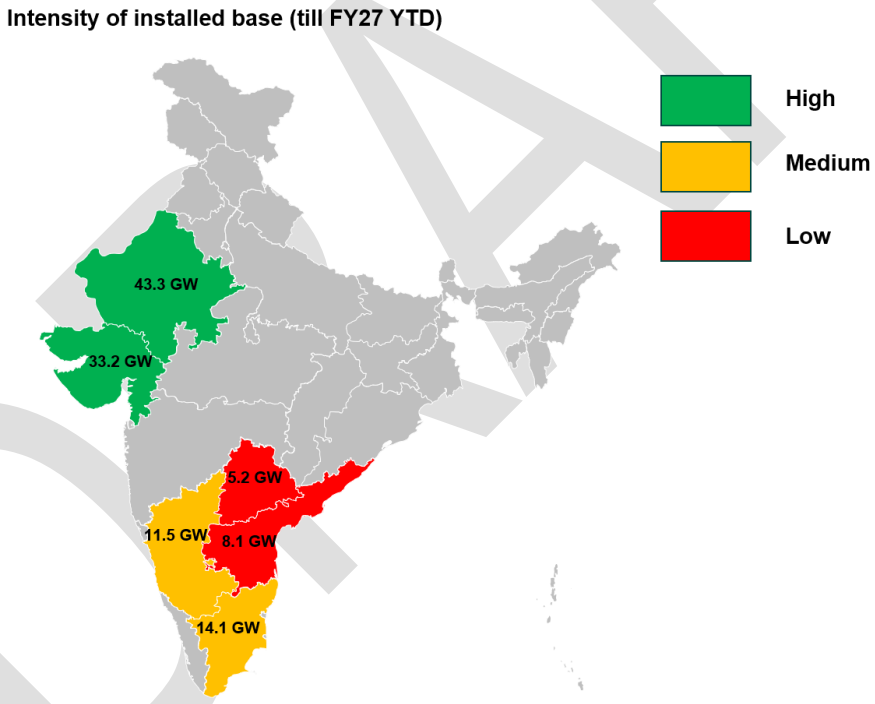
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SJVN Pan India Solar-Wind-Storage Hybrid (Firm Power), 1,500 MW, Nov-2023	Rajasthan	135
SECI Rajasthan Solar Tranche-IV, 1,785 MW, Dec-2021	Rajasthan	425
SECI Pan India Solar Tranche-VIII, 1,200 MW, Feb-2020	Rajasthan	500
GUVNL Gujarat Solar Tranche-XXI, 600 MW, Jan-2024	Gujarat	400
GUVNL Gujarat Solar Tranche-XIV, 500 MW, Jun-2022	Gujarat	317
SECI Pan India Solar, 7,000 MW (Manufacturing-linked), Jan-2020	Gujarat	1465
GUVNL Gujarat Solar Tranche-XVII, 600 MW, May-2023	Gujarat	600
GUVNL Pan India Solar Tranche-XVIII, 500 MW, Jan-2023	Gujarat	420
GUVNL Pan India Solar Tranche-XIX, 500 MW, Apr-2023	Gujarat	680
GUVNL Gujarat Solar Tranche-XIII, 500 MW, Mar-2022	Gujarat	120
GUVNL Gujarat Solar Tranche-XII, 500 MW, Mar-2021	Gujarat	60
SECI Pan India Solar Tranche-XVIII, 1,000 MW, Dec-2024	Rajasthan	300

Source: Crisil Intelligence

Total pan-India solar installed base as of June 2026

Gujarat, Rajasthan and Tamil Nadu form ~56% of the total pan-India solar installed base.



State	FY15-18	FY19-21	FY22	FY23	FY24	FY25	FY26	FY27 YTD
Rajasthan (GW)	1.5	3.4	6.2	4.5	4.3	7.0	12.7	2.3
Gujarat (GW)	0.8	2.8	1.9	2.1	4.3	5.9	10.8	3.9
Karnataka (GW)	4.9	2.5	0.2	0.7	0.3	2.4	1.4	0.4
Telangana (GW)	2.8	0.6	0.5	0.1	0.1	0.08	0.2	0.1
Andhra Pradesh (GW)	2.6	2.1	0.09	0.1	0.1	1.0	2.1	0.6

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Tamil Nadu (GW)	1.7	2.6	0.6	1.7	1.5	3	3.4	0.5

Note: FY27 YTD refers to April-June 2026. The data within the map represents total solar installed base for respective states.
Source: Ministry of New and Renewable Energy (MNRE), Crisil Intelligence

As illustrated in the chart, Rajasthan, Gujarat and Tamil Nadu have a total of ~91 GW of total solar power installed base or ~56% of total solar capacity in the country as of June 2026. This was mainly because of attractive solar policies by the state governments, as well as high irradiance and ample land availability. The states have also set renewable energy targets of 90 GW, 100 GW and 20 GW, respectively, by fiscal 2030.

Rajasthan remains the most preferred destination for solar power development due to its high solar irradiation, abundant land availability, and favourable policy environment, with RIPS 2024 further promoting renewable energy investments. Gujarat continues to witness strong solar capacity additions under its Renewable Energy Policy 2023, which targets 50% of installed power capacity from non-fossil fuel sources by 2030. In contrast, solar capacity growth in Karnataka has moderated post FY2019 due to restrictions on additional solar power procurement amid surplus solar generation in the state.

On the pricing front, solar tariffs showed a rapid decline, with a rapid fall in component pricing, technological improvements in efficiency, and the government's policy push. The Central Electricity Authority (CEA) in February 2025 released new guidelines, advising mandatory incorporation of storage with standalone solar. Energy Storage Systems (ESS) would need to have a minimum backup equivalent to two hours and be installed at 10% of the project’s solar capacity. Auctions previously conducted under this format have seen tariff range between Rs 3.2-3.6 per unit. The solar-plus-storage projects saw a weighted average tariff of Rs 3.16 per unit in fiscal 2026. This declined from the fiscal 2025 level, when the weighted average tariff was Rs 3.4 per unit.

The MNRE released ALMM II on July 31, 2025. This mandate states that all projects allocated one month after the cut-off date, that is, the release date of ALMM II, must procure solar modules from ALMM I manufacturers, which in turn will procure cells from ALMM II manufacturers. As domestically manufactured solar modules are 40-60% more expensive than imported cell-based modules, the tariffs for the projects bid may see an upward trend.

Solar power capacity additions expected at 230-270 GW over fiscals 2027-2031

Crisil Intelligence foresees solar power capacity additions of 230-270 GW over fiscals 2027-2031, including 45-50 GW expected in fiscal 2027. This growth is primarily spurred by robust government backing, demonstrated through an aggressive tendering strategy. Key catalysts include technological advancements, affordable financing, and supportive policies. However, infrastructural challenges such as land and connectivity availability are affecting project momentum as of the date of analysis.

Solar to witness additions of 45-50 GW in fiscal 2027

The solar additions momentum continued in fiscal 2027, with 11.9 GW solar capacity already added during the first quarter of fiscal 2027. Owing to a robust pipeline of projects and favourable government policies, solar capacity additions are expected at 45-50 gigawatt (GW) in fiscal 2027, while fiscals 2027-2031 are expected to see additions of 230-270 GW.

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Solar capacity additions of 230-270 GW expected over fiscals 2027-2031

Crisil Intelligence expects 230-270 GW of solar capacity additions over fiscals 2027-2031. This will be driven by additions under:

- **Central schemes:** The Solar Energy Corporation of India (SECI) and other central discoms tenders under various schemes, which remains in pipeline, with ~58 GW allocated as of June 2026.
- **State solar policies:** About 23 GW of projects are under construction and are expected to be commissioned over fiscals 2027-2031, based on the capacity allocated by states as of June 2026.
- **Public sector undertakings (PSUs):** The Central Public Sector Undertaking (CPSU) programme under Jawaharlal Nehru National Solar Mission (JNNSM) was extended to 12 GW in February 2019. The government is also encouraging cash-rich PSUs to set up renewable energy projects. In particular, NTPC has a target of installing ~35 GW of renewable energy capacities by fiscal 2028. Similarly, NHPC had allocated 2 GW of projects in 2020, while the Indian Railways has committed to 20 GW of solar power by 2030. Other PSUs such as Neyveli Lignite Corporation (NLC), defence organisations, and governmental establishments are also expected to contribute to this addition.
- **Rooftop solar projects:** Crisil Intelligence expect 70-80 GW of rooftop solar projects to be commissioned by fiscal 2031, led by PM Surya Ghar Yojana and industrial and commercial consumers under net/gross metering schemes of various states.
- **Open-access solar projects:** Crisil Intelligence expect 35-45 GW of open-access solar projects under the capex and opex modes to be commissioned by fiscal 2031, led by the Green Energy Open Access Rules, 2022, sustainability initiatives and RE100 targets of corporate consumers, and better tariff structures and policies in states such as Uttar Pradesh and Karnataka, which are longer term in nature. The extension of the Approved List of Models and Manufacturers (ALMM) List-II compliance deadline for net-metering and open-access projects until December 2026 is also expected to support near-term execution and reduce supply-side disruption in fiscal 2027.

The Ministry of New and Renewable Energy (MNRE) has amended the solar bidding guidelines, solar-wind hybrid project guidelines, and guidelines for the procurement of round-the-clock (RTC) power. The amendments include incorporating several provisions related to extension in commissioning timelines, the definition of force majeure, payment security, and terms of default (discussed in detail later). Overall, the amendments are positive and aimed at resolving hurdles faced by developers.

Further, amendments to open-access regulations through the Green Energy Open Access Rules, energy banking regulations, changes in minimum contract demand, standardising the calculation of charges, etc., will help address the key issues of high levies, absence of banking provisions, and lack of standardisation across procedures in the open-access market.

Crisil Intelligence's outlook factors in the prevailing market dynamics, where regulatory and policy support is key. The renewable energy domain is highly dependent on policy support, and any uncertainty surrounding this is considered negative. Bottlenecks related to land acquisition, transmission connectivity and execution risk remain key factors to monitor for future capacity additions in the segment.

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Investment to grow multifold amid large opportunity and enabling ecosystem

Continued regulatory positives along with consistent policies are key to encouraging investment in the solar power segment. However, on the regulatory front, strict enforcement of renewable purchase obligation (RPO) compliance is necessary to ensure utilities continue procuring renewable power in line with the central policy push.

Domestic banking sector key lender to the segment

The main source of finance for solar projects has been credit lines taken from domestic banks. Domestic banks have been known to finance projects at 9-12%, with tenures of 15-18 years, based on the creditworthiness of the borrower. There are also several non-banking financial companies such as Indian Renewable Energy Development Agency Limited (IREDA) and Power Finance Corporation Limited (PFC), which actively lend to the solar power market. In April 2026, PFC lending rates for renewable wind/solar projects stood at 8.95-9.70% for state-sector borrowers/central public sector undertakings/joint ventures based on categories A++ to A, and 9.20-9.70% for private-sector borrowers based on categories IR-1 to IR-3. To reduce the cost of capital for projects and further improve project economics, many players have increasingly resorted to private equity investments and debt refinancing to raise and free up capital. The proceeds are used to invest in new projects.

Developers have been exploring diverse instruments and sources to raise finance, such as green bond issuances, external commercial borrowings, private placements and qualified institutional placements. This not only lowers the cost of capital but also frees up credit from domestic banks to be used again as initial capital for new projects. Several large renewable energy players such as Greenko, ReNew Power and Azure Power have raised funds from the offshore market through green bonds and other offshore debt instruments. Further, government entities and large financial institutions are also raising funds through the bond route to invest in the country's growing renewable energy sector.

In November 2025, NTPC Green Energy Limited announced the issuance of Rs 1,500 crore unsecured non-convertible debentures through private placement. The debentures carried a 7.01% per annum coupon rate and had a tenure of 10 years. The proceeds were to be used for financing capital expenditure, including refinancing and recoupment of capital expenditure already incurred, extending financing to subsidiaries and joint ventures, and general corporate purposes.

Earlier, in September 2025, Solar Energy Corporation of India Limited issued and listed its maiden debenture issue of Rs 600 crore on the National Stock Exchange. The debentures carried a 7.14% per annum coupon rate and had a maturity tenure of 10 years. The proceeds were to be utilised for capital expenditure towards renewable energy projects, recoupment of capital expenditure already incurred towards renewable energy projects, and general corporate purposes.

Some key advantages of green bond issuances are:

- A firm with a strong background and appropriate instrument structuring can raise funds at a lower cost of capital than domestic banks, including hedging costs if market conditions are favourable. Additionally, green bonds offer fixed-rate financing compared with the floating-rate nature of project loans, which is aligned with the fixed-tariff power purchase agreement (PPA) revenue model of these projects.
- Green bonds enable diversification of the debt profile and refinancing of existing bank debt, thus allowing bank credit to be utilised later or elsewhere.

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- Structural flexibility is relatively easier as coupon payment frequency can be structured (e.g. step-up in coupon rate at a later stage in the tenure). However, this can affect yields and banks may also provide similar terms, depending on creditworthiness.

However, the caveat here is that several bond issuances have gone towards refinancing existing debt and meeting expenses of operational assets, where commissioning and stabilisation of operations have already been achieved. These assets are less risky compared with greenfield projects. Consequently, bond issuances are being used by players as well as financial institutions to lower the cost of debt once the project is operational, that is, through refinancing at a later stage.

Recent bond issuances for renewable/green financing

Name of the IPP/Company	Month-Year of allotment	Value of bonds issued *(Rs. crore)*	Bond tenor *(years)*	Bond yield *(%)*
NTPC Green Energy Limited	Nov-25	1500	10	7.01%
Solar Energy Corporation of India	Sep-25	600	10	7.14%
Indian Renewable Energy Development Agency Limited	May-25	1500	5	7.00%
Indian Renewable Energy Development Agency Limited	Mar-25	910	10	7.74%
Indian Renewable Energy Development Agency Limited	Feb-25	820	11	7.40%
Indian Renewable Energy Development Agency Limited	Jan-25	1330	10	7.28%

Source: Crisil Intelligence

However, several factors, as detailed below, impact fundraising and its cost:

- Rupee depreciation and an increase in hedging costs add to cost pressures.
- Elevated global interest rates affecting coupon expectations and the attractiveness of bond issuances.

Despite this, a major driver for the sector has been the entry of global investors, which has widened access to funding for renewable energy projects and supported competitive bid tariffs, partly offsetting other negative factors. Continued regulatory support, resolution of stressed assets for domestic banks and continued inflow of equity capital from global investors and promoters remain key monitorable.

In addition to financing conditions, execution-related risks will remain important monitorable. Delays in transmission infrastructure, grid connectivity, land acquisition, module procurement, and state-level approvals can affect project timelines and capital deployment. Uneven enforcement of RCO/RPO compliance across states could also moderate demand visibility for renewable power and related market instruments such as RECs.

The race to build a larger portfolio than competitors has led to increased asset sales and consolidation in the sector over the past few years. This has been driven by several factors:

- Several deals involve operational assets tied up at tariffs higher than current auction-discovered tariffs, but with creditworthy counterparties. Such acquisitions help buyers improve portfolio scale, balance weighted average tariffs and reduce construction and commissioning risks.

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- Large renewable platforms such as Azure, ReNew, Greenko and Adani have benefited from equity investments by global investors, private equity firms and pension funds. This gives them greater ability to pursue inorganic expansion, especially during periods of slower auction activity or aggressive tariff bidding.
- Recent fund-raising by large platforms and global energy-transition funds also indicates continued investor appetite for renewable energy assets. This capital availability supports consolidation, as well-funded players can acquire operational or under-construction portfolios from smaller developers.
- Acquiring projects in locations or states near already operational assets helps improve economies of scale, as spare parts and staff can be centrally located and used across multiple projects.

Crisil Intelligence expects consolidation to continue with the ongoing quest for a larger portfolio among big players and the exit of several smaller firms from the sector due to increased competition.

Key growth drivers shaping the solar power industry

Focus on solar to help meet renewable consumption obligation targets

To promote renewable energy consumption across Indian states, the government has mandated designated consumers, including distribution licensees, open access consumers and captive users, to ensure a minimum share of electricity consumption from eligible non-fossil sources. This framework, earlier referred to as renewable purchase obligation (RPO), is now covered under the renewable consumption obligation (RCO) framework.

In October 2023, the Ministry of Power notified the year-wise RCO trajectory up to fiscal 2030, effective from April 1, 2024. Subsequently, the Ministry issued an amendment notification on September 27, 2025, superseding the October 20, 2023 notification. The revised RCO trajectory for distribution licensees is as follows:

RCO trajectory for distribution licensees

Year	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30
Wind RCO	0.67%	1.45%	1.97%	2.45%	2.95%	3.48%
Hydro RCO	0.38%	1.22%	1.34%	1.42%	1.42%	1.33%
Distributed	1.50%	2.10%	2.70%	3.30%	3.90%	4.50%
RCO *	27.36%	28.24%	29.94%	31.64%	33.09%	34.02%
Other RCO	29.91%	33.01%	35.95%	38.81%	41.36%	43.33%

Source: Bureau of Energy Efficiency, Crisil Intelligence

With these targets, the Ministry has increased the share of the “Other RCO” category, which rises to 29.94% in fiscal 2027 and 34.02% in fiscal 2030. This would provide significant impetus for distribution companies (discoms) to procure additional renewable energy, including solar power, as solar is generally accounted for under the Other RCO category. This category also allows eligible renewable energy from storage systems, including battery energy storage systems and pumped storage projects, to be counted towards compliance to the extent the stored energy is generated from eligible renewable sources.

The revised renewable consumption obligation (RCO) framework took effect from April 1, 2024. The Bureau of Energy Efficiency guidelines state that obligations under wind, hydro and other renewable energy components are fungible,

meaning shortfalls in one of these categories can be met by surpluses from another. Surplus from distributed renewable energy can also be used to meet shortfalls in wind, hydro or other renewable energy consumption. However, any shortfall in distributed renewable energy can be met only through distributed renewable energy, purchase or self-retention of renewable energy certificates, or payment of the buyout price.

Going forward, unless states and obligated entities can procure the required renewable power, renewable energy certificates (RECs), or use other permitted compliance routes such as the buyout mechanism, compliance may remain challenging in the face of rising RCO targets.

Lower REC prices on the exchange are expected to support an increase in RCO compliance levels, as obligated entities can buy more RECs to meet their targets. Strict enforcement remains critical for significant improvement and fair distribution of compliance across states. Under the latest RCO compliance mechanism, the Bureau of Energy Efficiency is responsible for monitoring compliance and reporting to the Central Government, while penalties for non-compliance are to be imposed as per the Energy Conservation (Compliance Enforcement) Rules, 2025.

Declining solar module and system costs improving project economics

The continuous decline in solar module and overall system costs has emerged as one of the most significant growth drivers for the solar power industry. Advances in solar cell technology, increasing manufacturing scale, improved production efficiencies, and stronger global supply chains have substantially reduced the cost of solar photovoltaic (PV) systems over the past decade. These cost reductions have made solar energy increasingly competitive with conventional power generation sources and accelerated its adoption across utility-scale, commercial and industrial (C&I), agricultural, and residential segments.

Lower solar module prices directly reduce the capital expenditure required for project development, while declining balance-of-system costs including inverters, mounting structures, cabling, engineering, procurement, and construction (EPC) costs further improve project economics. As a result, developers can achieve higher returns on investment, improved project viability, and shorter payback periods. The reduction in overall project costs has also contributed to a decline in the levelized cost of electricity (LCOE), making solar power one of the most cost-effective sources of new electricity generation.

In India, policy initiatives aimed at strengthening domestic manufacturing capabilities, including the Production Linked Incentive (PLI) Scheme for High Efficiency Solar PV Modules, are expected to support long-term cost competitiveness by expanding local manufacturing capacity and reducing dependence on imported equipment. The scheme is facilitating significant investments in integrated solar manufacturing facilities, thereby improving supply-chain resilience and enhancing the affordability of solar components.

The improvement in project economics resulting from lower module and system costs has increased investor confidence and attracted greater private sector participation in the renewable energy sector. It has also supported large-scale deployment under government programs such as utility-scale solar parks, rooftop solar initiatives, and PM-KUSUM, thereby driving sustained growth in installed solar capacity. Furthermore, declining costs are expanding the addressable market for solar power by making clean energy solutions economically attractive for a wider range of consumers and businesses.

Overall, the continued reduction in solar module and system costs is expected to remain a key catalyst for industry growth, supporting higher solar capacity additions, greater energy affordability, and the ongoing transition toward a cleaner and more sustainable energy mix.

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PLI Scheme for solar modules

The Government of India launched the Production Linked Incentive (PLI) Scheme for High Efficiency Solar PV Modules to strengthen domestic solar manufacturing and reduce dependence on imports, particularly from China. The scheme incentivizes manufacturers based on the production and sale of high-efficiency solar PV modules and encourages the establishment of integrated manufacturing facilities covering polysilicon, wafers, cells, and modules. The policy is a key pillar of India's strategy to build a self-reliant solar manufacturing ecosystem and support the country's renewable energy transition.

The scheme has a total outlay of ₹24,000 crore, implemented in two phases. Tranche-I was approved with an outlay of ₹4,500 crore, while Tranche-II was launched with an outlay of ₹19,500 crore. Incentives are provided over five years after the commissioning of manufacturing facilities and are linked to manufacturing efficiency, local value addition, and technological advancement.

Under Tranche-I, awards were issued for the establishment of 8,737 MW of fully integrated solar PV manufacturing capacity. Under Tranche-II, SECI awarded capacities totalling approximately 39,600 MW to 11 manufacturers. Collectively, the scheme has awarded manufacturing capacity of approximately 48.3 GW, supporting the development of an integrated domestic solar supply chain.

Besides reducing import dependence, the scheme aims to generate employment, attract private investment, facilitate technology transfer, and improve India's competitiveness in global solar manufacturing. As of October 2024, investments of around ₹35,000 crore and direct employment for approximately 10,000 people had been reported under the scheme.

ALMM-led capacity expansion may reduce India’s solar module cost gap

Crisil Intelligence expects imported cell-based module prices to be around $0.15-0.17 per watt-peak (Wp) and domestic cell-based module prices to be $0.24-0.26/Wp before goods and services tax (GST) in fiscal 2027. Imported-cell modules may remain cheaper in the near term because players are likely to clear older technology inventory at low prices, while premium pricing may apply to TopCon technologies.

China’s efforts to reduce photovoltaic overcapacity and enforce stricter efficiency standards from January 1, 2027, could improve polysilicon market sentiment and gradually push up prices. However, the near-term impact is expected to be limited because polysilicon supply remains high and prices are still close to cash-cost levels.

If polysilicon prices rise, imported cell-based module costs may increase, narrowing the price gap with domestic cell-based modules. Even so, domestic content requirement (DCR) modules remain significantly costlier, mainly because India’s domestic cell manufacturing capacity is still limited.

The implementation of ALMM II in fiscal 2026 and the potential rollout of ALMM III by fiscal 2028 are expected to support upstream capacity expansion. Over time, higher domestic cell availability could help reduce the cost gap between DCR modules and imported cell-based modules.

PM-KUSUM

The Pradhan Mantri Kisan Urja Suraksha evam Utthaan Mahabhiyan (PM-KUSUM) is one of India's flagship renewable energy programmes focused on solarizing the agricultural sector. The scheme aims to improve farmers' energy security, reduce dependence on diesel-powered irrigation pumps, lower electricity subsidy burdens on state utilities, and increase farmer incomes through decentralized solar power generation.

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The scheme targets the addition of 34.8 GW of solar capacity by March 2026 with central financial assistance of ₹34,422 crore.

PM-KUSUM consists of three components:

Component A

Development of 10,000 MW of decentralized grid-connected renewable energy power plants (500 kW to 2 MW). Farmers, cooperatives, panchayats, FPOs, and rural entrepreneurs can establish solar plants and sell electricity to DISCOMs under long-term arrangements.

Component B

Installation of 14 lakh standalone solar agricultural pumps in off-grid areas. Farmers receive substantial capital subsidies from the central and state governments, reducing upfront investment requirements.

Component C

Solarization of 35 lakh grid-connected agricultural pumps, including feeder-level solarization. Farmers can use solar energy for irrigation and export surplus power to the grid, creating an additional source of income.

The scheme has become a significant demand driver for India's solar industry by creating large-scale opportunities for solar module manufacturers, EPC companies, inverter suppliers, and solar pump manufacturers. It also supports rural electrification and distributed renewable energy deployment.

Solar rooftop capacity expected to grow by 70-80 GW over the next five years, Surya Ghar Yojana to be the prime boost for the sector

Crisil Intelligence expects growth in the solar rooftop segment to be led by the commissioning of capacity in the residential and commercial and industrial (C&I) space. Residential rooftop consumers will be a key contributor to growth led by the Prime Minister's household scheme, which if effectively implemented can boost the residential segment offtake substantially. This will further be supported by capacity added by industrial and commercial consumers under net/gross metering schemes of various states.

PM Surya Ghar Yojana kickstarts residential rooftop segment

The newly launched PM Surya Ghar Yojana in February 2024 is expected to boost residential offtake of solar rooftop, specifically by addressing cost hurdles. The government emphasised its plan to support the installation of solar panels for 10 million households. It will provide a subsidy for installing rooftop solar systems in residential houses, which will help save money on electricity bills.

The subsidy, under the scheme, has been increased to Rs 30,000 per kW from Rs 18,000 for plant sizes up to 2 kW. For plant sizes of 3 kW, the maximum subsidy available is Rs 78,000, which also serves as the cap for project sizes larger than 3 kW. Under this scheme, the government estimates the electricity benefit to be up to 300 units per month per household. This essentially means the 67% jump in subsidy support has been directed to smaller rooftop projects, which, as per market estimates, would represent most of the solar rooftop potential in India and may face affordability challenges due to their small size.

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This scheme is expected to drive 55-60 GW of residential rooftop additions between fiscal 2027 and fiscal 2031, taking the installed base to 65-70 GW in fiscal 2031 from an estimated 9.6 GW as of fiscal 2026. So far, many banks have registered to provide financing for solar rooftops under the scheme. These banks will provide loans at floating rate of interest and for maximum tenure of 5-10 years.

Under the PM Surya Ghar: Muft Bijli Yojana, the Ministry of New and Renewable Energy had issued operational guidelines in July 2024 for the saturation of government buildings with rooftop solar systems, targeting technically feasible installations across buildings under central ministries, departments, autonomous bodies and subordinate offices by December 2025. CPSEs with renewable energy experience were designated to support ministries in implementation through models such as capex, RESCO, turnkey execution and aggregation. While some regions, such as Chandigarh and Daman & Diu, had achieved 100% of their government-building rooftop solar targets by March 2025, subsequent official updates have focused more on the residential rooftop component of the scheme, which crossed 40 lakh beneficiary households by June 2026 and is targeting 75 lakh households by December 2026.

Another business model facilitated by government policies is net metering. In most state policies, net metering is allowed for residential and C&I consumers. All discoms can utilise units generated from rooftop solar power plants to comply with their solar renewable purchase obligation (RPO) targets if the consumer is not an obligated entity. Furthermore, any excess units generated by the entities, over and above their obligation, will be utilised by discoms to meet their solar RPO targets. In case discoms are providing feed-in tariff (FiT), the DISCOMs will meet their RPO targets from the units injected into the grid from such projects.

Owing to lower capital costs, rooftop projects have become increasingly appealing to C&I consumers. Specifically, the net metering scheme—under which power generated can be consumed captively and the balance/excess can be sold to the grid—is attractive for consumers paying high tariff to DISCOMs.

The cost of generating solar power from rooftop projects is estimated to be Rs 3.5-4.5 per unit (without availing accelerated depreciation). C&I consumers are best placed to claim accelerated depreciation benefits and increase their project returns/reduce generation cost. This segment includes high-tension consumers and commercial consumers such as malls, hospitals, government establishments and high-consumption group residential complexes.

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4.7. Overview of Wastewater treatment landscape in India

In India, the wastewater sector is facing significant challenges, with a large portion of the population lacking access to proper sanitation and wastewater treatment facilities. The National Commission for Integrated Water Resources Development (NCIWRD) projects the country's water requirements to reach approximately 1,180 billion cubic metres by 2050, with around 70% allocated for agriculture, 9% for drinking water, 7% for industrial purposes, 6% for energy generation and the rest for other uses.

Research conducted by the Ministry of Jal Shakti shows the quality of rivers has shown some improvement, with 46% of rivers examined in 2022 designated as contaminated, compared with 70% in 2015. The Central Pollution Control Board (CPCB) has identified the release of industrial waste and untreated or partially treated municipal wastewater into water bodies, and inadequate solid waste management as some of the primary causes of water pollution.

A 2021 assessment by NITI Aayog indicates that India is one of the most water-stressed regions globally, with approximately 600 million Indians facing high water stress. By 2030, the demand for the water is expected to be twice the available supply, potentially leading to water scarcity for millions of people and impacting the country's GDP. Effective management of water resources, and reusing and recycling them, is essential for a sustainable future.

Wastewater generation and treatment capacity in India

The expected sewage generated has increased steadily over the years, from 70,517 MLD in fiscal 2020 to 82,300 MLD in fiscal 2026, based on population growth and rapid urbanisation. Sewage treatment capacity has also increased from 29,738 MLD to 46,435 MLD during this period, based on monthly reports submitted by state pollution control boards to the National Green Tribunal (NGT). This is a positive step towards addressing the country's wastewater management challenges.

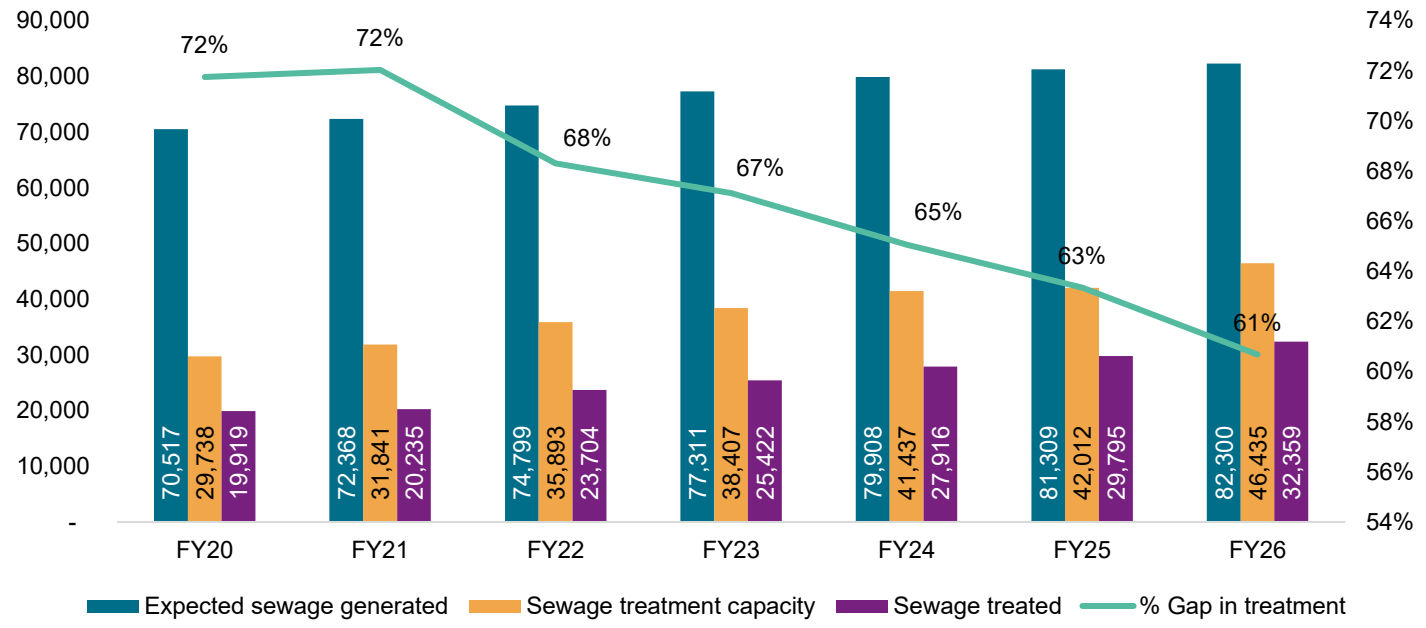
The actual sewage treated has also shown an increasing trend, from 19,919 MLD to 32,359 MLD, indicating a growth of ~30% during the period. While there is still a significant gap between installed capacity and actual treatment, it has narrowed over the years, indicating improved utilisation of existing infrastructure.

The utilisation rate of STPs hovering around 60% can be attributed to several factors. One major reason is that STP capacities are often designed to cater to future demand, considering the projected population growth and urbanisation in the area. This means that the existing capacity may not be fully utilised, as the current sewage generation might lower than the designed capacity for the respective catchment area.

Another significant reason for low utilisation is the lack of proper sewage collection infrastructure in many areas. In some cases, the sewage collection network is incomplete, or the pipes are old and leaky, leading to significant losses of sewage during transmission. This results in a lower volume of sewage reaching the STP, which in turn affects the utilisation rate.

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STP capacity vs utilisation (in Million Litres per Day (MLD), %)

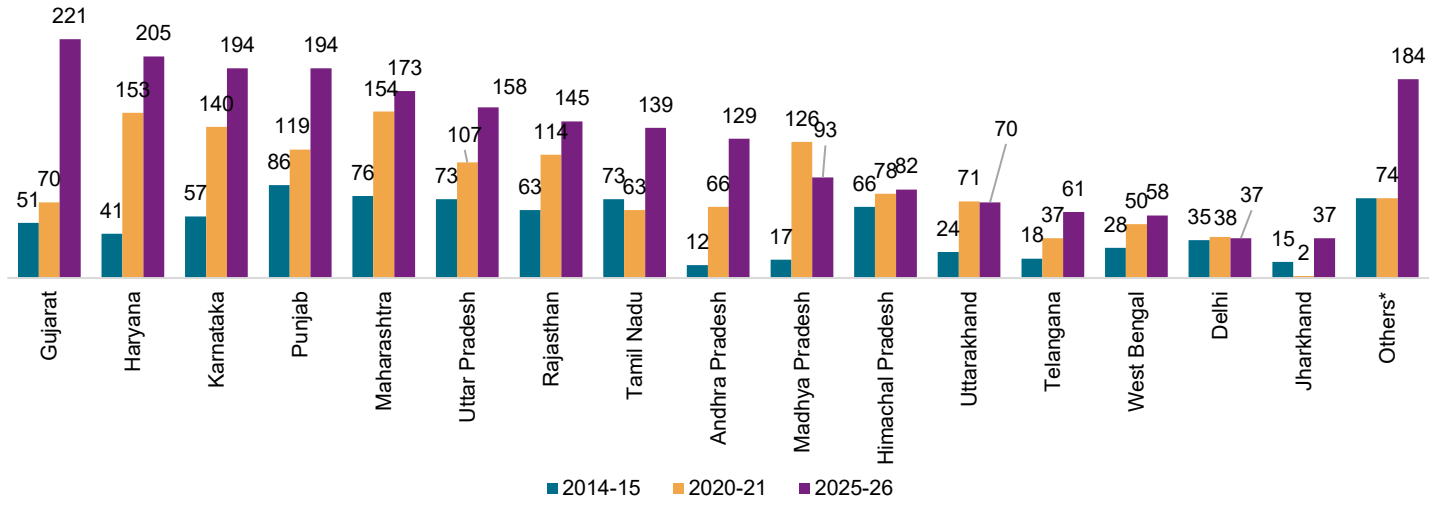


Note: For states where NGT monthly progress reports for March were not available, data from the nearest available month was used. Additionally, data for Chandigarh and Arunachal Pradesh has not been published and therefore was not included in the analysis

Source: NGT monthly progress reports, Niti Aayog, CPCB, Crisil Intelligence

Certain states, including Gujarat, Haryana, Karnataka, and Uttar Pradesh, have not only established a large number of STPs but have also demonstrated remarkable growth in their numbers between 2015 and 2026, with some even achieving triple-digit growth. This surge suggests that these states are prioritizing the development of smaller, ULB-based STPs, which has contributed to the significant increase in their overall numbers.

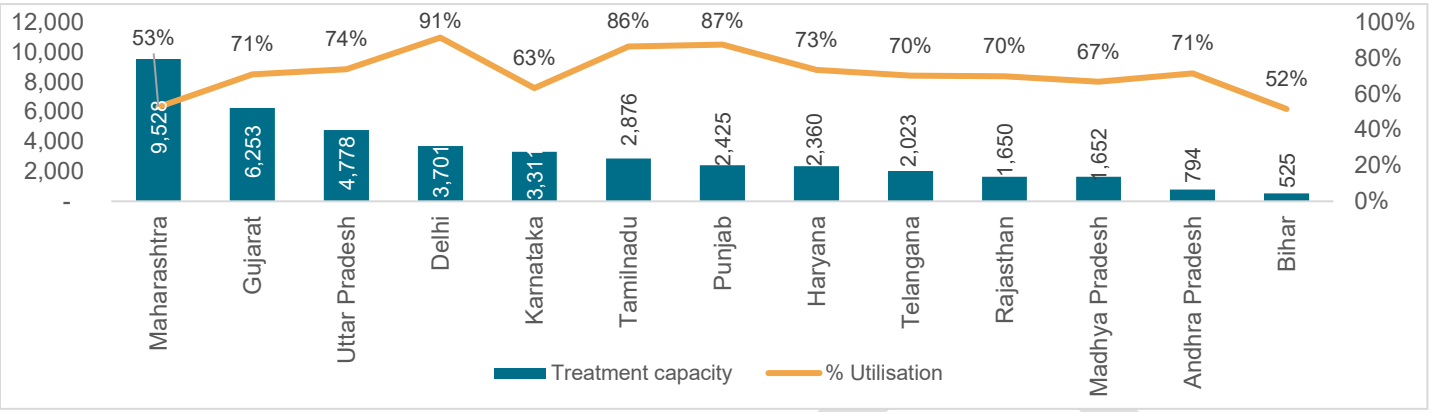
Number of Sewage Treatment Plants (STPs) across states



*Notes: * Others includes states with less than 30 operational STPs such as J&K, Chhattisgarh, Odisha, Goa, Sikkim, Puducherry, Bihar, Kerala, Mizoram, Daman & Diu, Tripura*

Source: CPCB Status of STP report, MPR report published by each SPCBs, Crisil Intelligence

STP capacity across states (FY25-26)



Note: For states where NGT monthly progress reports for March were not available, data from the nearest available month was used. Additionally, data for Chandigarh and Arunachal Pradesh has not been published and therefore was not included in the analysis

Others include states Jharkhand, J&K, Kerala, Himachal Pradesh, Goa, Puducherry, Manipur, Nagaland, Sikkim, Dadra & Nagar Haveli, A&N Island, Mizoram, Tripura, Assam, Meghalaya, and Lakshadweep

Source: NGT monthly progress reports, Crisil Intelligence

The states with the highest treatment capacity are Maharashtra, Gujarat, Uttar Pradesh, Delhi and Karnataka, accounting for approximately 59% of the country's total treatment capacity. Maharashtra has the largest share at around 21%, followed by Gujarat with 14%, Uttar Pradesh with 10%, and Delhi and Karnataka with each around 7-8%. These are among the most populous and industrialised states and their high treatment capacities reflect the significant efforts being made to manage their wastewater.

Overall, the data indicates that the top 10 states are making significant progress in managing their wastewater. This progress can be attributed to state-level initiatives, such as the New Liquid Waste Management Rules in Gujarat and Maharashtra's upgraded water policy of 2019, which added mandates on reuse and sanitation. These initiatives highlight the importance of tailored approaches to address the unique challenges and opportunities in each state.

Overview of construction spend on water treatment, wastewater treatment and supply market

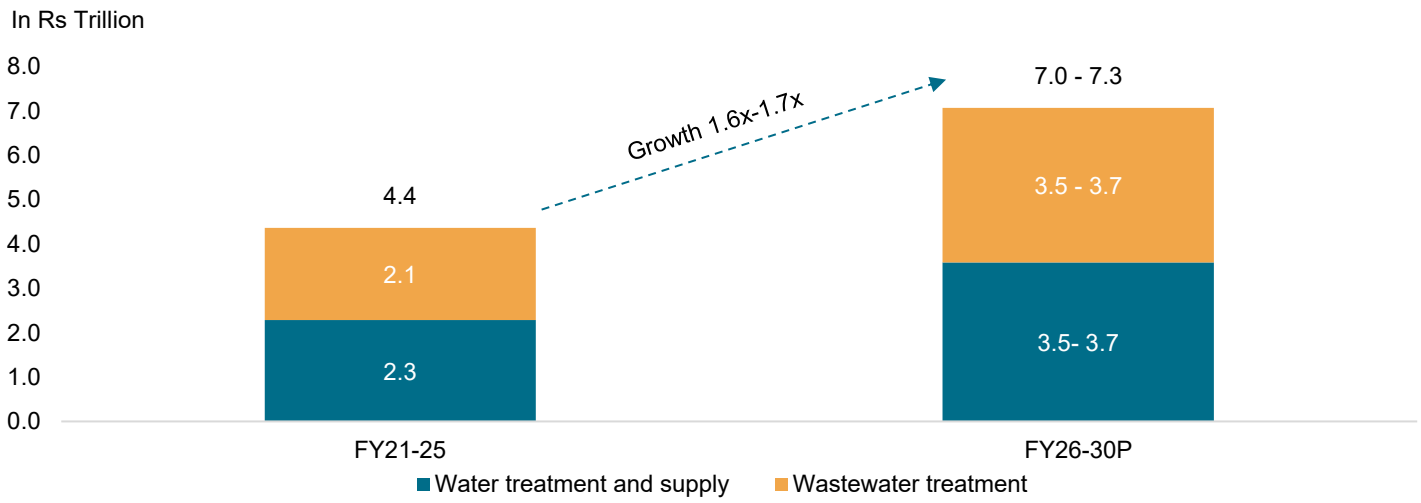
Govt's increased focus on water supply and sanitation to drive investments

Investments in urban infrastructure recorded a 33% CAGR between fiscal 2020-fiscal 2025 led by investments in Water supply and sanitation under schemes such as Swachh Bharat Mission, Jal Jeevan mission, AMRUT and deferred investments in Metro projects a bulk of which were under implementation and have achieved financial closure. Urban infrastructure includes construction-intensive mass rapid transit system (MRTS), bus rapid transit system (BRTS), water supply and sanitation (WSS) projects, smart cities, and related infrastructure development.

Crisil Intelligence projects ~Rs 7.0-7.3 trillion spends on water treatment, supply and wastewater treatment between fiscals 2026 and 2030, which is ~ 1.6x-1.7x higher than the amount invested in the previous five years. Water treatment, wastewater treatment and supply projects are expected to account for more than half of the total urban infrastructure investments over the next five years, driven primarily by state governments and through centrally sponsored programmes such as Jal Jeevan mission, AMRUT and Swach Bharat mission.

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Construction spends on water and wastewater treatment infrastructure



Notes: P: projected
Source: Crisil Intelligence

Indian water treatment market has grown remarkably over the past five years, fuelled by the government's initiatives to enhance water supply and sanitation infrastructure. The Har Ghar Jal scheme for rural areas under the Jal Jeevan Mission and the 24x7 water supply plan for 500 cities under the AMRUT programme have been instrumental in driving this growth, with additional support from other schemes such as the Smart City Mission.

Rapid growth in water treatment and supply market can be attributed to significant investments in water infrastructure, including the augmentation of water treatment plant (WTP) capacity, renovation of existing WTPs and expansion of pipeline infrastructure. The integration of cutting-edge technologies, such as SCADA and leakage detection systems, has played a crucial role in modernising the sector. With continued urbanisation and industrialisation, the country's demand for clean water is on the rise, creating a pressing need for efficient water treatment solutions.

The Jal Jeevan Mission has already led to substantial investment in rural water infrastructure, with rural household tap water connections increasing from 16.1% in 2019 to 80% just five years later, the next phase of growth is expected to be driven by urban development. The government's plans to provide 24x7 water supply and reduce non-revenue water (NRW) in urban areas are anticipated to be major growth drivers.

Key projects across water and wastewater treatment sector in India

Project	State / Union territory	Capacity	Total cost (Rs Mn)	Status	Completion date
Water Treatment Plant (Panjrapur)	Maharashtra	910 MLD	31,450	Planning	NA
Water Treatment Plant (Bhandup)	Maharashtra	2,000 MLD	41,238.8	Planning	29-Feb-2028
Water Treatment Plant (Bilga, Ludhiana)	Punjab	580 MLD	15,460.0	Planning	31-Dec-2026
Water Treatment Plant (Aluva) and associated transmission network	Kerala	190 MLD	5,230.0	Planning	30-Apr-2028
Water Supply Scheme (Indore)	Madhya Pradesh	1,650 MLD	10,730.0	Planning	30-Nov-2027

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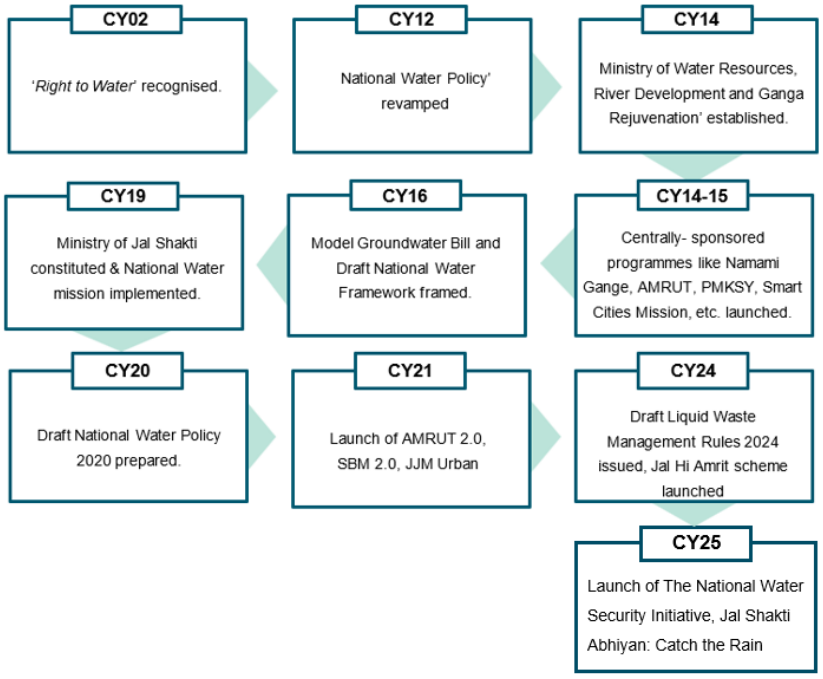
Project	State / Union territory	Capacity	Total cost (Rs Mn)	Status	Completion date
Water Treatment Plant (Versona)	Maharashtra	270 MLD	10,362.1	Planning	30-Apr-2028
Water Treatment Plant (Bidkin) and associated transmission network	Maharashtra	70 MLD	4,000.0	Planning	30-Jun-2028
Water Treatment Plant (Vallah) associated transmission network and overhead service reservoirs	Punjab	440 MLD	6,653.2	Under execution	28-Feb-2026
Water Treatment Plant (Dighi Port Industrial Area)	Maharashtra	50 MLD	1,771.6	Under execution	31-May-2026
Pipe Water Supply Scheme (Mathura)	Uttar Pradesh	NA	33,115.0	Under execution	31-Dec-2026

Note: The above list is not exhaustive and only an indicative list of projects,
NA- Not Available, MLD - Million Litres per Day
Source: Projects Today, Crisil Intelligence

Key growth drivers and challenges of the water treatment, supply and wastewater treatment market of India

Government policies and regulatory framework in India

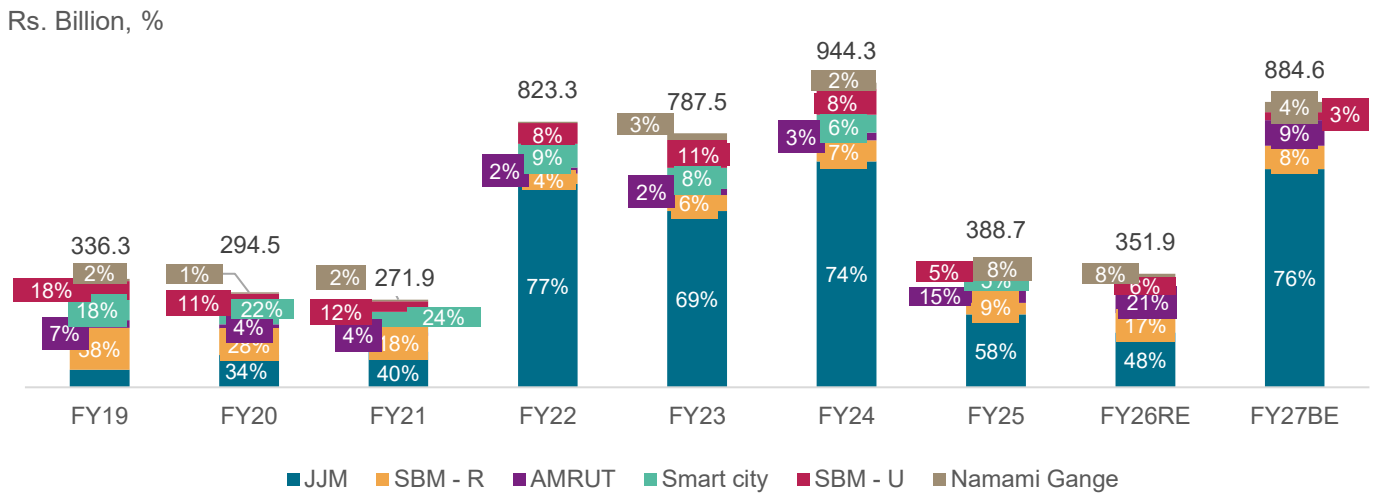
The government has various policies and frameworks that supported the growth of the water management sector in the country



In India, water management is primarily the responsibility of state governments, with the central government providing technical and financial support. Recognising the importance of water conservation, the government has made it a top priority.

The National Water Mission continues to guide the policy, prioritising water conservation, rainwater harvesting and improving efficiency to ensure long-term sustainability in water resource management. These guidelines aim to build resilient systems that ensure safe drinking water, addressing long-standing issues of competence and capacity in small water systems.

Budgetary allocation across different funds related to WSS sector



Source: India Budget, expenditure profile, Crisil Intelligence
Notes: Till FY22 Namami gange program was called as National ganga plan and ghat works; In FY26BE budget for Smart city mission is not available

Launched on August 15, 2019, the Jal Jeevan Mission (JJM) is a flagship programme of the central government, with the objective of providing functional household tap connections (FHTCs) to all rural households. It aims to improve the lives of rural communities by providing them safe and adequate drinking water and promoting sustainable water management practices.

Jal Jeevan Mission

JJM uses a multi-stakeholder approach, involving the central government, state governments and local communities. It promotes community participation in water management, with a focus on sustainable and equitable use of water resources. It also emphasises on the importance of technological innovations, such as solar-powered water supply systems, to reduce cost and improve efficiency.

The mission has made significant progress with over 74 million FHTCs provided to rural households so far. Community participation in water management is being promoted, with a focus on sustainable and equitable use of water resources. A comprehensive plan has been developed to achieve the mission's objectives, build resilient water supply systems and promote community-led initiatives. It also recognises the importance of community education and awareness about water management to ensure long-term sustainability of water resources.

The mission is being implemented in a phased manner by developing in-village piped water supply infrastructure. Local communities are given help in capacity building and training to ensure their active participation in water management. Community-led total sanitation (CLTS) will help improve the overall quality of life in rural areas.

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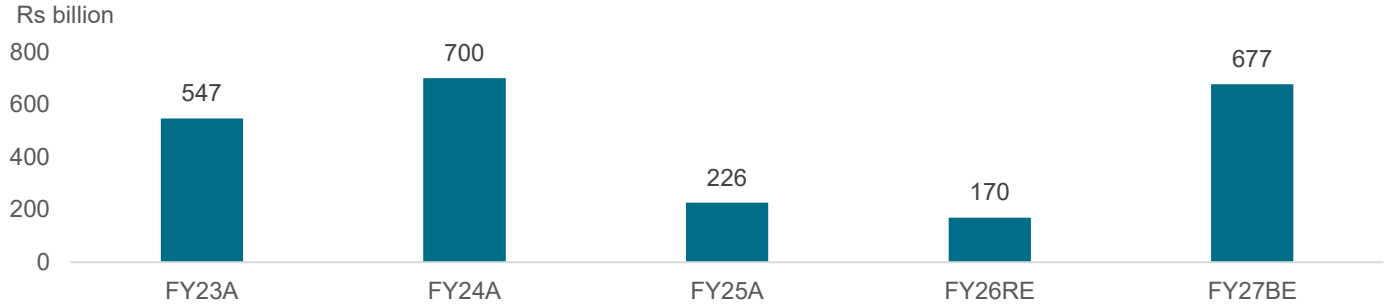
JJM's fund distribution ratio varies with states and Union Territories (UT), with Himalayan and northeastern states receiving 90% central funding, other states 50% and UTs without legislature receiving 100% central funding.

Fund distribution ratio for different states/ UTs

State/UTs	Central share (%)	State share (%)
Himalayan and northeastern sates	90	10
Other states	50	50
UT with legislature	90	10
UT without legislature	100	0

Source: JJM toolkit, Crisil Intelligence

Budgetary allocation for JJM



Note: A: Actual, RE: Revised estimates, BE; Budget Estimates
Source: Ministry of finance, Crisil Intelligence

The substantial budget allocation for JJM, though with some fluctuation over the years, also reflects the government's commitment to providing adequate funding to support the mission's objectives. The funds allocated to are utilised to provide tap water supply to households and to maintain and upgrade existing water supply infrastructure. The steady increase in household connections provided under the mission suggests it is on track to achieve its targets. Overall, the data suggests that JJM is making progress towards its objectives and the government is committed to supporting the mission through adequate funding.

AMRUT 2.0

The AMRUT 2.0 scheme was launched on October 1, 2021, by the Ministry of Housing and Urban Affairs (MoHUA) with the aim of making cities self-reliant and water secure. The scheme is a continuation of the previous AMRUT scheme, which was launched in 2015. It is designed to provide basic services such as water supply, sewerage and urban transport to households and build amenities in cities to improve the quality of life for all citizens, especially the poor and disadvantaged.

The main objectives of AMRUT 2.0 are:

- **Universal piped water supply:** Giving water tap connections to all households to ensure every household has access to clean and safe drinking water
- **Universal coverage of sewerage and septage management:** To provide universal coverage of sewerage and septage management in 500 AMRUT cities, ensuring that every household has access to proper sanitation facilities
- **Promoting circular economy of water:** Recycling and reusing treated sewage, reducing the burden on freshwater resources and minimising the environmental impact of wastewater disposal

- **Rejuvenation of water bodies:** To augment water availability, enhance amenity value and develop green spaces, which will, in turn, improve the overall aesthetic and environmental quality of urban areas
- **Making cities *atmanirbhar* and water secure:** By ensuring they have necessary infrastructure and resources to manage their water needs sustainably

The AMRUT 2.0 scheme has several key components, including:

- **Water supply:** The scheme aims to provide universal piped water supply with household water tap connections, ensuring that every household has access to clean and safe drinking water
- **Sewerage and septage management:** It aims to provide sewerage and septage management in 500 AMRUT cities, ensuring every household has access to proper sanitation facilities
- **Rejuvenation of water bodies:** It seeks to rejuvenate water bodies to augment water and enhance amenity value and develop green spaces, improving the overall aesthetic and environmental quality of urban areas
- **Technology sub-mission:** It will leverage latest technologies in the field of water to improve the efficiency and effectiveness of water supply and sewerage systems.
- **Public-private partnerships (PPPs):** The scheme encourages PPP projects in million-plus cities, with a minimum of 10% of total fund allocation at the city level committed to such project

Funds distribution ratio:

States/UTs	Central share (%)
Union Territories	100%
Northeastern states and Himalayan states	90%
Cities of states with less than one lakh population	50%
Cities of states with population one lakh to 10 lakh (both included)	On-third of the project cost
Cities of states with population more than 10 lakh	25% of the project funds by the Centre (except for projects taken up under PPP mode) *

Note: PPP projects amounting to at least 10% of total project allocation for all cities with population above 10 lakhs in a state will be mandatorily taken up under this scheme

Source: AMRUT 2 guidelines (MoHUA), Crisil Intelligence

The total indicative outlay for AMRUT 2.0 is Rs 2,990 billion, including the total Central assistance of Rs 767.6 billion, for five years (FY22 to FY26). As on November 15, 2024, Central assistance of Rs 639.77 billion was approved to states/UTs, of which Rs 117.56 billion has been released so far. The states/UTs have reported utilisation of Rs 65,40 billion of central share, and cumulatively, with state's share, the total expenditure reported by states/UTs is Rs 170.89 billion.

Budget allocation under the scheme

Mission component	Allocation (Rs billion)
Projects	667.50
Incentive for reforms (8% of CA allocation)	53.40
Administrative and other expenses (A&OE) for states/ UTs (3.25% of project CA allocation)	21.69

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Mission component	Allocation (Rs billion)
Administrative and Other Expenses for MoHUA (1.75% of project CA allocation)	11.68
Technology sub-mission (1% of project CA allocation)	6.67
IEC activities (1% of project CA allocation)	6.67

Source: AMRUT 2 guidelines (MoHUA), Crisil Intelligence

Namami Gange Programme

The Namami Gange Programme (NGP), also known as National Mission for Clean Ganga, is an integrated conservation programme launched in June 2014 with the aim to achieve the twin goals of conservation and restoration of the water quality of the Ganga, along with effective pollution abatement.

The initiative has been implemented, considering the significant economic, environmental and cultural value associated with the river. The programme was initially set to run until March 2021 but was subsequently extended to March 2026. The 100% centrally funded programme adopts a hybrid annuity-based PPP model.

The Ganga flows more than 2,500 km through the plains of north and eastern India, with the Ganga basin comprising 26% of India's landmass, making it a key source of livelihood and water for many citizens. The NPG covers eight states, 47 towns and 12 rivers, comprising the main river and its tributaries. The second phase of the programme, which runs from fiscal 2021 to 2026, aims to build on the success of the first phase.

The first phase of the programme, which ended in 2021, saw the completion of several key projects, including the creation of sewerage infrastructure, control of industrial pollution and improvement with regard to rural sanitation.

In addition to these efforts, the government has also promoted sustainable agricultural practices, such as organic farming, to reduce pollution and improve the overall health of the Ganga basin. The introduction of new technologies, such as the use of GIS and remote sensing, has helped monitor the health of the river as well. Public awareness and community participation have been crucial components, with initiatives such as Ganga Utsav, which aims to promote awareness and education about the river among the general public, successful in engaging the community. Ganga Amantran, a 34-day river rafting expedition, has also been instrumental in promoting community participation and public awareness.

The programme has also seen significant investment in infrastructure development, including the creation of sewerage, industrial pollution control and rural sanitation infrastructure, which has improved the overall quality of life for people living in proximity to the Ganga basin.

Furthermore, initiatives such as Arth Ganga aim to promote sustainable agriculture and reduce pollution in the basin area – this has seen significant success, with the adoption of sustainable agricultural practices by farmers in the Ganga basin, and the reduction of pollution from industrial and agricultural sources.

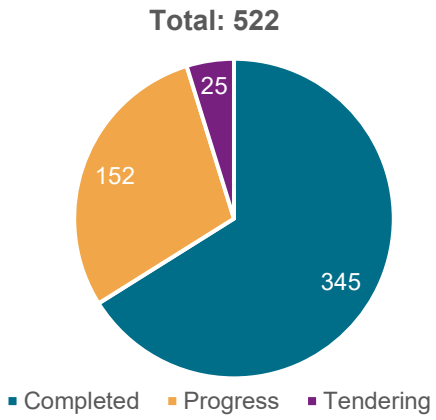
As the programme moves forward, there are plans to restore the ‘wholesomeness’ of the river, defined in terms of ensuring continuous flow, unpolluted flow, geologic and ecological integrity, and climatic and spatial understanding.

Towards this, the programme will continue to focus on creation of sewerage, industrial pollution control and rural sanitation infrastructure, and will introduce advanced technologies to monitor and further improve the health of the river.

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Overall, of a total of 513 under NGP, 344 projects have been completed, which represents a completion rate of ~67%, which is a notable achievement, considering the complexity and scale of the programme. The fact that 143 projects are still in progress and 26 are at the tendering stage indicates that the programme continues to have a strong pipeline of projects

Projects under NGP segregated by status



Note: As of February 2026
Source: NGP dashboard, Crisil Intelligence

Uttar Pradesh has the highest number of projects, totalling 161. The state has also made significant progress, with 101 projects completed. Uttarakhand has made significant progress as well, with 60 projects of a total of 87 completed, representing a completion rate of ~69%. In contrast, Jharkhand, Delhi and Madhya Pradesh have relatively fewer projects and will need to accelerate the pace of project implementation to meet the overall objectives of the NGP.

Rapid urbanisation and rising demand for treated water and sewage management in urban and peri-urban areas

Rapid urbanisation and expansion of urban and peri-urban settlements are expected to drive sustained demand for water supply and sanitation infrastructure. Growing urban populations and increasing pressure on existing civic infrastructure are necessitating investments in water distribution networks, sewerage systems, sewage treatment plants (STPs), and wastewater recycling facilities to ensure reliable access to safe water and effective sanitation services.

Government initiatives such as AMRUT 2.0 are supporting sector growth through significant investments in urban water supply, sewerage, and septage management infrastructure. The mission aims to make cities water-secure by expanding water supply coverage, increasing sewage treatment capacity, improving sewerage connectivity, and promoting reuse of treated wastewater.

Increasing water stress and stricter environmental standards are driving investments in wastewater treatment and water recycling infrastructure. The growing adoption of treated water for industrial, horticultural, agricultural, and other non-potable applications is expected to support the development of advanced treatment facilities and strengthen circular water management practices. As a result, rising urbanisation, increasing infrastructure requirements, and greater emphasis on

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sustainable water resource management are expected to remain key growth drivers for the Water Supply and Sanitation (WSS) industry.

Growing industrial water demand and stricter effluent discharge norms driving wastewater recycling and Zero Liquid Discharge (ZLD) adoption

The growing requirement for reliable water supply across industrial, commercial, and urban sectors has emerged as a key driver for the Water Supply and Sanitation (WSS) industry. Rapid industrialization, urban expansion, and increasing economic activity have significantly increased the demand for freshwater resources, placing considerable pressure on existing water infrastructure. As water scarcity concerns intensify across several regions, industries and municipalities are increasingly investing in wastewater treatment, recycling, and reuse solutions to ensure sustainable water availability and reduce dependence on freshwater sources.

In parallel, environmental regulators have implemented increasingly stringent effluent discharge standards to prevent contamination of surface water and groundwater resources. Industries are required to treat wastewater to prescribed quality standards before discharge or reuse, driving demand for advanced water and wastewater treatment infrastructure. Compliance with these regulations has accelerated investments in treatment technologies such as membrane filtration, reverse osmosis, biological treatment, tertiary treatment systems, and resource recovery solutions.

The adoption of wastewater recycling and reuse practices has gained significant momentum as industries seek to optimize water consumption and enhance operational resilience. Treated wastewater is increasingly being utilized for process applications, cooling systems, landscaping, construction activities, and other non-potable uses, helping reduce freshwater withdrawal while improving overall water-use efficiency. This trend is creating substantial opportunities for water treatment service providers, equipment manufacturers, and engineering solution providers within the WSS ecosystem.

Additionally, Zero Liquid Discharge (ZLD) systems are witnessing increased adoption across water-intensive industries such as power generation, chemicals, pharmaceuticals, textiles, food and beverages, and oil and gas. ZLD technologies enable industries to recover and reuse a significant portion of wastewater while minimizing or eliminating liquid effluent discharge. This not only supports regulatory compliance but also helps mitigate water scarcity risks and strengthens long-term water security.

Growing emphasis on sustainable resource management and Environmental, Social and Governance (ESG) commitments is further encouraging industries and municipalities to invest in advanced wastewater treatment and recycling infrastructure. Organizations are increasingly viewing wastewater as a valuable resource that can be treated, recovered, and reused rather than discharged, supporting the transition toward circular water management practices.

Overall, rising industrial water demand, increasing water stress, stricter environmental regulations, and the growing focus on wastewater recycling and reuse are expected to remain key growth drivers for the Water Supply and Sanitation industry. These trends are likely to drive sustained investments in water treatment infrastructure, wastewater recycling facilities, and Zero Liquid Discharge solutions, supporting long-term growth across the WSS sector.

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4.8. Key growth drivers for construction industry in India

Growth Driver	Key Discussion Points
Urbanisation trends and emergence of new growth corridors	• Rapid urban expansion is the most durable engine of construction demand: cities continue to absorb migrating populations seeking employment, education and healthcare, and this growth is no longer confined to metropolitan cores. Peripheral zones, satellite towns and Tier-II/III cities are emerging as new growth corridors, generating layered demand for transportation networks (metro rail, ring roads, expressways), civic utilities (water supply, sewerage, waste management) and wider urban infrastructure, with Tier-II/III cities now capturing a growing share of metro-rail and water-infrastructure allocations. • Policy has reinforced this decentralisation: Union Budget 2026-27 recognised Tier-II/III cities with populations above five lakh as emerging economic hubs and proposed City Economic Regions (CERs) receiving ₹5,000 crore each over five years through a challenge-based framework, alongside municipal-bond incentives and university townships near industrial and logistics corridors. • Connectivity investment is converting emerging cities into investable corridors – market research projects land-price appreciation of 25–100% in high-growth Tier-II/III corridors as expressways, industrial corridors and airports improve access – while seven proposed high-speed rail corridors are positioned as inter-city 'growth connectors' seeding future urban development along their alignments.
Demographic dividend and rising infrastructure demand	• India's young age structure is a multi-decade demand driver: over 65% of the population is under 35 with a median age of about 28 years, and the working-age share is projected to peak at ~68.9% by 2030, around 1.04 billion working-age persons, with the dependency ratio at a historic low. A growing working-age population directly fuels household formation, housing demand, urban mobility and consumption-linked commercial construction. • The same demographics expand the need for institutional infrastructure (education and skilling facilities), social infrastructure (healthcare and affordable housing) and physical infrastructure capacity (power, water, transport and telecom/digital networks), requirements that are progressively embedded in central and state capital-expenditure programmes. • On the supply side, construction remains one of the largest absorbers of India's incremental workforce, while the falling dependency ratio creates fiscal space that governments are channelling into infrastructure investment, though realising the dividend depends on continued skilling and enabling urban infrastructure.
Sustained government capital expenditure push	• The National Infrastructure Pipeline, launched with significant investment in spanning energy, roads, railways, urban infrastructure and affordable housing, remains the institutional backbone of this push; projects are tracked transparently on the India Investment Grid, and financing is diversified across budgetary support, PPPs, development finance institutions and asset monetisation. • The composition of spending is broadening into high-speed rail corridors, expressway expansion, renewable energy and emerging asset classes, catalysing large-scale infrastructure creation across geographies and crowding in private investment through the capex multiplier effect on economic activity.
Private sector participation and evolving PPP models	• India now deploys the full spectrum of PPP models – Build-Operate-Transfer (toll and annuity variants), Design-Build-Finance-Operate-Transfer, the Hybrid Annuity Model (HAM) and Toll-Operate-Transfer (TOT) – with standardised model RfQs, RfPs and concession agreements improving transparency and investor confidence • Infrastructure financing is diversifying beyond bank credit toward NBFCs, InvITs/REITs and capital markets, as noted in the Economic Survey 2025-26, for EPC players, HAM and

Growth Driver	Key Discussion Points
	monetisation-linked structures offer steadier cash-flow profiles and broaden the universe of bankable projects.
Strategic focus on multimodal connectivity and logistics	• The PM Gati Shakti National Master Plan and National Logistics Policy institutionalise integrated, GIS-based planning so that highways, railways, ports, waterways and economic zones are synchronised – explicitly targeting the planning silos, clearance delays and cost overruns that historically inflated India's logistics costs relative to advanced economies. • Dedicated Freight Corridors are reshaping freight economics – the Eastern DFC is operational and the Western DFC is nearing completion – while 30+ Multimodal Logistics Parks (MMLPs) have been approved under Bharatmala/Gati Shakti with six awarded, studies indicate MMLPs integrated with DFCs can reduce door-to-door freight costs by up to ~40%, with 200+ such parks potentially required by 2047. • Industrial corridors, rail-linked cargo terminals, port-led development and integrated warehousing clusters are creating a class of large, technically demanding projects, spanning earthworks, structures, utilities and rail sidings, that also generate ancillary demand for optical-fibre laying, HDD crossings, ducting and power works along every new alignment, a segment directly relevant to telecom-linked constructors.
Technological modernisation and sustainability focus	• Project delivery is shifting to a digital-first model: Building Information Modelling (BIM) is increasingly embedded in government-backed mega programmes such as Bharatmala, Sagarmala and metro rail systems to reduce design clashes and rework, while drones, 3D scanning, digital twins and AI-based project controls are improving survey speed, progress monitoring and risk management. • Prefabrication, precast systems and modular construction are gaining traction as contractors seek schedule certainty and quality consistency amid skilled-labour constraints, and green construction is mainstreaming, low-carbon materials, energy-efficient design and IGBC/LEED certification, driven by tightening regulation and ESG-linked capital. • Growing industrial water demand and stricter effluent discharge norms are driving wastewater recycling and Zero Liquid Discharge (ZLD) adoption in industrial construction, while adjacent technology-led segments – renewable energy, battery storage, data centres and 5G/fibre densification – are adding high-specification construction demand.

Source: Crisil Intelligence

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4.9. Government initiatives across infrastructure sectors

PM-WANI Scheme

The Prime Minister's Wi-Fi Access Network Interface (PM-WANI) scheme was approved in December 2020 to accelerate the proliferation of affordable broadband through public Wi-Fi hotspots across India. The framework enables small businesses, local entrepreneurs, and community institutions to become Public Data Offices (PDOs) without requiring a telecom licence or registration fee, thereby lowering barriers to broadband access and supporting the objectives of the National Digital Communications Policy (NDCP) 2018. PM-WANI is designed to complement other digital infrastructure initiatives such as BharatNet by extending last-mile connectivity and improving internet access, particularly in rural and underserved regions.

As of 28 February 2026, a total of 4,09,403 operational public Wi-Fi hotspots (PDOs) were active under PM-WANI across India. Additionally, 207 PDO Aggregators (PDOAs) and 113 App Providers were registered under the ecosystem. The government also reported that 24.5 million users had accessed PM-WANI hotspots, consuming approximately 58.64 petabytes of data since launch. Recent policy reforms allowing FTTH-based PDO operations, hotspot aggregation, roaming between PDOAs, and mobile data offload are expected to further accelerate adoption.

BharatNet Project

BharatNet Project is India's flagship rural broadband programme aimed at connecting Gram Panchayats through high-speed optical fibre infrastructure. The project serves as the foundational broadband backbone enabling digital governance, online education, telemedicine, financial inclusion, and rural entrepreneurship.

As of February 2026, 2,17,805 Gram Panchayats were service-ready under BharatNet. Separately, the Ministry of Communications reported that approximately 0.22 million Gram Panchayats, representing nearly 97% of the Phase I and Phase II target, had been connected, supported by nearly 0.7 million km of optical fibre cable laid across the country.

National Broadband Mission 2.0

The National Broadband Mission (NBM) 2.0 serves as India's broadband roadmap for 2025-2030, focusing on universal access to high-speed broadband, enhanced fibre infrastructure, satellite-based connectivity, and digital inclusion. The mission seeks to connect villages and key public institutions such as schools, PHCs, Anganwadi centres, and Panchayat offices while leveraging 5G and satellite technologies.

During 2026, the government reaffirmed NBM 2.0 as the principal framework for achieving universal broadband access by 2030. The Ministry of Communications reported that India had crossed 1 billion internet subscribers, broadband subscriptions exceeded 1 billion, and mobile penetration reached 92%. NBM 2.0 has established a set of measurable 2030 targets and continues to be supported through Right of Way reforms, fibre deployment initiatives, and integration with BharatNet expansion programmes.

Amended BharatNet Programme (ABP)

The Amended BharatNet Programme (ABP), approved on 4 August 2023, is designed to upgrade the existing BharatNet network into a resilient IP-MPLS ring topology architecture with long-term service assurance and maintenance. The programme is focused not only on infrastructure deployment but also on utilization, rural FTTH adoption, and last-mile connectivity expansion.

The latest official progress data shows significant implementation momentum. As of June 2026, 13,494 Gram Panchayats had already been upgraded under ABP. Subsequently, the Digital Bharat Nidhi dashboard reported that in August 2026, the number of upgraded Gram Panchayats had increased to 28,700, supported by 55,780 km of optical fibre laid and 2,82,954 FTTH connections provided under the programme. The ABP continues to target connectivity to approximately 0.27 million Gram Panchayats, broadband access to around 0.38 million villages on demand, and 15 million rural FTTH connections over five years.

Pradhan Mantri Gram Sadak Yojana (PMGSY)

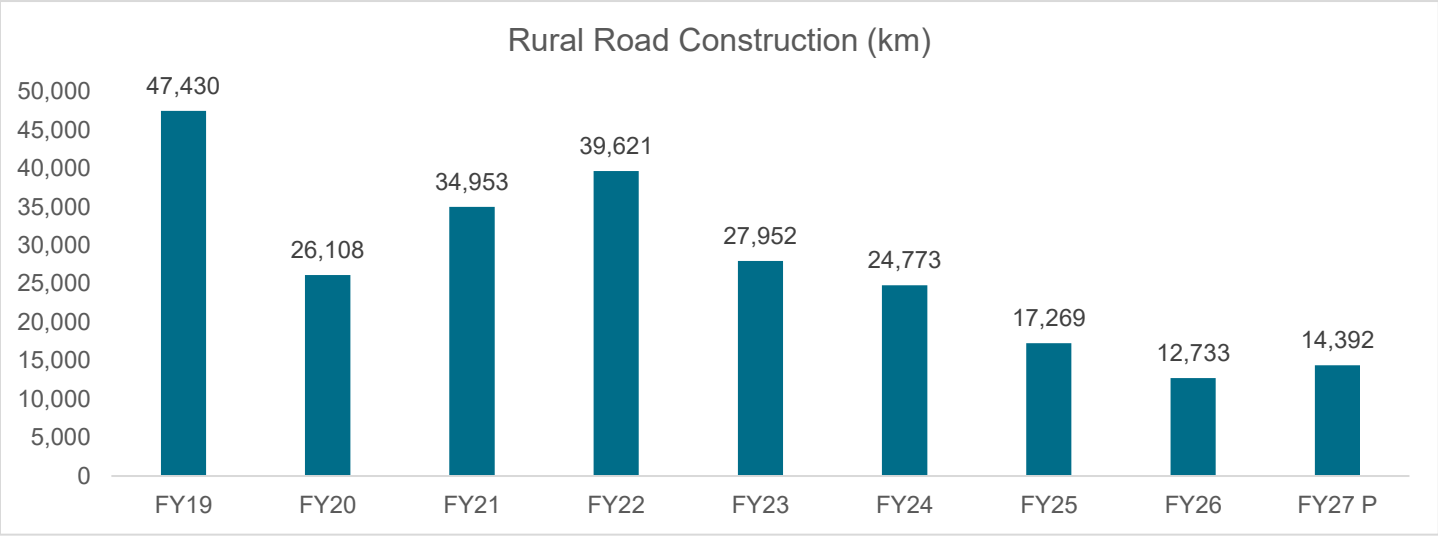
The Pradhan Mantri Gram Sadak Yojana (PMGSY) is a unique initiative aimed at enhancing rural connectivity by establishing a single all-weather road to eligible unconnected habitations with a population of 500 or more, as per the 2001 Census, in plain regions. The first phase of PMGSY was initiated in 2000, during which the government identified 172,769 habitations in need of all-weather roads. As of the fiscal year 2021, 99% of these eligible and feasible habitations have been successfully connected.

In addition, the government introduced PMGSY-II in 2013-14, focusing on the consolidation of the existing rural road network, which spans a total of 50,000 kilometres, to enhance its efficiency in providing transportation services for people, goods, and services. To date, 49,429 kilometres of rural roads have been sanctioned under PMGSY-II, with 93% of this work completed. The overarching scheme encompasses the construction and upgrading of rural roads.

In fiscal year 2020, the construction of rural roads was significantly reduced to approximately 27,000 kilometres, compared to around 49,000 kilometres in the previous year. Fiscal year 2021 saw an increase to about 37,000 kilometres, while fiscal year 2022 recorded approximately 42,000 kilometres of construction. However, in fiscal year 2023, rural road construction fell short of the target. For fiscal year 2024, the target for rural road construction has been revised down to 38,000 kilometres out of a total of over 800,000 kilometres of rural roads.

The Pradhan Mantri Gram Sadak Yojana (PMGSY), a flagship programme of the Indian government, aims at connecting rural areas by constructing roads. As of now, a total of 8,34,519 km of road length has been sanctioned under various ongoing interventions/ verticals of PMGSY. Of this, 7,82,247 km road has already been completed and upgraded.

Year-wise length constructed / upgraded under PMGSY



Source: Ministry of Rural Development

National Highways Development Programme (NHDP)

NHDP encompasses the construction of national highways and upgradation and widening of existing ones. NHDP projects are primarily awarded to public sector or private players by the National Highways Authority of India (NHAI). Implementation is done in coordination with the public works department of various states and the Border Roads Organization. Projects are awarded to private players either on an EPC (cash) contract or on a build-operate-transfer basis, and now on the newly introduced hybrid annuity model. Cash contracts are mainly financed through budgetary allocations from the Central Road Fund, negative grants/premium received, and toll revenue. Loans and grants are also received from the World Bank and the Asian Development Bank. This programme is being implemented in seven phases.

Projects under NHDP

NHDP Phases	
Phase 1	Four laning of 5,846 kms of highways along Delhi-Kolkata-Chennai Mumbai corridor Connecting 10 major ports through four laned highways covering 380 kms and other miscellaneous roads covering 1,754 km
Phase 2	Constructing 7,142 kms of four laned Highways along: 1) North-South (Srinagar-Kanyakumari) corridor 2) East-West (Silichar-Porbandar) corridor
Phase 3	Four laning of 12.109 kms of high-density national highways Connecting state capitals and other important economic and tourist places
Phase 4	Two/Four laning of 20,000 kms of low density stretches. Out of which, 14,799 km is assigned to NHAI and the remaining to MORTH
Phase 5	Six laning of 6,500 kms of stretches under Golden Quadrilateral and, 800 kms under other high density stretches
Phase 6	Constructing 1,000 kms of four/six lane expressways between closely located urban areas
Phase 7	Constructing other 700 kms of highway projects like construction of ring roads, grade separators, bypasses and service roads

Source: National Highways Authority of India (NHAI), Crisil Intelligence

National Rural Drinking Water Programme (NRDWP)

NRDWP was launched by the Government of India to give impetus to the provision of basic infrastructure in rural areas. The programme aims to provide a stable source of drinking water to habitations that lack drinking water or where water available is non-potable. At the central level, about 30% of the funds are earmarked for increasing coverage, 20% for tackling water quality issues, 10% for operations and maintenance, 20% for sustainability, 10% for the Desert Development Programme, 5% for mitigating drinking water problems in the wake of a natural calamity and the remaining 5% for providing access to potable drinking water.

Pradhan Mantri Krishi Sinchayee Yojana (PMKSY)

Aiming to converge irrigation investment at the field level to maximize its impact, the government initiated PMKSY in fiscal 2016, with a spending target of Rs 500 billion until 2020. It was approved by the Cabinet Committee on Economic Affairs on July 1, 2015.

Key schemes converged include Accelerated Irrigation Benefit Programme (AIBP), Integrated Water Shed Management Programme (IWSMP), On Farm Water Management (OFWM or Har Khet ko Pani), and Per Drop More Crop, of which micro

irrigation is a component. Micro-irrigation promotes efficient water conveyance and precision water application devices, such as drips, sprinklers, pivots, and rain-guns. The target is to enhance the area under cultivation to 8 million hectares by 2020.

AIBP and OFWM fall under the Ministry of Water Resources, Per Drop More Crop is under the Department of Agriculture, Cooperation and Farmer's Welfare, and IWSMP is overseen by the Department of Land Resources. In 2016-17, government allocated Rs. 57.7 billion for PMKSY, which were revised to Rs. 51.9 billion.

Atal Mission for Rejuvenation and Urban Transformation (AMRUT)

In May 2015, the government approved the Atal Mission for Rejuvenation and Urban Transformation (AMRUT) to replace the Jawaharlal Nehru National Urban Renewal Mission (JNNURM), to focus on basic infrastructure services such as water supply, sewerage, storm water drains, transport and development of green spaces and parks.

The government allocated Rs 500 billion for five years (2015-16 to 2019-20) under this scheme, higher than the Rs 360 billion spent under JNNURM over the last five years. Despite the scheme expected to end in fiscal 2020, it has continued further with Rs 65 billion as revised estimates for fiscal 2021 and Rs 73 billion budgeted allocation for fiscal 2022.

The scheme will also cover JNNURM projects sanctioned between 2005 and 2012 and those that have achieved 50% physical progress (102 projects) or have availed of 50% central government funding until now (296 projects).

Smart Cities Mission

In June 2015, the Ministry of Urban Development laid down operational guidelines for formulation, approval and execution of projects under the Smart Cities Mission. The purpose of the mission is to drive economic growth and improve the quality of life by enabling local area development and harnessing technology.

The core infrastructure elements in a smart city would include adequate water supply, assured electricity, sanitation, efficient public transport, affordable housing, robust IT connectivity and digitization, etc.

The mission will cover 100 cities (distributed among states and UTs) over 2015-16 to 2019-20. The smart city mission too has been extended with further impetus to the mission due to Covid-19 where the centralized IT systems showcased success in information dissemination, controlling crowds etc.

The Smart Cities Mission will be operated as a centrally sponsored scheme, and the proposed financial support to the mission is Rs 480 billion over five years (average Rs 1 billion per city per year). An equal amount will be contributed by the states. Bihar, Gujarat, Karnataka, Madhya Pradesh, Maharashtra, Odisha, Punjab and Tamil Nadu have successfully set up financial intermediaries. A number of schemes in the mission are expected to be taken up on public-private partnership basis.

Special purpose vehicles (SPVs) will be set up for the implementation of smart city plans, with 50:50 equity from states and urban local bodies. Further, 500 acres is the minimum area norm for retrofitting; 50 acres for redevelopment and 250 acres for greenfield projects. For north-eastern and Himalayan states, the criteria will be 50% of the mentioned norms. About 10% of the energy needs of smart cities are to be met by renewable sources. The mission also mandates 80% of buildings to be energy-efficient and green buildings and 35% of housing in greenfield projects to be reserved for economically weaker sections.

4.10. Key challenges faced by the construction industry in India and the role of consultancy services

Execution risk remains the defining constraint of the industry. As per MoSPI's monthly flash report for May 2026, 1,987 monitored central-sector infrastructure projects (each above ₹150 crore) showed a cumulative cost overrun of about ₹5.4 lakh crore against original sanctioned costs, and MoSPI reporting has indicated average time overruns of roughly 36 months among delayed projects, with land acquisition, forest and environmental clearances and infrastructure-support gaps cited as leading causes. Each umbrella challenge from the scope of work is assessed below, covering the associated sub-challenges, followed by the role of consultancy services in addressing time overruns, cost escalations, quality deficiencies and compliance gaps in infrastructure projects.

Challenges	Description
Competitive intensity	• The Indian construction market is highly fragmented, with a long tail of regional and mid-sized contractors competing against large national EPC players, and public procurement remains predominantly lowest-price (L1) driven – a combination that incentivises aggressive bidding and systematically under-prices execution risk at the tender stage. • Under-priced contracts frequently convert into funding stress mid-execution once material, labour and finance costs crystallise, contributing to slow progress, quality compromises, contractor defaults and re-tendering; the resulting thin and volatile margins stretch working-capital cycles and heighten counterparty risk for clients, lenders and subcontractors. • The scale of the public pipeline continues to attract new entrants into EPC and HAM segments, and periodic relaxation of technical and financial qualification criteria – intended to broaden participation – further intensifies rivalry, rewarding players with disciplined bid selection, cost intelligence and execution credibility.
Technical gaps	• Skilled-manpower shortages persist across specialised trades (formwork, welding, tunnelling, HDD operation, MEP) and professional roles (planning, quality, safety and BIM specialists), constraining productivity and quality even as project complexity rises – a gap consistently highlighted in industry technology literature. • Deficient detailed project reports, inadequate geotechnical and utility investigations and design gaps discovered during execution trigger scope changes, re-engineering and rework, which are leading internal causes of time and cost overruns on Indian projects. • Technology penetration remains uneven: while large players deploy BIM, drones and digital project controls, high initial costs and talent shortages slow adoption among small and mid-sized contractors; simultaneously, emerging asset classes – high-speed rail, tunnels, battery storage, data centres, ZLD-compliant utilities – demand capabilities the domestic contracting base is still building.
Corporate mismanagement	• Weak project governance – inadequate cost-to-complete tracking, poor subcontractor management and the absence of early-warning systems – has historically allowed execution problems to compound undetected until projects became financially distressed. • Past cycles of over-leveraging, aggressive diversification and imprudent bid pipelines pushed several prominent EPC and infrastructure developers into insolvency, leaving stalled assets and eroding lender confidence in the sector; contract-management lapses, delayed notices, weak documentation of variations and claims, dilute recoverability and lock capital in prolonged arbitration. • Governance expectations from lenders, rating agencies and capital markets – including for IPO-bound companies – are now driving formalisation of internal controls, related-party discipline, independent project assurance and transparent reporting as preconditions for financing and listing.
Land acquisition delays	• Land acquisition and right-of-way issues are consistently reported by implementing agencies as leading causes of time overruns in MoSPI's project monitoring, alongside forest, wildlife and environmental clearances, utility shifting, law-and-order disruptions and delays in civil works. • Linear projects – highways, railways, transmission lines, pipelines and optical-fibre routes – are especially exposed, because even small unacquired stretches block continuous execution; stoppages

Challenges	Description
	impose idle plant and machinery costs, extended site overheads, demobilisation/remobilisation expenses and input-cost escalation during the delay period, only partially compensated under standard contracts. • Mitigation is improving through Gati Shakti-based alignment planning that anticipates acquisition conflicts, digitisation of land records and appointed-date discipline in highway awards, but the risk remains material, particularly for state-level and brownfield urban projects.
Macroeconomic influences	• Construction outcomes are acutely sensitive to commodity cycles - research on Indian project overruns notes that materials and installation can account for the dominant share, so volatility in steel, cement, bitumen and fuel prices translates directly into cost escalations, particularly on fixed-price contracts without robust price-variation clauses. • Logistics issues – freight-cost pressures, port congestion and long inland leads for bulk materials – compound input-cost stress and disrupt schedules, although improving corridor infrastructure is gradually easing this constraint; global supply-chain disruptions periodically affect availability and pricing of imported components such as speciality steel, electricals and telecom equipment. • Interest-rate and liquidity cycles affect both project viability in BOT/HAM structures and contractor cash flows, while delayed client payments and retention releases cascade financial stress down the subcontractor and vendor chain.
Others as applicable	• Multi-layered compliance obligations – labour laws (including BOCW), environmental consents, GST, safety codes and state-specific regulations – create exposure to penalties, stop-work orders and blacklisting where compliance systems are weak, making structured regulatory management a core execution capability. • Dispute-resolution timelines remain a drag- despite standardised concession agreements and conciliation mechanisms, arbitration and appellate processes keep significant contractor capital locked in claims, affecting liquidity and bid capacity across the sector. • Climate and site risks – monsoon intensity, flooding, heat stress on labour productivity and adverse geotechnical conditions – increasingly require climate-resilient design and revised working calendars, while the digitisation of project delivery introduces newer operational risks around cybersecurity, data integrity and systems interoperability.

Source: Crisil Intelligence

Role of consultancy services in addressing key execution challenges

Consultancy services – project management consultancy (PMC), design and engineering review, cost and procurement advisory, independent quality assurance and compliance advisory – have become integral to de-risking infrastructure delivery. Their role maps directly to the four execution challenges identified in the scope of work.

Execution Challenge	Role of Consultancy Services
Time overruns	• Front-end planning and de-risking: rigorous DPR preparation and review, geotechnical and utility investigations, constructability analysis and realistic baseline scheduling prevent the downstream surprises – design changes, utility conflicts, clearance gaps – that most frequently derail programmes. • Programme and project management: PMC firms provide critical-path monitoring, look-ahead planning, interface and stakeholder coordination (land, utilities, clearances) and early-warning dashboards, mirroring the government's own shift to real-time monitoring of project slippages through data-analytics portals. • Delay analytics and recovery: forensic schedule analysis, resequencing and acceleration planning, together with contractually robust extension-of-time substantiation, help projects recover time while preserving entitlements.
Cost escalations	• Cost planning and quantity surveying: independent cost estimation, value engineering and lifecycle costing at design stage, and escalation modelling with well-structured price-variation clauses at contract stage, insulate budgets from commodity volatility. • Procurement advisory: packaging strategy, vendor development, rate-contract frameworks and commodity-price risk guidance help manage steel, cement and fuel exposure across the programme. • Contract and claims management: disciplined variation control, cost-to-complete tracking, claims preparation and defence, and dispute-avoidance mechanisms shorten resolution cycles and protect contractor and owner margins alike.
Quality deficiencies	• Independent quality assurance and control: third-party inspection, structured materials-testing regimes and digital quality workflows reduce rework and latent defects across the delivery chain. • Design proof-checking and technical audits: independent design review, proof consultancy and safety audits for complex structures – widely mandated on public projects – catch deficiencies before they are built in. • Technology enablement: consultants drive implementation of BIM, digital twins and drone-based progress verification, bridging the technology and skills gaps of smaller contractors and standardising quality outcomes.
Compliance gaps	• Regulatory advisory: management of environmental and forest clearances, labour-law and EHS compliance frameworks, and statutory audit trails avert penalties, stop-work orders and reputational damage. • Lenders' and investors' assurance: independent-engineer and lenders'-engineer roles, techno-economic viability studies and periodic monitoring reports keep financing compliant and disbursement-linked. • Governance and transaction support: PPP structuring, concession-compliance monitoring, ESG reporting and capital-market readiness – including industry and project diligence for DRHP filings – align execution with regulatory and investor expectations.

Source: Crisil Intelligence

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5. Peer benchmarking

In this section, Crisil has analysed some key players operating in the telecom infrastructure services, optical fibre deployment, network rollout, telecom EPC, telecom tower maintenance service industry. The peer list has been based on comparable revenue, and product/service offerings. Data has been obtained from publicly available sources, including annual reports available in the public domain/ filed with the RoC, investor presentations of listed players, regulatory filings, rating rationales, and/or company websites and social media pages.

Financials in the competitive section have been re-classified by Crisil, based on annual reports available in the public domain/ filed with the RoC and financial filings by the relevant players. Financial ratios and other parameters provided in this report may not match with the reported financial parameters by the players on account of standardisation and re-classification done by Crisil.

Note: The list of competitive landscape peers considered in this section is not exhaustive but an indicative list.

Overview of key players

Company name	Year of incorporation	Geographic presence	Key offerings and services portfolio
Aerial Telecom Solutions Private Limited	2010	Pan India	Aerial Telecom Solutions Private Limited is a systems integrator and managed services provider delivering telecom and technology solutions across network deployment, managed services, digital transformation, enterprise IT, IP services, resource management, EV infrastructure, and KPO/e-commerce support. The company provides end-to-end telecom and technology lifecycle services including build, operate, and maintain capabilities.
Pratap Technocrats Pvt. Ltd.	2015	Pan India	Pratap Technocrats provides telecom infrastructure and project management services with expertise in network operations and maintenance, fiber infrastructure management, and large-scale telecom deployment projects. Its offerings include tower and fiber O&M, infrastructure rollout, installation, project execution, and telecom ecosystem management for operators and government agencies.
Narula Infrastructure Private Limited (NIPL)	2005	Pan India	NIPL is a telecom infrastructure solutions provider offering OFC project rollout, fiber maintenance, telecom equipment installation and commissioning, operations and maintenance services, and energy project execution. The company supports telecom operators through nationwide network deployment and infrastructure management services.
RST Semiconductors Private Limited	2012	Pan India	RST Semiconductors Private Limited is a telecom-focused semiconductor and smart-card solutions company that manufactures SIM cards, secure modules, smart cards, and embedded security products for mobile network operators (MNOs), banking institutions, and government e-governance projects. The company supplies SIM cards and secure modules directly to

Company name	Year of incorporation	Geographic presence	Key offerings and services portfolio
			telecom operators and supports digital infrastructure initiatives through secure card manufacturing and personalization services.
Pace Digitek Limited	2007	Pan India, 6 countries including India	Pace Digitek provides telecom power systems, optic fiber laying, energy management solutions, renewable energy solutions, and operations & maintenance services. The company offers integrated infrastructure solutions spanning telecom power, solar solutions, fiber deployment, and energy management platforms.
Annu Projects Ltd.	2003	11 states in India	Annu Projects offers design, development, implementation, operations and maintenance of essential overhead and underground utilities infrastructure across telecom infrastructure, sewerage infrastructure vertical and gas pipeline vertical. As on March 31, 2025, the company own a fleet of over 400 machinery and equipment (such as horizontal directional drilling machine, excavators, splicing machine, digitrack machine, OTDR machine, HDPE pipe welding machine etc.
SG Encon Limited	2011	12 states in India	SG Encon Limited provides telecom network lifecycle solutions including OFC layout and maintenance, telecom tower O&M, fiber rollout projects, RF optimization, and small-cell network support. The company also offers pipeline installation through HDD technology, civil construction, interior works, and project management consultancy services. The company's O&M services include Preventive Maintenance & Corrective Maintenance & Corrective Fault Management Services. In FY26, SG Encon reported Rs. 2.8 billion revenue in the O&M services segment, which accounts for ~5.7% of the overall market share within the tower maintenance industry in India.

Note: N.A.-not available

Source: Company annual reports, company website, Investor presentations, filings, Crisil Intelligence

Overview of key projects undertaken

Company name	Projects Undertaken
Aerial Telecom Solutions Private Limited	In Jan 2025, Aerial Telecom Solutions Private Limited, as the implementation partner in a consortium led by RVNL with HFCL, secured two BSNL orders for the development, upgradation, operation, and maintenance of the BharatNet middle-mile network under the Design-Build-Operate-Maintain (DBOM) model. These projects strengthen the company's presence in large-scale digital connectivity infrastructure, supporting broadband network expansion across India.
Pratap Technocrats Pvt. Ltd.	Pratap Technocrats has undertaken key telecom infrastructure projects for BSNL, including BharatNet Phase III optical fibre network deployment across Rajasthan, Haryana, and Assam, and 4G Saturation programme implementation in Odisha and Andhra Pradesh. The company also delivers large-scale managed services, covering telecom network O&M, fibre maintenance, and telecom infrastructure support across 23 states and 16 telecom circles.
Narula Infrastructure Private Limited (NIPL)	Narula Infrastructure Pvt. Ltd. has undertaken large-scale optical fibre cable (OFC) laying and telecom tower infrastructure projects, including nationwide fibre and tower deployments for Bharti Airtel. The

Company name	Projects Undertaken
	company also provides telecom network operations and maintenance services, managing extensive fibre and tower infrastructure for clients such as Bharti Airtel, Reliance Jio, Tata Communications, Indus Towers, and ATC under long-term contracts.
RST Semiconductors Private Limited	N.A.
Pace Digitek Limited	Pace Digitek has undertaken telecom infrastructure projects for BSNL and RNS, OFC network projects for BSNL and TANFINET, ICT infrastructure projects for RailTel, Railway Kavach implementation for Indian Railways, power management solutions for BSNL and Reliance, and telecom network O&M services for Tata Teleservices. The company provides end-to-end EPC, equipment supply, and long-term O&M services across these projects.
Annu Projects Ltd.	**TBU**
SG Encon Limited	**TBU**

Note: N.A.-not available; The data provided in this section is not exhaustive but indicative in nature
Source: Company annual reports, website, Investor presentations, filings, Crisil Intelligence

Revenue Segmentation (FY26)

Company name	Revenue Segmentation
Aerial Telecom Solutions Private Limited*	Product: 5.41% Services: 94.57% Export: 0.02%
Pratap Technocrats Pvt. Ltd.	N.A.
Narula Infrastructure Private Limited (NIPL)*	Operation & Maintenance Charges: 54.85% Infra Project: 0.90% OFC Project: 42.25% EB Project: 0.03% JJM Project:0.33% Railway Project: 1.64%
RST Semiconductors Private Limited	N.A.
Pace Digitek Limited	Energy: 45.2% Telecom: 54.5% Others: 0.3%
Annu Projects Ltd.	**TBU**
SG Encon Limited	Operation & Maintenance: 98.6% Construction & interiors: 0.6% Gas pipeline, sewage & solar: 0.7% Engineering Consultancy: 0.1%

*Notes: *For Aerial and Narula FY25 segmentation is presented, as these companies have not disclosed their FY26 financials*
N.A.- Not Available

NIPL, Pace Digitek Limited data is on consolidated basis, Aerial Telecom Solutions Private Limited is on standalone basis.
Source: Company annual reports, website, Investor presentations, filings, Crisil Intelligence

Share of exports (FY26)

Company name	Share of exports
Aerial Telecom Solutions Private Limited*	0.02%
Pratap Technocrats Pvt. Ltd.	N.A.
Narula Infrastructure Private Limited (NIPL)	N.A.
RST Semiconductors Private Limited	N.A.
Pace Digitek Limited	0%
Annu Projects Ltd.	**TBU**
SG Encon Limited	0%

*Note: *For Aerial FY25 export share is presented, as the company has not disclosed its FY26 financials*
N.A.- Not Available
Source: Company annual reports, Investor presentations, filings, Crisil Intelligence

Planned Expansion

Company name	Planned Expansion
Aerial Telecom Solutions Private Limited	N.A.
Pratap Technocrats Pvt. Ltd.	N.A.
Narula Infrastructure Private Limited (NIPL)	N.A.
RST Semiconductors Private Limited	N.A.
Pace Digitek Limited	2.5 to 10 GWh BESS Capacity Expansion
Annu Projects Ltd.	**TBU**
SG Encon Limited	**TBU**

Note: N.A.-Not Available
Source: Company annual reports, website, Investor presentations, filings, Crisil Intelligence

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Orderbook details

Company name	Orderbook in Rs. million (FY26)
Aerial Telecom Solutions Private Limited	N.A.
Pratap Technocrats Pvt. Ltd.	N.A.
Narula Infrastructure Private Limited (NIPL)	N.A.
RST Semiconductors Private Limited	N.A.
Pace Digitek Limited	1,13,379
Annu Projects Ltd.	**TBU**
SG Encon Limited	2,894

Note: N.A.-Not Available

Source: Company annual reports, website, Investor presentations, filings, Crisil Intelligence

Operating Income and growth (CAGR)

Company name	FY24	FY25	FY26	CAGR%(FY24-26)
Aerial Telecom Solutions Private Limited	2,943.09	3,928.91	N.A.	-
Pratap Technocrats Pvt. Ltd.	10,768.66	13,675.07	N.A.	-
Narula Infrastructure Private Limited (NIPL)	3,506.48	5,110.38	N.A.	-
RST Semiconductors Private Limited	388.45	N.A.	N.A.	-
Pace Digitek Limited	24,349.47	24,389.12	26,412.70	4%
Annu Projects ltd.	TBU	TBU	TBU	TBU
SG Encon Limited	2,363.12	2,760.15	2,871.80	10%

Note: N.A.-Not Available

On consolidated basis: Pratap Technocrats Pvt. Ltd, Narula Infrastructure Private Limited (NIPL), Pace Digitek Limited while others are on standalone basis

All numbers are restated as per Crisil Intelligence standards and may not match the company reported numbers.

Source: Company annual reports, Crisil Intelligence

Key observations:

- SG Encon serves as the vendor for leading telecom players like Reliance Jio, which holds ~39% share of total subscriber base as of March 2026, and Indus tower which is the largest player in terms of towers and co-locations in the telecom tower market in India.

Operating EBITDA, margin and growth

Company name	Op. EBIDTA				Op. EBIDTA Margin (%)		
	FY24	FY25	FY26	CAGR% (FY24-26)	FY24	FY25	FY26
Aerial Telecom Solutions Private Limited	154.67	231.13	N.A.	-	5.26%	5.88%	N.A.
Pratap Technocrats Pvt. Ltd.	1627.61	2766.42	N.A.	-	15.11%	20.23%	N.A.
Narula Infrastructure Private Limited (NIPL)	241.71	342.45	N.A.	-	6.89%	6.70%	N.A.
RST Semiconductors Private Limited	26.95	N.A.	N.A.	-	6.94%	N.A.	N.A.
Pace Digitek Limited	4,030.92	4972.29	4586.26	7.00%	16.55%	20.39%	17.36%
Annu Projects Ltd.	TBU	TBU	TBU	TBU	TBU	TBU	TBU
SG Encon Limited	165.27	223.67	322.21	0.40	6.99%	8.10%	11.22%

Note: N.A.-Not Available

On consolidated basis: Pratap Technocrats Pvt. Ltd, Narula Infrastructure Private Limited (NIPL), Pace Digitek Limited and while others are on standalone basis

Op. EBITDA margin = Op. EBITDA / operating income

All numbers are restated as per Crisil Intelligence standards and may not match the company reported numbers.

Source: Company annual reports, Crisil Intelligence

Net profit margins and growth (PAT)

Company name	PAT				PAT Margin (%)		
	FY24	FY25	FY26	CAGR% (FY24-26)	FY24	FY25	FY26
Aerial Telecom Solutions Private Limited	69.28	91.82	N.A.	-	2.35%	2.33%	N.A.
Pratap Technocrats Pvt. Ltd.	1,136.18	1,930.19	N.A.	-	10.40%	13.98%	N.A.
Narula Infrastructure Private Limited (NIPL)	140.33	347.37	N.A.	-	3.99%	6.57%	N.A.
RST Semiconductors Private Limited	3.41	N.A.	N.A.	-	0.88%	N.A.	N.A.
Pace Digitek Limited	2,298.71	2,435.47	2,283.80	-0.32%	9.35%	9.91%	8.55%
Annu Projects Ltd.	TBU	TBU	TBU	TBU	TBU	TBU	TBU
SG Encon Limited	1,019.69	1,498.47	2,370.36	52.47%	4.31%	5.42%	8.24%

Note: N.A.-Not Available

On consolidated basis: Pratap Technocrats Pvt. Ltd, Narula Infrastructure Private Limited (NIPL), Pace Digitek Limited while others are on standalone basis

PAT margin = PAT / Total income

All numbers are restated as per Crisil Intelligence standards and may not match the company reported numbers.

Source: Company annual reports, Crisil Intelligence

Working capital days

Company name	FY24	FY25	FY26
Aerial Telecom Solutions Private Limited	-181.06	-314.94	N.A.
Pratap Technocrats Pvt. Ltd.	-89.15	32.03	N.A.
Narula Infrastructure Private Limited (NIPL)	-3,162.34	2,781.19	N.A.
RST Semiconductors Private Limited	65.67	N.A.	N.A.
Pace Digitek Limited	-30.81	-161.57	-141.81
Annu Projects Ltd.	TBU	TBU	TBU
SG Encon Limited	-783.52	-1,454.65	-848.73

Note: N.A.-Not Available

On consolidated basis: Pratap Technocrats Pvt. Ltd, Narula Infrastructure Private Limited (NIPL), Pace Digitek Limited while others are on standalone basis

Tangible net worth = total paid up equity share capital + gross reserves + goodwill - intangible assets

All numbers are restated as per Crisil Intelligence standards and may not match the company reported numbers.

Source: Company annual reports, Crisil Intelligence

Fixed Asset Turnover

Company name	FY24	FY25	FY26
Aerial Telecom Solutions Private Limited	15.95	15.20	N.A.
Pratap Technocrats Pvt. Ltd.	15.98	23.26	N.A.
Narula Infrastructure Private Limited (NIPL)	21.19	30.05	N.A.
RST Semiconductors Private Limited	2.82	N.A.	N.A.
Pace Digitek Limited	25.39	63.69	33.66
Annu Projects Ltd.	TBU	TBU	TBU
SG Encon Limited	29.03	37.54	38.70

Note: N.A.-Not Available

On consolidated basis: Pratap Technocrats Pvt. Ltd, Narula Infrastructure Private Limited (NIPL), Pace Digitek Limited while others are on standalone basis

Fixed asset turnover ratio = operating income / gross block

All numbers are restated as per Crisil Intelligence standards and may not match the company reported numbers.

Source: Company annual reports, Crisil Intelligence

Book to Bill ratio (%)

Company name	FY24	FY25	FY26
Aerial Telecom Solutions Private Limited	N.A.	N.A.	N.A.
Pratap Technocrats Pvt. Ltd.	N.A.	N.A.	N.A.
Narula Infrastructure Private Limited (NIPL)	N.A.	N.A.	N.A.
RST Semiconductors Private Limited	N.A.	N.A.	N.A.
Pace Digitek Limited	N.A.	N.A.	N.A.
Annu Projects Ltd.	TBU	TBU	TBU
SG Encon Limited	84.20	103.62	99.15

Note: N.A.-Not Available

Source: Company annual reports, Crisil Intelligence

Return of capital employed (ROCE%)

Company name	FY24	FY25	FY26
Aerial Telecom Solutions Private Limited	14.61	14.17	N.A.
Pratap Technocrats Pvt. Ltd.	38.21	45.57	N.A.
Narula Infrastructure Private Limited (NIPL)	17.42	29.07	N.A.
RST Semiconductors Private Limited	7.19	N.A.	N.A.
Pace Digitek Limited	60.30	41.92	19.08
Annu Projects Ltd.	TBU	TBU	TBU
SG Encon Limited	34.60	35.68	36.48

Note: N.A.-Not Available

On consolidated basis: Pratap Technocrats Pvt. Ltd, Narula Infrastructure Private Limited (NIPL), Pace Digitek Limited while others are on standalone basis

RoCE = profit before interest and tax / (average total debt + average tangible net worth + average deferred tax liability)

All numbers are restated as per Crisil Intelligence standards and may not match the company reported numbers.

Source: Company annual reports, Crisil Intelligence

Return on Equity (RoE%)

Company name	FY24	FY25	FY26
Aerial Telecom Solutions Private Limited	28.76	28.94	N.A.
Pratap Technocrats Pvt. Ltd.	31.86	37.90	N.A.
Narula Infrastructure Private Limited (NIPL)	18.28	34.33	N.A.
RST Semiconductors Private Limited	N.A.	N.A.	N.A.
Pace Digitek Limited	63.27	31.19	14.07
Annu Projects Ltd.	TBU	TBU	TBU
SG Encon Limited	28.41	31.50	30.96

Note: N.A.-Not Available

On consolidated basis: Pratap Technocrats Pvt. Ltd, Narula Infrastructure Private Limited (NIPL), Pace Digitek Limited while others are on standalone basis

RoE = PAT / average tangible net worth

All numbers are restated as per Crisil Intelligence standards and may not match the company reported numbers.

Source: Company annual reports, Crisil Intelligence

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About Crisil Intelligence (formerly Market Intelligence & Analytics)

Crisil Intelligence is a leading provider of research, consulting, risk solutions and advanced data analytics, serving clients across government, private and public enterprises. We leverage our expertise in data-driven insights and strong benchmarking capabilities to help clients navigate complex external ecosystems, identify opportunities and mitigate risks. By combining cutting-edge analytics, machine learning and AI capabilities with deep industry knowledge, we empower our clients to make informed decisions, drive business growth and build resilient capacities.

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