

ICRA ANALYTICS LTD

Assessment of Infrastructure Industry in India

LCC Projects Limited

21st August 2026

Contents

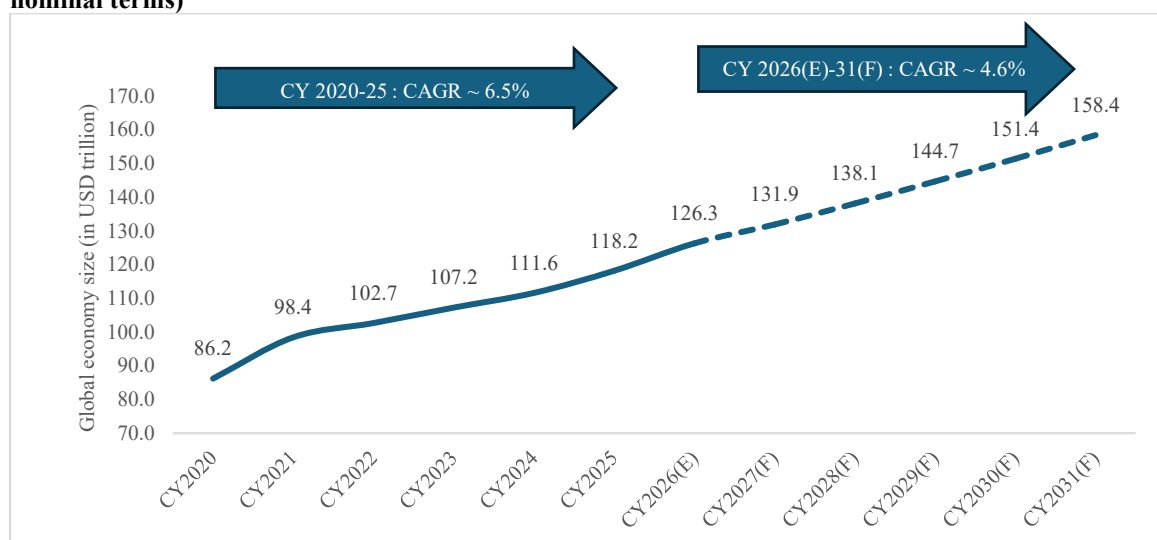
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1. Global Macroeconomic Overview and Future Outlook

According to the International Monetary Fund (IMF), the global economy is expected to reach a nominal size of USD 126.3 trillion in CY2026 (in nominal terms) and grow further to USD 158.4 trillion in CY2031 (in nominal terms), reflecting a compound annual growth rate (CAGR) of ~5%. Despite facing multiple global challenges over the past year, economic activity had shown notable resilience due technology-related investment; accommodative financial conditions and fiscal and monetary policy support. However, due to current global crisis pertaining to middle east conflict, economic growth may slow down through its impact on commodity markets, inflation impact and overall financial conditions. With inflation in major advanced economies nearing targeted levels, central banks are beginning to shift towards monetary policy easing, signalling a more accommodative stance ahead, although geopolitical tensions and higher commodity prices pose renewed inflationary risks. Amid this global momentum, India stands out with a projected nominal GDP of USD 4.15 trillion in CY 2026, positioning it as the world's fourth-largest economy. This underscores India's growing macroeconomic significance and its expanding role in shaping global growth dynamics.

Chart 1: Global GDP historical review (CY2020-CY2025) and outlook (CY2026-CY2031) (in USD trillion-nominal terms)

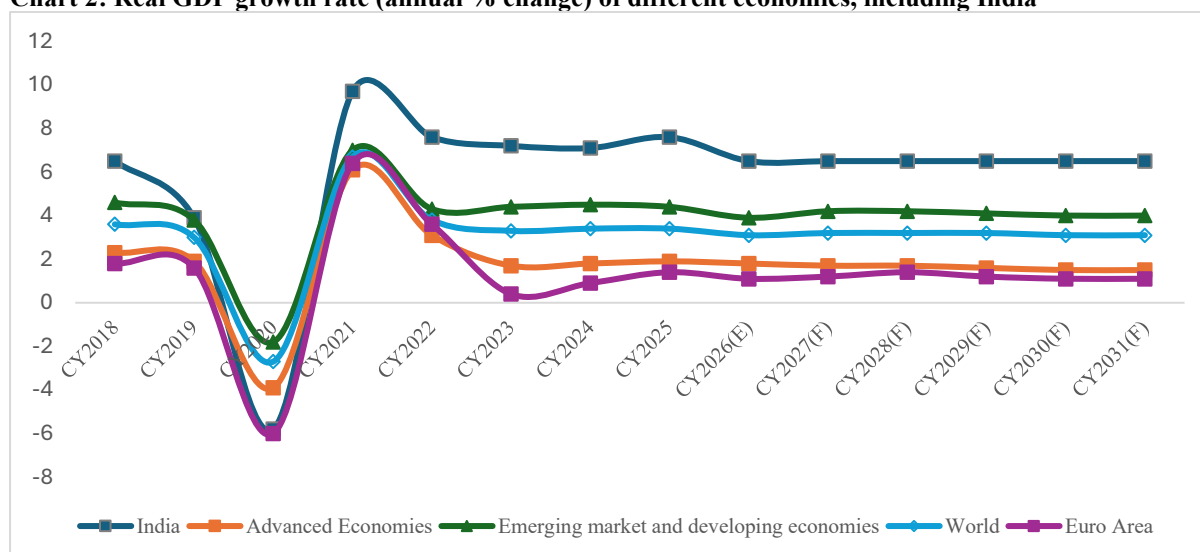


Source: IMF (WEO April 2026), ICRA Analytics

Note: F-Forecasted; data from CY2027-2031 are forecasted; E- Estimated; CY2026 is estimated

1.1 Global Economies and Growth Trend

Chart 2: Real GDP growth rate (annual % change) of different economies, including India



Source: International Monetary Fund (IMF), ICRA Analytics, April 2026 release

Note: F- Forecasted; data from CY2027-2031 are forecasted; E- Estimated

Note: For India, data and forecasts are presented on a fiscal year basis, and GDP from 2011 onward is based on GDP at market prices with fiscal year 2011/12 as a base year.

Table 1: India v/s Other Economies (Real GDP, Y-o-Y % change)

Real GDP growth (Annual % change)	CY 2020	CY 2021	CY 2022	CY 2023	CY 2024	CY 2025	CY 2026(E)	CY 2027(F)	CY 2028(F)	CY 2029(F)	CY 2030(F)	CY 2031(F)
India	-5.8	9.7	7.6	7.2	7.1	7.6	6.5	6.5	6.5	6.5	6.5	6.5
Advanced economies	-3.9	6.0	3.0	1.7	1.8	1.8	1.6	1.7	1.7	1.6	1.5	1.5
Emerging market and developing economies	-1.8	7.0	4.3	4.4	4.5	4.4	3.9	4.2	4.2	4.1	4.0	4.0
World	-2.7	6.6	3.8	3.5	3.3	3.3	3.1	3.2	3.2	3.2	3.1	3.1

Source: International Monetary Fund (IMF), ICRA Analytics, April 2026 release

Note: F- Forecasted; data from CY2026-2031 are forecasted

- The global economy is estimated to expand at ~3.1% during CY2026 and is expected to remain steady at ~3.1% till CY2031.
- Advanced economies: Real GDP growth is expected to decline from ~1.8% in CY2025 to ~1.6% in CY2026 and remain stable at ~1.5% until CY2031.

Key economies:

- USA: Expected to grow from ~2.1% in CY2025 to ~2.3% in CY2026 and moderate to ~2.1% in CY2027.
- Canada: Expected to be moderate from ~1.7% in CY2025 to ~1.5% in CY2026 and ~1.5% in CY2027.
- Japan: Expected to moderate from 1.2% in CY2025 to ~0.7% in CY2026 and at ~0.6 % in CY2027.
- UK: Growth to moderate from ~1.3% in CY2025 to ~0.8% in CY2026 and grow to ~1.3% in CY2027.
- Euro area: Growth to moderate from ~1.4% in CY2025 to ~1.1% in CY2026 and ~1.1% in CY2027.

Emerging & developing economies: Growth slowed from ~4.4% in CY2025 to ~3.9% in CY2026.

- East Asia: Growth from ~4.1% in CY2025 to ~4.4% in CY2026 and moderate to ~3.8% in CY2027.

- **Europe:** Falling from ~1.5% in CY2025 to ~1.3% in CY2026 and ~1.4% in CY2027.
- **Latin America & Caribbean:** Slight dip from ~2.4% in CY2025 to ~2.3% in CY2026, rising to ~2.7% in CY2027.

1.2 Major infrastructure initiatives by various economies worldwide

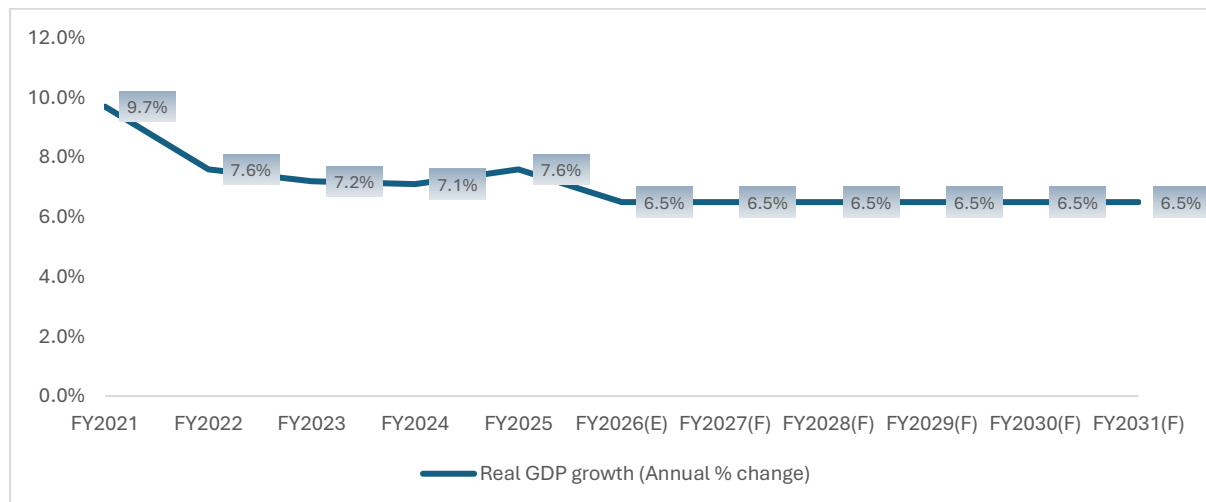
China: China is accelerating infrastructure development through its “Six Networks” initiative, with planned investment exceeding RMB 7 trillion in 2026 to stimulate domestic demand and support long-term economic growth. The programme focuses on water networks, smart power grids, computing infrastructure, next-generation communication networks, urban underground pipelines, and logistics systems. Major investments include over RMB 5 trillion during 2026-2030 for power grid modernization and ultra-high-voltage transmission projects, as well as RMB 5 trillion for the construction and renovation of 770,000 km of gas, water, drainage, and heating pipelines, aimed at enhancing energy security, digital connectivity, and urban resilience.

European Union: The EU is accelerating infrastructure investment to strengthen competitiveness, energy security, and digital transformation. Key priorities include cross-border electricity interconnectors, power grids, energy storage, electrification, renewable energy infrastructure, digital infrastructure (AI, data centres, cybersecurity, and computing capacity), transport and rail connectivity, and defence-related infrastructure. The EU is also using the Recovery and Resilience Facility (RRF) and other funding programs to expand investments in climate and digital infrastructure, while Germany has announced a €500 billion infrastructure fund for transport, energy, and digital networks over the coming decade.

2. Indian Macroeconomic Outlook

2.1 GDP trend and outlook

Chart 3: GDP growth trend in India (in real terms)



Source: RBI, IMF, ICRA Analytics

Note: F-Forecasted; E- Estimated

Data from FY2026-2031F are forecasted from IMF

The Reserve Bank of India (RBI) has projected real GDP growth at 6.7% for FY2026-27, as announced by RBI Governor Sanjay Malhotra in August 2026. This represents a slight upward revision from the projection made in June 2026. The RBI has projected real GDP growth at 6.7% for FY2027, with quarterly growth of 7.0% in Q1, 6.4% in Q2, 6.5% in Q3, and 6.8% in Q4.

Per RBI, though global economic volatility, elevated energy prices, supply chain pressures, and uneven monsoon conditions pose risks, several mitigating factors support the growth outlook. Government initiatives in climate-resilient agriculture, crop diversification, and water conservation are expected to cushion rural risks. Urban demand is likely to remain strong, driven by sustained growth in services, GST-related benefits, and stable employment conditions. Additionally, high-capacity utilisation, healthy credit expansion, and continued public infrastructure spending are expected to sustain investment momentum. Services exports are projected to remain

robust, while recent trade agreements and export diversification efforts should support merchandise exports, reinforcing the RBI's growth projections.

Looking ahead, the real GDP growth for Q1:2027-28 is projected at 7.3 per cent.

Table 2: RBI estimates of GDP growth

Real GDP Growth	FY2027 F	FY2027 F			
% change	(F)	Q1 (F)	Q2 (F)	Q3 (F)	Q4 (F)
GDP at market prices	6.7	7.0	6.4	6.5	6.8

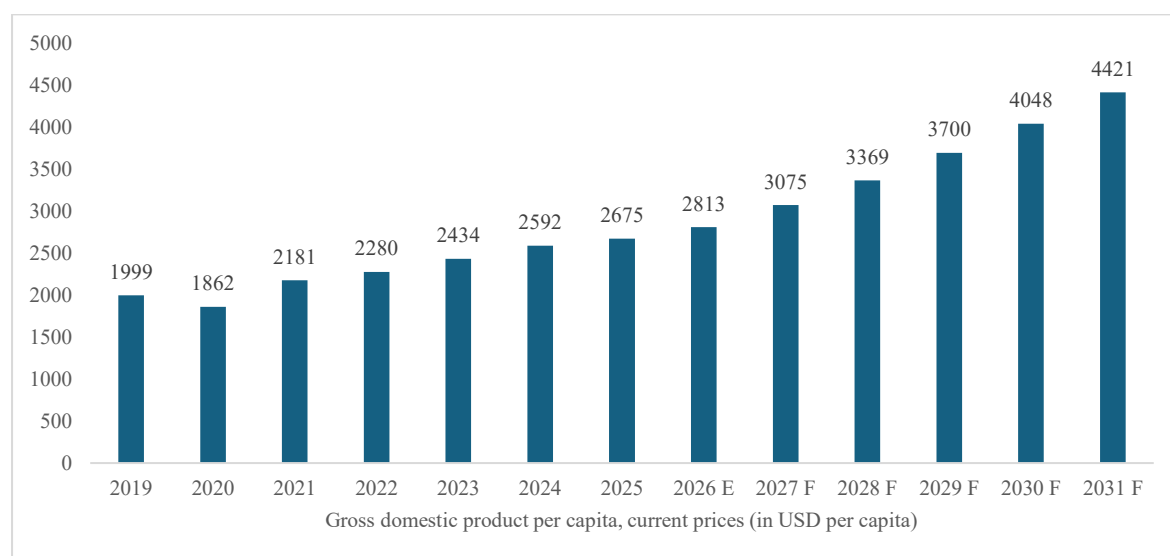
Source: RBI, ICRA Analytics
Note- F- Forecasted

On the other hand, International Monetary Fund (IMF) has forecasted India's real GDP growth at 7.6% in FY2026, and 6.5% from FY2027 to FY2031. The growth outlook is supported by the positive carryover effects of the strong economic performance in 2025 and the reduction in additional US tariffs on Indian goods from 50% to 10%, which more than offset the adverse impact arising from the Middle East conflict.

2.2 Per capita GDP

India's GDP per capita in 2025, (at current USD), was US\$ 2,675, reflecting an increase from US\$ 2,592 in 2024. The IMF predicts that India's GDP per capita will grow at a CAGR of ~9.5% through CY 2031 from CY 2025, reaching approximately USD 4,421.

Chart 4: Per Capita GDP trend of India (at current USD)



Source: IMF, World Bank, ICRA Analytics
Note: F- Forecasted; E- Estimated

2.3 Sectoral growth trend

Chart 5: Real Growth in Gross Value Added in the past 3 years Base Year 2022-23)

Industry	FY2024	FY2025 (FRE)	FY2026 (PE)
Agriculture, Forestry and Fishing	2.6%	4.2%	3.0%
Industry	10.9%	8.3%	8.5%
Mining & Quarrying	2.4%	11.7%	5.2%
Manufacturing	12.7%	9.3%	10.7%
Electricity, Gas, Water Supply & Other Utility Services	10.7%	2.9%	1.7%
Construction	9.9%	7.3%	7.4%
Services	7.0%	7.9%	9.3%
Trade, Hotels, Transport, Communication and Services Related to Broadcasting	10.1%	6.6%	11.0%
Financial, Real Estate & Professional Services	5.5%	10.0%	10.4%
Public Administration, Defence and Other Services	6.8%	5.0%	5.0%
GVA at Basic Prices	7.2%	7.3%	7.9%

Source: RBI, ICRA Analytics

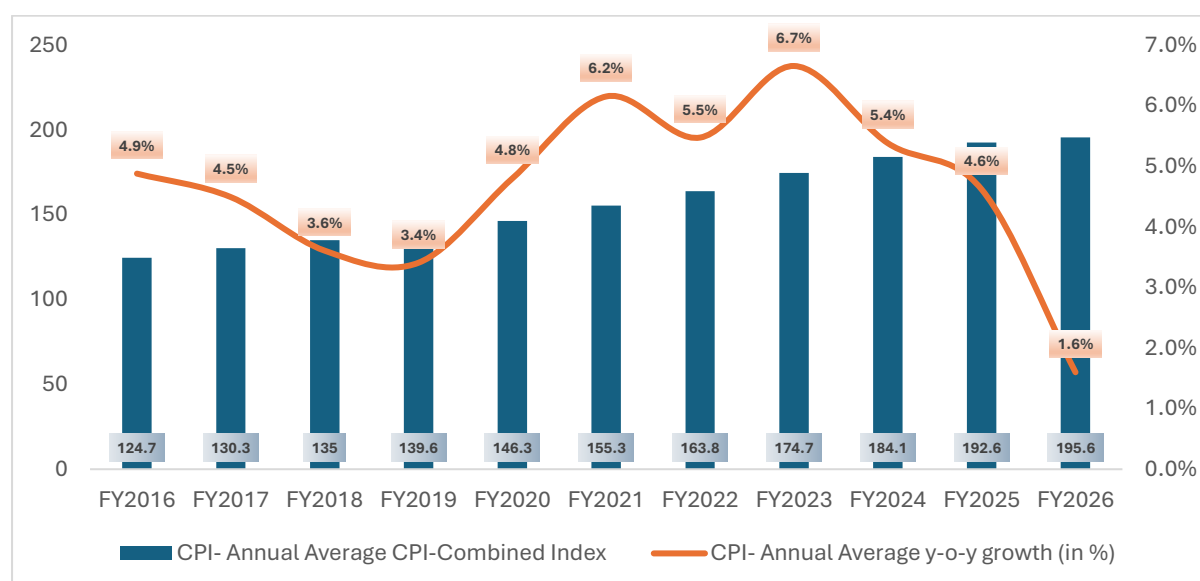
FRE: First Revised Estimates, PE: Provisional Estimates

India's real Gross Value Added (GVA) growth for the fiscal year 2025–26 (FY2026) is estimated at 7.7%, according to provisional estimates released by the National Statistical Office (NSO) on 5th June 2026. This marks an upward revision from the 7.1% growth recorded in FY2025.

The agriculture and allied sector's Gross Value Added (GVA) projected at 3.0% in FY2026, up from 4.2% in FY2025. At the same time, the construction sector is expected to register a robust 7.4% growth, driven by accelerated infrastructure development. Likewise, the financial, real estate, and professional services sector is projected to grow by 10.4%, reflecting strong momentum in business and real estate activities. Manufacturing sector is expected to register a robust growth of 10.7%. The manufacturing sector, together with key service segments such as Trade, Hotels, Transport, Communication and Services Related to Broadcasting, and Financial, Real Estate & Professional Services, continues to demonstrate strong performance and is expected to support rising incomes, increased financial savings, and greater participation in investment products, thereby reinforcing the resilience and sustained growth of the economy.

2.4 CPI general and Inflation trends

Chart 6: Inflation and CPI y-o-y growth trend (Base Year : 2011-12)



Source: MOSPI, ICRA Analytics

Retail inflation in India, as indicated by the Consumer Price Index (CPI), which represents the cost of daily goods and services, with the base year 2024 for the month of June 2026 is 4.38% over May 2025. This is slightly upward

in comparison with April 2026 CPI at 3.93%. All India Consumer Food Price Index (CFPI) for the month of June 2026 over May 2025 is 5.32%

The Monetary Policy Committee (MPC) of the Reserve Bank of India has projected CPI Inflation for 2026-27 at 5.0%. The projection takes into El Niño-driven rainfall variability and global crude oil prices volatility amid geopolitical uncertainties, clouding the near-term inflation outlook. While overall inflationary pressures remain contained, the risk of higher food, fuel, and input costs translating into broader inflation persists. This decision was revealed at the end of the MPC meeting on 5th August 2026, led by Sanjay Malhotra, along with the latest monetary policy statement from the central bank.

Furthermore, the MPC has raised its inflation forecasts for the first two quarters of fiscal year 2027, now anticipating 4.2% inflation in Q2, 5.9% in Q3, and 5.5% in Q4. Inflation for Q1:2027-28 is projected at 5.3%.

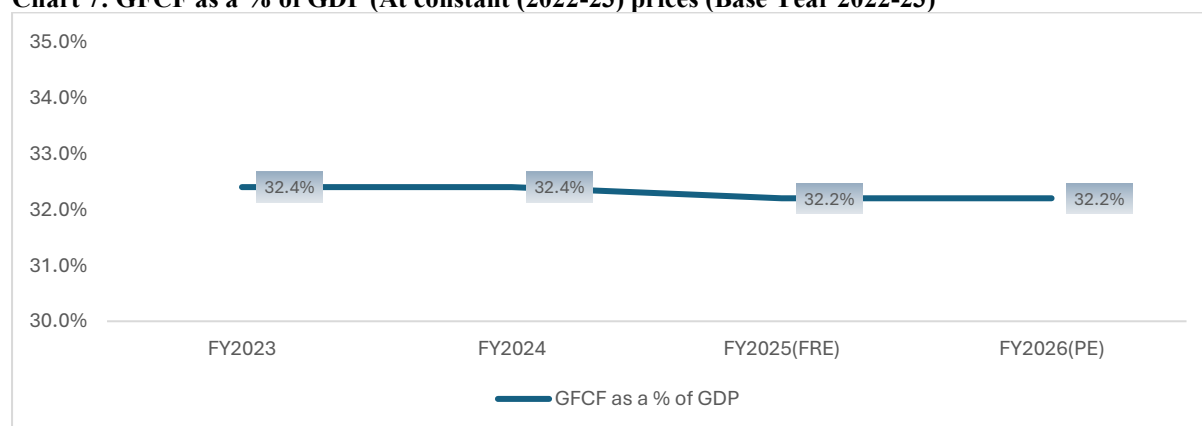
- Q2 FY27: Adjusted to 4.2% from 5.1%.
- Q3 FY 27: Adjusted to 5.9% from 5.9%.
- Q4 FY 27: Adjusted to 5.5% from 5.4%.
- Q1 FY 28: Projected at 5.3%

The central bank indicated that, excluding precious metals, the underlying inflationary pressures remain subdued as demand pressures remain contained. Core inflation, which excludes potential fluctuations from precious metals, is anticipated to remain stable, with underlying pressures continuing to be contained.

The MPC highlighted that the ongoing conflict in West Asia, along with uncertainties related to the monsoon and El Niño, poses risks to both inflation and growth. It emphasized that it would continue to closely monitor evolving inflationary pressures going forward.

2.5 Gross fixed capital formation (GFCF)

Chart 7: GFCF as a % of GDP (At constant (2022-23) prices (Base Year 2022-23))



Source: MOSPI, ICRA Analytics

Note: FRE- First Revised Estimates; PE-Provisional Estimates

India's Gross Fixed Capital Formation (GFCF) is estimated to increase from Rs. 84.53 lakh crore in FY2023 to Rs. 104.34 lakh crore in FY2026 at a CAGR of ~ 7.3%. The ratio of GFCF to GDP has remained stable to 32.2% in FY2026 from 32.4% in FY2023. This indicates an uptick in investment, led by government spending on infrastructure coupled with growth in domestic demand.

2.6 Concluding remarks

The global economy remains resilient, supported by technology-driven investment, accommodative financial conditions, and strong services trade, but growth is expected to moderate amid the Middle East conflict and elevated geopolitical uncertainty. Global growth is projected at 3.1% in 2026 and 3.2% in 2027, while inflation is expected to rise temporarily due to higher energy and commodity prices. The outlook is clouded by risks such as prolonged geopolitical tensions, supply chain disruptions, fiscal vulnerabilities, and trade fragmentation. However, continued AI-driven productivity gains, structural reforms, and stronger international trade cooperation could support growth and enhance economic resilience.

3. Infrastructure Industry in India

3.1 Overview of National Infrastructure Pipeline

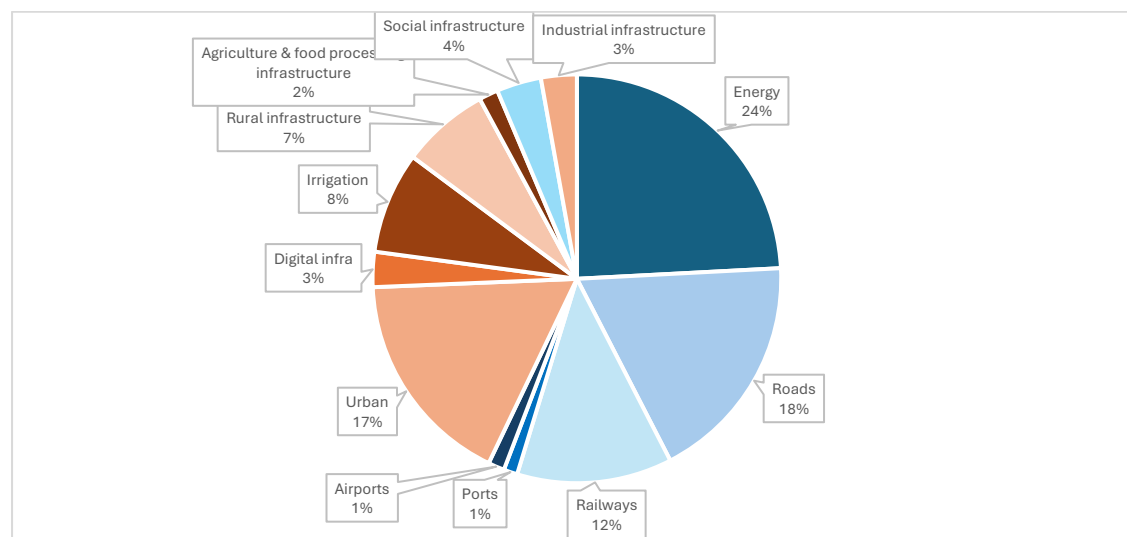
Infrastructure is an enabler for growth in India. It is estimated that India would require to spend more than \$2.2 trillion on infrastructure to achieve the goal of becoming \$7 trillion economy by CY2030. During FY2008-17, India pumped in about \$1.1 trillion on infrastructure. Keeping this in view, the National Infrastructure Pipeline (NIP) was launched with projected investments of around Rs. 111 lakh crore (\$1.5 trillion) during for FY2020-25 to build world- class infrastructure in the country. A taskforce to draw up the NIP was constituted under the chairmanship of the Secretary, Department of Economic Affairs (DEA), Ministry of Finance. It aims at identifying technically feasible and financially or economically viable infrastructure projects that would improve the quality of life for the citizens.

Within NIP, major investments have been earmarked for the irrigation sector. Given that India has water resource scarcity, investments are required in efficient water management technologies such as micro irrigation. Priority is also given to interlinking of rivers to increase the overall area under irrigation, domestic, industrial water supply and hydropower generation. The National Water Development Agency (NWDA) had originally identified 30 inter-basin transfer of water projects, with several progressing at different stages of preparation. As part of the National Infrastructure Pipeline (NIP) vision, the total irrigated land target was set at ~85 million hectares by FY2025, covering ~61% of cultivable land. This was intended to reduce dependence on monsoons and enhance farmers' incomes.

Since 2014, the Government has increasingly emphasized large-scale infrastructure creation, coordinated planning, and multimodal connectivity to support sustainable economic growth and regional development. This strategic shift has been supported by a significant increase in public capital expenditure, which has risen from approximately ₹2 lakh crore in FY2014–15 to ₹12.2 lakh crore in the Union Budget FY2026–27. Complementary initiatives such as PM Gati Shakti National Master Plan, Bharatmala Pariyojana, Sagarmala Programme, Pradhan Mantri Awas Yojana (PMAY), Jal Jeevan Mission, UDAN, and the National Logistics Policy have further strengthened infrastructure planning and execution by improving multimodal connectivity, expanding household access to essential services, and enhancing logistics efficiency.

3.2 Sectoral breakdown

Chart 8: Sector breakdown of total capital expenditure for infrastructural projects (FY2020-25)

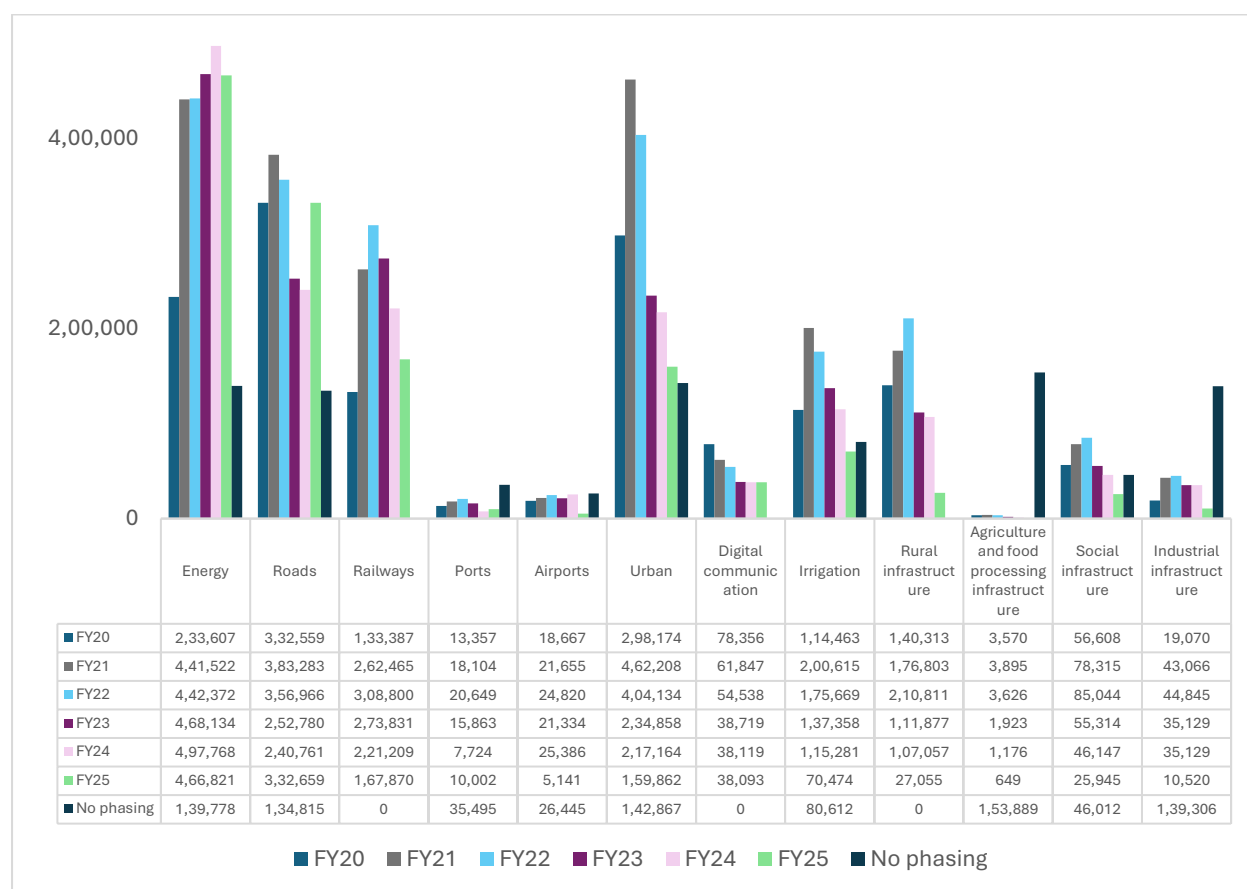


Source: NIP, DEA, ICRA Analytics

During FY2020 to FY2025, the projected infrastructure investment in India was divided among different sectors with the energy sector dominating with a share of 24%, closely followed by the transport sector- Roads, Urban and Railways with shares of 18%, 17% and 12% respectively. These sectors together comprise ~71% of the total projected infrastructure investments.

3.3 Expenditure Outlay

Chart 9: Sectoral breakdown of projected annual capital expenditure in infrastructure during FY2020-FY2025 (in Rs. Crore)



Source: NIP, DEA, ICRA Analytics

The FY2025 budget prioritizes infrastructure spending in energy, roads, railways, and urban development, including Smart Cities, MRTS, and Jal Jeevan Mission. Private sector investment will be encouraged through viability gap funding and supportive policies. NIP's investment target has increased from ₹111 trillion to ₹160 trillion, with a significant rise in project count.

Around 2,600 projects worth ₹49 trillion are in the conceptualization stage. Energy receives the highest share of investments at 24%, reflecting its critical role. Roads and urban infrastructure follow with 19% and 16%, respectively, emphasizing connectivity and urban growth. Railways account for 13%, highlighting the focus on transportation enhancement. Irrigation and rural infrastructure each receive 8%, supporting agriculture and rural development. Industrial, social, and digital infrastructure receive 3% each, showing moderate investment. Ports, airports, and agriculture receive 1% each, indicating a lower priority in overall spending.

3.5 Major infrastructure developmental plans in the economy

Road sector development plans:

India continues to strengthen its road infrastructure through large-scale investments aimed at improving connectivity, reducing logistics costs, and supporting economic growth.

Bharatmala Pariyojana: The Bharatmala Pariyojana Phase-I remains the Government's flagship highway development programme, focusing on economic corridors, feeder routes, border and coastal roads, greenfield expressways, and improved connectivity to ports. The programme envisages the development of 34,800 km of National Highways. According to the Ministry of Road Transport & Highways (MoRTH) Annual Report 2025–26, approximately 27,000 km of highway projects had been awarded and around 20,000 km had been completed by March 2026. The Government has shifted its focus from rapid network expansion towards timely completion

of ongoing projects, construction of wider access-controlled expressways, enhancement of road safety, and monetization of operational highway assets through Toll-Operate-Transfer (TOT), Infrastructure Investment Trusts (InvITs), and toll securitization.

PM Gati Shakti and Multi-Modal Logistics Parks (MMLPs): To improve freight movement and logistics efficiency, the Government is integrating highway development with the PM Gati Shakti National Master Plan. As of February 2026, the Network Planning Group (NPG) had evaluated 352 infrastructure projects with an estimated investment of ₹16.10 lakh crore, of which 201 projects had been sanctioned and 167 were under implementation. Additionally, 35 Multi-Modal Logistics Park (MMLP) locations have been identified across the country. Five MMLPs—Jogighopa, Chennai, Bengaluru, Nagpur, and Indore—are under various stages of development and are expected to become operational during FY2026–FY2027, supporting seamless multimodal freight movement and reducing logistics costs.

Pradhan Mantri Gram Sadak Yojana (PMGSY): Rural connectivity continues to be strengthened under the Pradhan Mantri Gram Sadak Yojana (PMGSY). As of March 2026, more than 8.36 lakh km of rural roads had been sanctioned, with over 7.75 lakh km completed under various PMGSY interventions, substantially improving rural accessibility, agricultural market linkages, and socio-economic development.

As a part of national industrial corridor programme, Indian government is developing 11 industrial corridors in a phased manner. These include industrial corridors connecting Delhi-Mumbai, Chennai-Bengaluru, Amritsar Kolkata, East Coast and Vizag Chennai Corridor, Bengaluru-Mumbai, extension of CBIC to Kochi via Coimbatore, Hyderabad-Nagpur, Hyderabad-Warangal, Hyderabad-Bengaluru, Delhi-Nagpur and Odisha Economic Corridor. A total of 308 Plots (1,789 acres) have been allotted until March 2024 in four cities. At present, about 2,104 acres of developed industrial land and 2,250 acres of commercial/ residential/ other land use are readily available for allotment.

Rail sector development plans:

Indian Railways has undergone significant infrastructure expansion and modernization over the past decade, supported by sustained public investment aimed at enhancing network capacity, operational efficiency, passenger services, safety, and freight logistics. Budgetary support has increased from approximately ₹32,000 crore in FY2014–15 to ₹2.78 lakh crore in the Union Budget FY2026–27, reflecting the Government's continued emphasis on railway-led infrastructure development.

Electrification has been a key focus area, with approximately 99.6% of the Broad-Gauge network electrified by March 2026, covering around 69,873 route kilometres. This transition has improved energy efficiency, reduced dependence on fossil fuels, lowered operating costs, and supported Indian Railways' long-term decarbonization objectives.

Passenger rail services have also witnessed significant modernization through the expansion of indigenous train platforms. As of April 2026, 162 Vande Bharat train services are operational across the country, offering improved speed, passenger comfort, and modern onboard technology. Higher-capacity 16-coach and 20-coach configurations have further enhanced carrying capacity on high-demand routes. The Vande Bharat Sleeper, introduced in January 2026, carried approximately 1.21 lakh passengers across 119 trips during its first three months of operation, recording 100% occupancy. Indian Railways has also expanded affordable long-distance connectivity through the Amrit Bharat Express, with 60 train services operational, improving accessibility for low- and middle-income passengers.

India is simultaneously advancing its high-speed rail infrastructure through the Mumbai–Ahmedabad High-Speed Rail (MAHSR) Corridor, a 508 km project designed for operations at speeds of up to 320 kmph and supported by advanced rolling stock, signalling, and train control systems. The Union Budget FY2026–27 has also reaffirmed the Government's commitment to expanding high-speed rail connectivity by undertaking planning and preparatory work for additional high-speed rail corridors across the country.

Station infrastructure is being upgraded under the Amrit Bharat Station Scheme, one of the world's largest railway station modernization programmes. Out of 1,338 identified stations, redevelopment work had been completed at 208 stations, with the remaining stations under various stages of implementation. Operational performance has also improved, with overall train punctuality exceeding 77%, while 24 railway divisions have reported more than 90% on-time performance.

Railway safety has been significantly strengthened through the deployment of Kavach, India's indigenous Automatic Train Protection (ATP) system. The technology continuously monitors train movements and automatically applies brakes to prevent collisions and signal-passing incidents. As of 2026, Kavach had been

deployed across 3,103 route kilometres, with implementation underway on an additional 24,427 route kilometres. The system has also been installed on 4,277 locomotives, while installation is in progress on another 8,979 locomotives. Kavach Version 4.0 has been commissioned on major corridors, including Delhi–Mumbai, Delhi–Howrah, and Prayagraj–Kanpur. Alongside other safety initiatives, these investments have contributed to a substantial decline in consequential train accidents, from 135 in FY2014–15 to 16 in FY2025–26.

Freight transportation and logistics integration have also improved through dedicated freight infrastructure and multimodal connectivity initiatives. The Eastern (1,337 km) and Western (1,506 km) Dedicated Freight Corridors (DFCs) are now largely operational, significantly enhancing freight capacity, reducing transit time, lowering logistics costs, and decongesting the conventional railway network. Complementing these corridors, the Gati Shakti Multi-Modal Cargo Terminal (GCT) Policy has strengthened rail-based freight infrastructure. As of 2026, 139 cargo terminals had become operational, while approximately 300 additional locations had been approved for development, improving cargo handling efficiency and strengthening supply chain connectivity across the country.

Several landmark engineering projects have further enhanced railway connectivity across strategically important and geographically challenging regions. These include the Chenab Bridge, inaugurated in 2025 as the world's highest railway arch bridge at 359 metres above the Chenab River; the Anji Khad Bridge, India's first cable-stayed railway bridge; the New Pamban Railway Bridge, India's first vertical-lift railway sea bridge connecting Rameswaram with the mainland; and the 51.38 km Bairabi–Sairang railway line, which has extended rail connectivity to Mizoram through a network of 45 tunnels and multiple major bridges. Collectively, these projects improve regional connectivity, facilitate economic development, enhance strategic mobility, and demonstrate India's growing engineering capabilities.

Renewable energy sector development plans:

The Ministry of New and Renewable Energy (MNRE) continues to drive India's clean energy transition with the objective of achieving 500 GW of installed electricity capacity from non-fossil fuel sources by 2030 under the country's Panchamrit commitments. As of 30 June 2026, India's installed renewable energy capacity reached 288.59 GW, while total installed solar capacity increased to 162.15 GW, compared with approximately 119 GW a year earlier. Solar energy now constitutes the largest share of India's renewable energy portfolio, supported by sustained policy interventions, manufacturing expansion, and large-scale infrastructure development. During FY2025–26, India added a record 44.61 GW of solar capacity, while total non-fossil fuel capacity additions reached 55.29 GW, reinforcing India's position among the world's fastest-growing renewable energy markets.

PM Surya Ghar: Muft Bijli Yojana – The scheme aims to install rooftop solar systems in one crore households with a financial outlay of ₹75,021 crore through FY2027. It is expected to facilitate approximately 30 GW of residential rooftop solar capacity and 40–45 GW of total rooftop solar installations. The programme continues to accelerate residential solar adoption through capital subsidies and reduced household electricity costs. As of 30 June 2026, grid-connected rooftop solar capacity reached 30.11 GW, reflecting strong growth in the residential and commercial rooftop segment.

Pradhan Mantri Surya Sarovar Yojana (PM-SSY) – Approved on 31 July 2026, the scheme aims to develop 5,000 MW of floating solar photovoltaic capacity integrated with 10,000 MWh of energy storage systems by utilizing reservoirs and inland water bodies. With an outlay of ₹5,070 crore during FY2026–27 to FY2030–31, the scheme is expected to reduce land requirements for solar projects, improve grid reliability, avoid approximately 10 million tonnes of CO₂ emissions annually, generate 16,000–17,000 jobs, and significantly expand India's floating solar capacity from the current level of around 700 MW.

Green Energy Corridor (GEC) Projects – The Green Energy Corridor programme continues to strengthen India's transmission infrastructure for renewable energy integration. GEC-I is under implementation across eight states, with 9,111 circuit kilometres (ckm) of transmission lines and 21,303 MVA of substation capacity completed. GEC-II is being implemented across seven states to facilitate renewable power evacuation and improve grid flexibility for future renewable energy expansion.

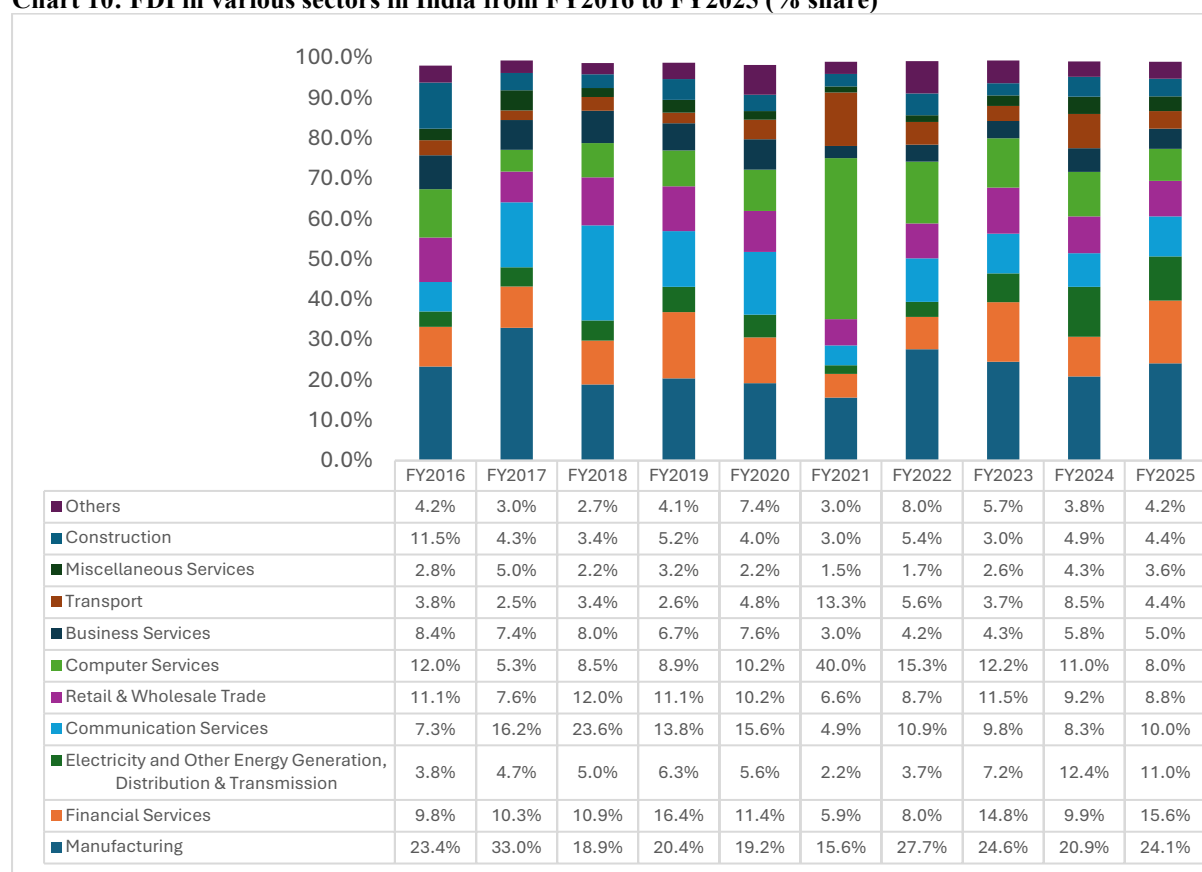
National Green Hydrogen Mission – Approved in January 2023 with an outlay of ₹19,744 crore, the mission aims to establish 5 million metric tonnes (MMT) of annual green hydrogen production capacity by 2030, supported by around 125 GW of additional renewable energy capacity, ₹8 lakh crore of investments, and an estimated reduction of 50 MMT of CO₂ emissions annually.

Production Linked Incentive (PLI) Scheme for High-Efficiency Solar PV Modules – The PLI scheme, with an outlay of ₹24,000 crore, is strengthening domestic manufacturing across the solar value chain. As of 31 March 2026, India's solar module manufacturing capacity had expanded to approximately 172 GW, compared with only 2.3 GW in 2014, significantly improving domestic manufacturing capabilities and reducing import dependence.

Solar Parks Scheme – The Solar Parks Scheme continues to provide developers with ready-to-use land and common infrastructure for utility-scale solar projects. As of February 2026, 54 solar parks with a cumulative sanctioned capacity of 39,188 MW had been approved across the country. Utility-scale solar projects remain the largest contributor to India's solar sector, with ground-mounted installations accounting for 121.25 GW of the country's 162.15 GW installed solar capacity as of 30 June 2026, while grid-connected rooftop solar contributed 30.11 GW, hybrid solar projects 4.36 GW, and off-grid solar systems 6.43 GW.

3.6 FDI inflows in Indian infrastructure industry

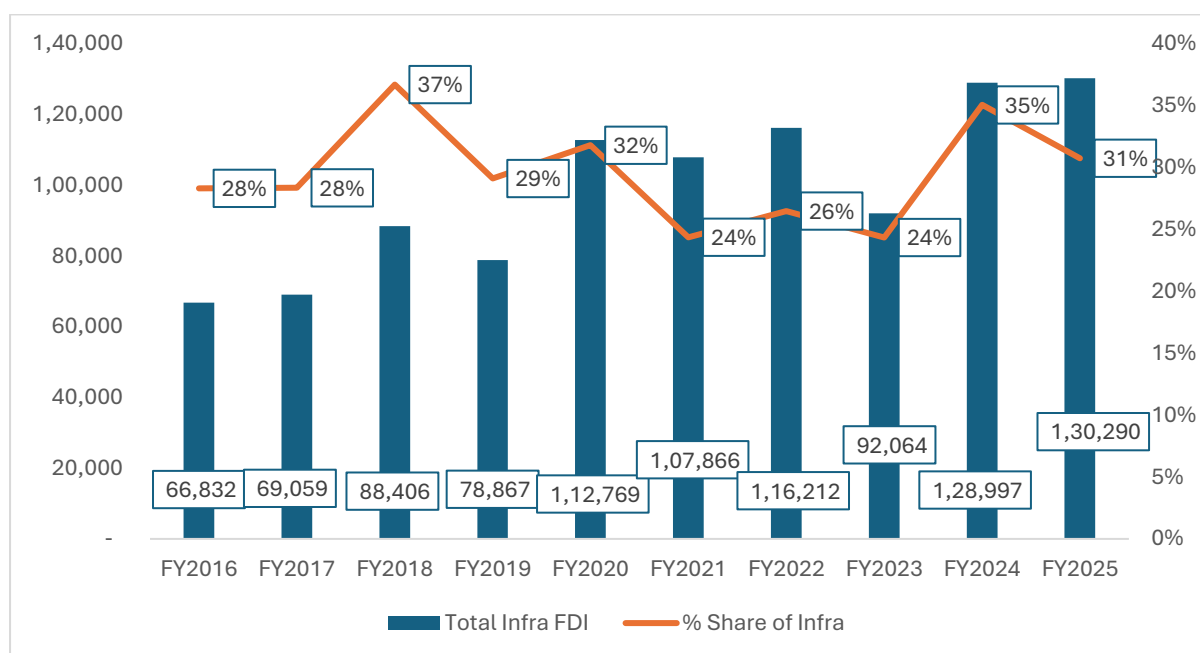
Chart 10: FDI in various sectors in India from FY2016 to FY2025 (% share)



Source: RBI, ICRA Analytics

Note: Others include Restaurants and Hotels, Education, Research & Development, Mining, Real Estate Activities, Trading etc.

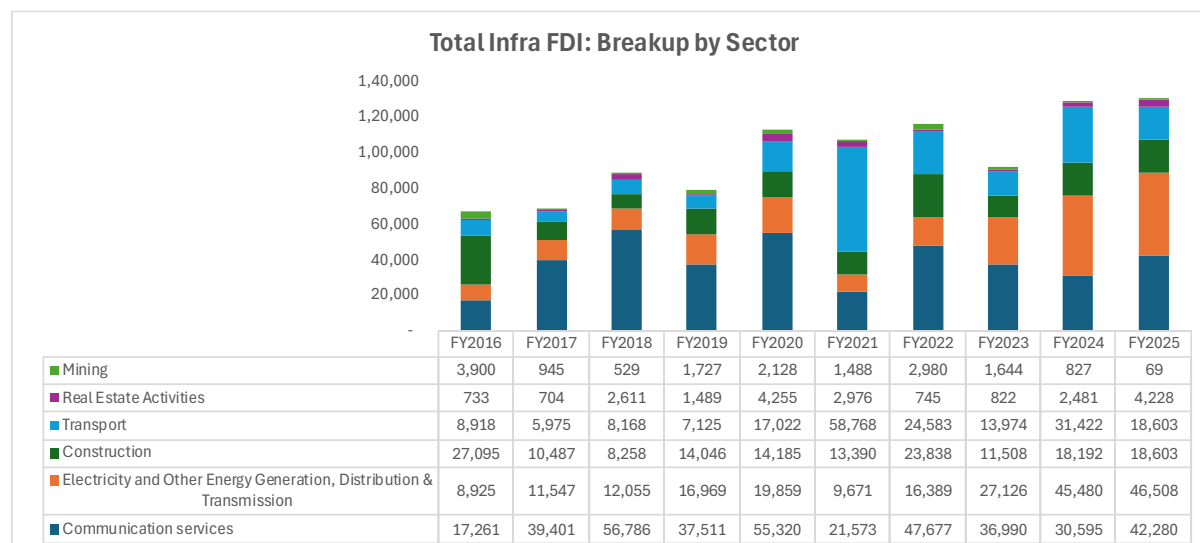
Chart 11: FDI inflows in infrastructure sectors in India between FY2016 to FY2025 (Rs. crore)



Source: RBI, ICRA Analytics

Note: Infrastructure Sectors includes construction, communication services, electricity and other energy generation, distribution & transmission, transport, real estate activities and mining.

Chart 12: Infrastructure FDI Inflows: Breakup by Sectors in India FY2016 to FY2025 (Rs. crore)



Source: RBI, ICRA Analytics

India continues to strengthen its position as a preferred global investment destination, supported by a liberal investment regime, policy reforms, and a rapidly expanding economy. Total Foreign Direct Investment (FDI) inflows reached US\$80.62 billion in FY2024-25, the highest level recorded during the last three financial years. During the first half of FY2025-26, India attracted US\$50.36 billion (provisional) in FDI inflows, representing a 16% increase over US\$43.37 billion during the corresponding period of FY2024-25 and marking the highest-ever FDI inflow for the first half of any financial year. FDI continues to play a vital role in providing non-debt capital, facilitating technology transfer, strengthening manufacturing capabilities, and generating employment. Government initiatives such as Make in India, the Goods and Services Tax (GST), and progressive FDI liberalisation across key sectors have significantly improved investor confidence. India now permits 74% FDI under the automatic route in the defence sector and 100% FDI under the automatic route in telecommunications, while the insurance sector allows 74% FDI under the automatic route subject to prescribed conditions.

3.7 Investment trend in infrastructure in India

Budgetary outlay towards infrastructure and government infra projects

The Union Budget FY2026–27 sustains infrastructure-led growth with public capital expenditure of ₹12.2 lakh crore. Key allocations include Roads & Highways (₹3.10 lakh crore), Ports, Shipping & Waterways (₹5,164.8 crore), Power (₹29,997 crore), and New & Renewable Energy (₹32,915 crore). The Budget also introduced the Infrastructure Risk Guarantee Fund, continued investment in multimodal infrastructure, and supports the Viksit Bharat 2047 vision.

Infrastructure:

- Public capital expenditure increased to ₹12.2 lakh crore.
- Launch of the Infrastructure Risk Guarantee Fund to improve private investment in infrastructure.
- Continued investment in roads, railways, logistics, ports, and urban infrastructure.
- Development of City Economic Regions to accelerate regional industrial and economic growth.
- Expansion of high-speed rail planning and multimodal connectivity.
- Strengthening of urban infrastructure through SASCI, Urban Challenge Fund, and AMRUT.
- Promotion of municipal bonds as an additional source of infrastructure financing.

Port, Shipping and Shipbuilding:

- The Union Budget FY2026–27 allocated ₹5,164.8 crore to the Ministry of Ports, Shipping and Waterways, representing a ~78% year-on-year increase over the revised estimates for FY2025–26.
- Introduced the Container Manufacturing Assistance Scheme (CMAS) with an outlay of ₹10,000 crore over five years to strengthen domestic container manufacturing capacity and reduce import dependence.
- Continued expansion of inland waterway infrastructure through the operationalization of 20 additional National Waterways, enhancing multimodal freight connectivity.
- Investments in ship repair and maintenance infrastructure at Varanasi and Patna to support inland shipping and improve operational efficiency.
- Focus on increasing the share of coastal shipping in domestic freight movement to reduce logistics costs and improve supply chain efficiency.
- Policy measures to encourage Indian ship ownership and enhance the competitiveness of the domestic maritime sector.
- Overall emphasis on strengthening maritime infrastructure, logistics efficiency, and indigenous manufacturing to position India as a globally competitive maritime and logistics hub under the Amrit Kaal Vision 2047.

Power and Renewables:

- The Union Budget FY2026–27 reinforces India's clean energy transition, with the Ministry of Power receiving ₹29,997 crore (up 39% over the revised estimates for FY2025–26) and the Ministry of New and Renewable Energy (MNRE) allocated ₹32,915 crore (up 30% year-on-year).
- Around 60% of the Ministry of Power's allocation (₹18,000 crore) has been earmarked for the Revamped Distribution Sector Scheme (RDSS) to improve the operational and financial performance of power distribution companies through smart metering and grid modernization.
- Budgetary support for Central Public Sector Undertakings (CPSUs) increased to ₹7,401 crore, strengthening investments in power generation and transmission infrastructure.
- Allocation under PM Surya Ghar: Muft Bijli Yojana increased to ₹22,000 crore to accelerate rooftop solar adoption, while funding for grid-connected solar power rose 78% to ₹1,775 crore.
- Continued support has been provided to PM-KUSUM with an allocation of ₹5,000 crore, while funding for the National Green Hydrogen Mission doubled to ₹600 crore to strengthen India's green hydrogen ecosystem.
- The Budget announced Basic Customs Duty (BCD) exemptions on capital goods for battery energy storage systems and extended duty exemptions for nuclear power project imports until 2035, supporting clean energy deployment and energy security.
- The Government also proposed the restructuring of Power Finance Corporation (PFC) and REC Limited to strengthen long-term financing for the power sector, along with the establishment of Rare Earth Corridors to support domestic manufacturing of critical minerals for clean energy technologies.

- An outlay of ₹20,000 crore has been proposed over the next five years for Carbon Capture, Utilisation and Storage (CCUS) technologies, reflecting the Government's focus on industrial decarbonization and low-carbon energy infrastructure.

Roads and Highways:

- The Ministry of Road Transport and Highways (MoRTH) received an allocation of ₹3.10 lakh crore in the Union Budget FY2026–27, representing an 8% increase over the revised estimates for FY2025–26, reaffirming the Government's focus on transport infrastructure development.
- Capital expenditure by the Ministry increased to ₹2.94 lakh crore, reflecting sustained investment in highway expansion and connectivity, with a 33% CAGR in capital spending between FY2013 and FY2027.
- National Highways Authority of India (NHAI) was allocated ₹1.87 lakh crore, accounting for around 60% of the Ministry's budget, to accelerate implementation of the Bharatmala Pariyojana and expansion of the national highway network.
- An allocation of ₹1.22 lakh crore has been earmarked for roads and bridges, supporting national highways, expressways, lane expansion projects, and connectivity in strategically important and underserved regions.
- Funding for road transport and safety increased to ₹400 crore, supporting initiatives to strengthen road safety, traffic management, and transport infrastructure.
- The Union Budget FY2026–27 announced the development of a new freight corridor connecting Dankuni (West Bengal) and Surat (Gujarat) to improve freight movement and logistics efficiency, along with the development of a new East Coast Industrial Corridor with a key logistics node at Durgapur.
- Continued investments under Bharatmala Pariyojana, expressway development, and integrated planning through PM Gati Shakti are expected to enhance multimodal connectivity, reduce logistics costs, and strengthen regional economic integration.

4. Irrigation Industry in India

4.1 Overview:

Agriculture and allied activities form an integral part of the Indian economy and currently, ~18% of India's GVA is contributed by this sector. India, possessing ~4% of the world's water resources supports a population of 1.4 billion. Limited water resources for agricultural activities, coupled with erratic monsoons and change in weather patterns, intensifies the need for efficient irrigation practices so as to ensure reduction of water stress in the country. Furthermore, this has resulted in irrigation systems becoming critical in maximizing agricultural output and ensuring food security for the nation. The disparity between availability of water and the actual demand for it necessitates innovation and sustainable management practices in the agricultural sector.

4.2 Agriculture and Irrigation in India:

As per PLFS (Periodic Labour Force Survey), the agricultural sector of India employs an estimated ~45% of India's workforce and comprises an estimated ~15% of India's GVA, making itself pivotal to the economy. However, traditional farming methods often yield less efficiency and productivity. This led the Government of India (GoI) to bring about the fourth agricultural revolution known as Agriculture 4.0. This initiative aims to improve yield quality and precision, while minimizing environmental damage, leading to more efficient and sustainable farming methods. Despite recent global headwinds, the sector has shown resilience and has even been a driving force to boost the economy forward.

Table 3: Agricultural Land by Use in India

Classification	FY2014	FY2015	FY2016	FY2017	FY2018	FY2019	FY2020	FY2021	FY2022	FY2023	FY2024 (P)
I. Geographical Area	328.7	328.7	328.7	328.7	328.7	328.7	328.8	328.7	328.7	328.8	328.8
II. Reporting Area for Land Utilisation	307.5	307.5	307.5	308.1	307.5	307.5	306.5	307.0	306.5	306.7	306.9
1. Forest	71.9	72.1	72.1	72.3	72.3	72.3	71.8	72.0	72.0	72.0	72.0
2. Not Available for Cultivation	43.7	44.0	43.8	44.6	44.1	44.3	44.3	44.4	44.1	44.4	45.1
3. Other Uncultivated land excluding Fallow Land	25.8	25.9	25.6	25.6	25.7	25.6	25.6	25.2	25.2	24.9	24.7
4. Fallow Lands	25.0	26.2	27.0	26.6	26.6	26.9	25.0	23.8	24.2	24.6	26.1
5. Net Area Sown	141.2	139.5	139.0	139.0	138.8	138.4	139.9	141.5	141.0	140.7	139.0
6. Total Cropped Area (Gross Cropped Area)	201.3	198.3	198.1	201.2	200.9	201.2	211.4	216.1	219.2	219.4	217.9
7. Area Sown more than once	60.1	58.8	59.2	62.2	62.1	62.7	71.5	74.6	78.2	78.7	78.9
8. Cropping Intensity*	142.5	142.2	142.6	144.7	144.8	145.3	151.1	152.7	155.4	155.9	156.8
III. Net Irrigated Area	68.4	68.6	67.8	69.2	70.1	72.2	75.5	77.7	77.9	79.3	82.4
IV. Gross Irrigated Area	96.3	97.9	97.8	99.4	101.3	104.5	112.2	118.9	120.4	122.3	130.5

Source: Land Use Statistics at a Glance, Ministry of Agriculture & Farmers Welfare, ICRA Analytics;
(P): Provisional

Irrigation schemes in India can be classified based on either cultivable command area (CCA) or by way of water application schemes used.

1. **Based on Cultivable Command Area (CCA):**

- **Minor Irrigation schemes:** Projects having Cultivable Command Area (CCA) of less than 2,000 hectares (ha).
- **Medium Irrigation schemes:** Projects having Cultivable Command Area (CCA) of more than 2,000 but less than 10,000 ha.
- **Major Irrigation schemes:** Projects having Cultivable Command Area (CCA) of more than 10,000 ha.

2. **Based on the Way of Water Application:**

- **Gravity/Flow Irrigation Scheme:** In this type, water is usually stored at a higher elevation, enabling supply by way of gravity. It can be further classified into perennial and non-perennial irrigation schemes based on supply of water during crop period.
- **Lift Irrigation Scheme:** In this type of systems, water is required to be pumped from lower elevation to the field or canal network.

In India both traditional and modern irrigation techniques are used in tandem. Traditional methods include moats, chain pump, dheelki, Rahat which are primarily dependent on surface and well waters. These are simpler and less costly, but lack precision, as compared to modern methods. Sprinkler system, drip irrigation system are modern irrigation methods, which provides extreme precision and reduces wastage of water, but can often be costlier to install and maintain.

4.3 Major Irrigation projects in India:

During the First Five Year Plan, India had 74 major and 143 medium irrigation projects. This number increased significantly with the government taking up 406 major, 1135 medium and 259 ERM schemes during FY1951 to FY2012 (end of XI Plan). 231 major, 880 medium and 122 ERM projects have been recorded as completed by end of XI Plan.

During FY2024–25, a total of 58 major/medium irrigation and multipurpose projects along with 5 drinking water projects were under appraisal by the Central Water Commission (CWC). Among these, 12 projects, including 3 major and medium irrigation/multipurpose projects, progressed through the appraisal process.

In FY2025, the government has invested in various irrigation projects (both major and medium), which are at various stages of construction. Many projects are also approved by the Advisory Committee of DoWR, RD&GR in the year. A detailed list of these projects has been mentioned below:

Table 4: Status of Irrigation Projects under Appraisal in D&R Wing of CWC

Sl. No	State	Name of the Project	Status
1	Rajasthan	Revised DPR of Transfer of Rajasthan Share of Yamuna Water at Tajewala Head Works to Churu and Jhunjhunu Districts of Rajasthan	Comments Issued
2	Madhya Pradesh	Parbati-Kalisindh-Chambal Integrated Project (integrated with ERCP)	Comments Issued
3	Odisha	Upper Udanti Irrigation Project	Comments Issued
4	Odisha	Govindapalli Irrigation Project	Comments Issued
5	Telangana	Sita Rama Lift Irrigation Project Phase – I	Under Examination
6	Telangana	Sammakka Sagar Project (Thupakulagudem Barrage)	Under Examination
7	Gujarat	Lift Irrigation Scheme and Tapi Barrage Project	Under Examination
8	Assam	Technical Examination of DPR Stage Hydromechanical Equipment Design for Amreng Irrigation Project (Medium)	Comments Issued
9	Andaman & Nicobar Islands	Khudirampur Dam	Comments Issued
10	Jammu & Kashmir	Improvement/Strengthening of Main Ravi Canal and its Distribution Network	Comments Issued
11	Uttar Pradesh	Badaun Irrigation Project	Comments Issued
12	Bihar	Modernisation of Western Main Canal of Sone Canal System	Under Examination
13	Bihar	Irrigation, Flood Control & Drainage in Saran District	Comments Issued
14	Bihar	Extension, Renovation and Modernisation of Western Kosi Canal Project	Under Examination

Source: Central Water Commission (CWC); ICRA Analytics Ltd.

Table 5: List of the Irrigation / Multipurpose Projects Accepted by the Advisory Committee of DoWR, RD&GR during FY2025

Sl. No.	Name of the Project	State	Type of the Project	Estimated Cost (₹ Crore)	Intended Benefits
1	1st RCE of Eastern Gandak Canal System (Gandak Phase-II) (RD 538 to RD 909.4)	Bihar	Major Irrigation Project	₹3,030.95 crore (at July 2023 PL)	CCA: 1.22 lakh hectares
2	Hidsing Medium Irrigation Project	Odisha	Medium Irrigation Project	₹332.26 crore (at 2023 PL)	CCA: 2,958 hectares
3	Mankada Medium Irrigation Project	Odisha	Medium Irrigation Project	₹1,053.69 crore (at 2024 PL)	CCA: 9,850 hectares

Source: Central Water Commission (CWC); ICRA Analytics Ltd.

4.4 Government initiatives:

The irrigation sector forms the backbone of India's agricultural landscape, playing a crucial role in ensuring food security, improving climate resilience, and stabilising farm incomes. Strengthening this sector through the development of robust infrastructure, modernisation of irrigation systems, and the promotion of sustainable water management is essential to enhance productivity. To achieve this, the Government of India has introduced several targeted programmes and schemes that encourage the adoption of water-efficient irrigation practices. The flagship scheme, Pradhan Mantri Krishi Sinchayee Yojana (PMKSY), has been central to this effort by improving irrigation coverage, promoting innovative techniques, and providing financial support for sustainable practices. Within this framework, the Per Drop More Crop (PDMC) initiative, which has been implemented under the Rashtriya Krishi Vikas Yojana (RKVY) since 2022–23, focuses on strengthening and incentivising micro-irrigation projects. Together, these initiatives aim to expand cultivable areas with reliable water access, enhance water-use efficiency, and modernise irrigation methods, ultimately making farming more sustainable and resilient. The PMKSY scheme along with its potential and impact is further discussed below.

Pradhan Mantri Krishi Sinchayee Yojana (PMKSY)

The Pradhan Mantri Krishi Sinchayee Yojana (PMKSY) continues to serve as the Government of India's flagship irrigation programme aimed at expanding assured irrigation, improving on-farm water-use efficiency, and promoting sustainable water management. Over the past decade, PMKSY has emerged as a key driver of irrigation-led agricultural transformation, with central assistance exceeding ₹64,407 crore. Since FY2017, the programme has benefited over 27 million farmers and has created or restored irrigation potential across 24.61 million hectares. Recognising the continued importance of irrigation infrastructure, the Union Budget FY2026–27 allocated ₹6,587 crore to PMKSY to further strengthen irrigation coverage, enhance water-use efficiency, and promote climate-resilient agriculture. Under the Per Drop More Crop (PDMC) component, the Government continues to promote micro-irrigation through drip and sprinkler systems to improve irrigation efficiency and conserve water resources. Since its inception, approximately 110.92 lakh hectares have been brought under micro-irrigation, significantly improving water-use efficiency while enhancing crop productivity and farm incomes.

Command Area Development and Water Management (CADWM)

Following Cabinet approval in April 2025, the Modernisation of Command Area Development and Water Management (M-CADWM) scheme is being implemented as a sub-scheme under PMKSY-AIBP with an initial outlay of ₹1,600 crore. The programme leverages SCADA, IoT-based monitoring, pressurised piped irrigation networks, and micro-irrigation infrastructure to improve water accounting and distribution efficiency. As of March 2026, 32 pilot clusters across 23 States and Union Territories have been approved under the scheme, with a Budget Estimate of ₹550 crore for FY2026–27, providing the foundation for a future national irrigation modernization framework.

Accelerated Irrigation Benefit Programme (AIBP): The Accelerated Irrigation Benefit Programme (AIBP) was launched by the Government of India in FY1997 to expedite the completion of ongoing major and medium irrigation projects that were beyond the financial capacity of states, with priority accorded to drought-prone and tribal regions. Following the launch of the Pradhan Mantri Krishi Sinchayee Yojana (PMKSY) in FY2016, AIBP was subsumed as one of its key components. The programme focuses on accelerating the creation of irrigation infrastructure to improve water availability and enhance agricultural productivity. Since FY2017, AIBP has received central assistance of ₹21,023 crore, benefiting approximately 17.30 million farmers, making it the largest component of PMKSY in terms of beneficiary coverage. As of FY2025–26, the programme has created 30.66 lakh hectares of irrigation potential, including 4.09 lakh hectares during FY2023–24 to FY2025–26, reflecting continued progress in expanding assured irrigation coverage. The programme has also been strengthened through new strategic investments such as the Kosi–Mechi Intra-State Link Project in Bihar, approved by the Cabinet Committee on Economic Affairs (CCEA) under PMKSY-AIBP. The project, with an estimated cost of ₹6,282.32 crore and central assistance of ₹3,652.56 crore, is targeted for completion by March 2029 and is expected to provide 2.11 lakh hectares of additional annual irrigation across the districts of Araria, Purnea, Kishanganj and Katihar, while restoring irrigation to 1.57 lakh hectares under the existing Eastern Kosi Main Canal command area.

Table 6: Potential created under AIBP

S. No.	State	Potential Created under AIBP during								Potential Created under AIBP up to March 2024
		2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	
1	Andhra Pradesh	11.89	10.41	2	0	0	0	0	0	330.79
2	Assam	28.28	0	1.17	0	0	7.1	0	0	128.97
3	Bihar	10.31	0.4	0.2	1.87	0.2	6.56	0.1	0.05	485.88
4	Chhattisgarh	6.66	9.96	0	0.04	0.1	0	0	0	208.79
5	Goa	0.07	0	0.26	0	0	0.14	3.77	0	24.69
6	Gujarat	116.5	312.18	98.64	28.69	13.91	12.29	10.81	17.89	1,935.87
7	Haryana	0	0	0	0	0	0	0	0	103.13
8	Himachal Pradesh	0	0	0	0	0	0	0	0.66	38.16
9	Jammu & Kashmir	0	0	0	5.26	0.9	0.36	0	0	65.32
10	Jharkhand	79.19	0	0	0	0.61	0	0	0	122.22
11	Karnataka	24.62	81	6.9	1.93	1.34	0	0.05	0.05	845.83
12	Kerala	0.07	0.24	0.8	0.95	0	0	0.53	0	52.24
13	Madhya Pradesh	73.73	72.28	16.2	11.22	1.74	2.64	2.41	2.74	984.78
14	Maharashtra	66.51	31.49	74.1	66.22	33.24	43.14	30.63	32.58	1045.36
15	Manipur	4	3.24	2.4	0	3.79	0.92	4.43	5.69	55.23
16	Meghalaya	0	0	0	0	0	0	0	0	0
17	Odisha	5.42	17.61	13.1	15.2	3.82	4.43	18.64	9.22	350.13
18	Punjab	0	11.62	0	0	1.44	21.93	0	18.05	254.26
19	Rajasthan	0	7.05	0.12	0.07	0	0	9.14	0	1,169.42
20	Tamil Nadu	0	0	0	0	0	4.12	0	1.03	5.15
21	Telangana	20	84.28	11.04	3.36	20.36	42.38	8.17	0	705.23
22	Tripura	0	0	0	0	0	0	0	0	16.19
23	Uttar Pradesh	67.4	61.13	384.88	181.97	48.49	20.06	0	3	2440.72
24	Uttarakhand	0	0	0	0	0	0	0	0	0
25	West Bengal	0	0	0	0	0	0	0	0	135.8
Total		514.65	702.9	611.76	316.77	129.94	166.07	88.68	90.96	11,504.15

Source: Agricultural Statistics at a Glance 2024-25, Ministry of Agriculture & Farmers Welfare, Ministry of Water Resources, River Development and Ganga Rejuvenation, ICRA Analytics; *Note: Data captured till FY2024

Har Khet Ko Pani (HKKP):

Under the Surface Minor Irrigation (SMI) sub-component of Har Khet Ko Pani (HKKP), the Government supports the development of small surface irrigation schemes to expand assured irrigation in underserved regions. Since April 2016, the programme has created irrigation potential of 4.29 lakh hectares, including 0.96 lakh hectares during FY2023–24 to FY2025–26, strengthening irrigation access and improving water availability for agriculture.

The Repair, Renovation and Restoration (RRR) of Water Bodies component focuses on restoring traditional water bodies to improve storage capacity, groundwater recharge, and irrigation potential. Since April 2016, the

programme has restored irrigation potential of 1.27 lakh hectares, including 0.41 lakh hectares during FY2023–24 to FY2025–26, contributing to enhanced water conservation and sustainable irrigation management.

As per latest updates (PIB, July 2025), the Government of India has released ₹545.35 crore as central assistance to states under the RRR of Water Bodies scheme (PMKSY–HKKP) from FY2016–17 up to 31st March 2025. This has restored an irrigation potential of 1.20 lakh hectares and revived 191.28 million cubic meters (MCM) of storage capacity. Major beneficiary states include Odisha (₹151.56 cr, 33.83 th ha restored), Tamil Nadu (₹146.74 cr, 14.25 th ha restored), and Rajasthan (₹82.01 cr, 17.77 th ha restored), among others.

- Watershed Development component (WDC):** The Watershed Development Component (WDC) under PMKSY emphasizes integrated watershed management to enhance water availability, restore soil health, and increase agricultural productivity in rain-fed regions. This component plays a pivotal role in supporting farmers in areas with limited irrigation infrastructure by promoting measures such as rainwater harvesting, soil moisture conservation, and groundwater recharge. Implementation under WDC has been progressing steadily, with state governments rolling out projects that combine water conservation with sustainable agricultural practices. A recent example includes the Madhya Pradesh government's plan to construct 50,000 farm ponds across the state for irrigation purposes. These ponds act as small reservoirs designed to collect and store rainwater, thereby ensuring water availability throughout the crop cycle. Their benefits extend beyond irrigation, as they also improve soil health, reduce dependency on erratic monsoons, and enable multiple cropping patterns. Over time, the cumulative impact of such interventions strengthens water security, improves rural livelihoods, and drives long-term agricultural sustainability in rain-fed areas.
- Per Drop More Crop (PDMC):** The Per Drop More Crop (PDMC) initiative aims to improve on-farm water-use efficiency by promoting the adoption of micro-irrigation technologies, including drip and sprinkler irrigation systems. The scheme provides financial assistance to farmers to encourage wider adoption of precision irrigation, thereby reducing water consumption, enhancing crop productivity, and promoting sustainable agricultural practices. PDMC primarily focuses on improving irrigation efficiency at the farm level through micro-irrigation techniques. Drip irrigation delivers water directly to the root zone through a network of emitters and lateral pipes, minimizing evaporation and runoff losses, while sprinkler irrigation distributes water uniformly under pressure, simulating natural rainfall and enabling efficient irrigation across a wide range of crops and field conditions. Implemented under PMKSY since FY2015–16 and under the Rashtriya Krishi Vikas Yojana (RKVY) since FY2022–23, the programme has emerged as India's flagship micro-irrigation initiative. According to PIB (June, 2026), approximately 110.92 lakh hectares have been brought under micro-irrigation. Since its inception, the Government has released ₹26,325 crore in central assistance under the scheme, significantly improving water-use efficiency and promoting precision agriculture across the country. Going forward, the Government has set a target of bringing an additional 100 lakh hectares under micro-irrigation during FY2025–26 to FY2029–30, requiring annual coverage of approximately 20 lakh hectares. The continued expansion of PDMC is expected to strengthen climate-resilient agriculture, improve irrigation efficiency, and support sustainable management of India's water resources.

Table 7: Top 6 Performing States in Terms of Area Covered under PDMC in 2025-26

Sl. No	State	Drip Irrigation (Hectares)	Sprinkler Irrigation (Hectares)	Total Area under Irrigation (Hectares)
1	Maharashtra	96,392.110	50,113.340	1,46,505.45
2	Andhra Pradesh	103,482.124	22,610.120	1,26,092.24
3	Tamil Nadu	82,170.200	38,140.310	1,20,310.51
4	Gujarat	51,352.980	61,396.990	1,12,749.97
5	Rajasthan	13,773.400	86,558.670	1,00,332.07
6	Uttar Pradesh	27,532.021	63,375.705	90,907.73
7	Karnataka	7,142.100	80,608.200	87,750.300

Source: Ministry of Agriculture & Farmers Welfare – PDMC Website

4.5 Rise in Irrigation Investments in India (FY2019-FY2028):

India's irrigation sector has witnessed significant growth in investments, driven by both government initiatives and market potential. The Indian irrigation systems market is projected to grow at a CAGR of 10.9% during 2023–2028, according to India Investment Grid. With the world's largest irrigated crop area of 8.26 million hectares and the second-largest arable land area of 159.7 million hectares, India presents immense opportunities for expansion and modernization of irrigation infrastructure.

A key driver of this growth is the Micro Irrigation Fund (MIF), operationalized by NABARD in 2019–20 with an initial corpus of ₹5,000 crore to support state governments in expanding micro-irrigation coverage beyond the provisions of the Pradhan Mantri Krishi Sinchai Yojana (PMKSY) – Per Drop More Crop. The Ministry of Agriculture & Farmers' Welfare (MoA&FW) further augmented the fund by an additional ₹5,000 crore during the Union Budget 2021–22 for the 15th Finance Commission period, offering a 2% interest subvention on loans to participating state governments starting from October 3, 2024 (previously 3%). As of 31 May 2025, cumulative loans sanctioned under MIF stood at ₹4,719.10 crore, with ₹3,750.57 crore already released. The loans sanctioned by NABARD under the Micro Irrigation Fund (MIF) aim to expand micro-irrigation coverage by 22.22 lakh hectares. Out of this, 21.69 lakh hectares had been covered by the participating states as of 31 March 2025.

The Pradhan Mantri Krishi Sinchai Yojana (PMKSY) continues to be a major contributor to irrigation investments. Between FY 2022–26, a total budget of ₹93,068 crore has been earmarked, including ₹37,454 crore in central support and ₹20,434 crore facilitated through NABARD-led debt servicing, with the remaining expenditure expected to be covered by state governments. The 2025 budget further allocated ₹8,259 crore to PMKSY to accelerate irrigation coverage and improve water-use efficiency. State-level initiatives are complementing central schemes. In Maharashtra, electricity rate concessions have been extended for 1,789 lift irrigation schemes until March 2027, with allocations of ₹886 crore for FY 2025–26 and ₹872 crore for FY 2026–27 to offset revenue losses to the Maharashtra State Electricity Distribution Company Limited (MSEDCL). Rural irrigation projects in Akola district, including the Ghonga and Kanadi minor irrigation projects, will receive ₹4.76 crore and ₹4.92 crore respectively for canal repairs and restoration of storage capacity, enhancing sustainable water supply for local farmers. In parallel, urban infrastructure in Nagpur is being strengthened with a ₹268.84 crore HUDCO loan for sewage and water projects, reflecting a balanced approach to urban and rural water management.

Table 8: State-wise Cumulative Loans Sanctioned and Released under Micro Irrigation Fund (MIF) as on 31st October 2025

S. No.	Name of the State	Loan Sanctioned (₹ Crore)	Loan Released (₹ Crore)
1	Andhra Pradesh	616.13	616.13
2	Gujarat	764.13	641.29
3	Tamil Nadu	1,357.93	1,357.93
4	Haryana	785.30	365.89
5	Punjab	149.65	45.46
6	Uttarakhand	4.81	0.58
7	Rajasthan	740.79	667.45
8	Karnataka	290.33	257.07
9	Telangana	144.43	0
Total		4,853.50	3,951.8

Source: MoA&FW, GoI

he first half of FY2025-26, India attracted US\$50.36 billion (provisional) in FDI inflows, representing a 16% increase over US\$43.37 billion during the corresponding period of FY2024-25 and marking the highest-ever FDI inflow for the first half of any financial year. FDI continues to play a vital role in providing non-debt capital, facilitating technology transfer, strengthening manufacturing capabilities, and generating employment. Government initiatives such as Make in India, the Goods and Services Tax (GST), and progressive FDI liberalisation across key sectors have significantly improved investor confidence. India now permits 74% FDI

under the automatic route in the defence sector and 100% FDI under the automatic route in telecommunications, while the insurance sector allows 74% FDI under the automatic route subject to prescribed conditions.

Government spending on the Irrigation Projects (Gujarat, Madhya Pradesh and Rajasthan)

Table: Government Spending on Irrigation Projects (₹ Crore)

States	FY2025	FY2026 RE	FY2027 BE
Gujarat	11,376	14,656	19,589
Madhya Pradesh	20,595	19,087	13,934
Rajasthan	7,419	8,042	7,808

Source: PRS (Gujarat and Madhya Pradesh), Finance Department, Government of Rajasthan, India

Note: RE – Revised Estimate, BE – Budgeted Estimates

Government spending on irrigation projects across Gujarat, Madhya Pradesh, and Rajasthan reflects varied investment priorities over FY2025-FY2027. Gujarat is witnessing the strongest growth in irrigation expenditure, with allocations increasing from ₹11,376 crore in FY2025 to ₹19,589 crore in FY2027 BE, representing a significant rise of over 72%. This indicates a strong focus on expanding irrigation infrastructure and strengthening water resource management in the state.

In contrast, Madhya Pradesh remains the largest spender in absolute terms in FY2025 and FY2026 RE, with allocations of ₹20,595 crore and ₹19,087 crore, respectively. However, the FY2027 Budget Estimate shows a notable reduction to ₹13,934 crore, suggesting either the completion of major projects or a shift in spending priorities.

Rajasthan's irrigation spending remains relatively stable over the period, increasing modestly from ₹7,419 crore in FY2025 to ₹8,042 crore in FY2026 RE before easing slightly to ₹7,808 crore in FY2027 BE. This indicates a continued but measured approach toward irrigation development.

Overall, the data highlights Gujarat's aggressive ramp-up in irrigation investments, while Madhya Pradesh is moderating expenditure after a period of high spending, and Rajasthan is maintaining a steady allocation pattern. These investments are critical for enhancing agricultural productivity, improving water availability, and strengthening drought resilience across the three states.

5. Construction of Dams

5.1 Overview

Dams are large structures which are built across rivers or streams to control the flow of water. These are substantial social investments serving one or more of four primary purposes:

- Providing water supply to domestic and industrial sectors
- Production of energy
- Irrigation
- Controlling flood

In India, dams play a meaningful role in the agricultural sector, providing water for irrigation while protecting downstream areas from damages caused by flooding. Major dams also double as hydropower projects, helping in meeting energy needs. The central government has implemented several initiatives to improve the safety conditions of the dams across India. The Dam Safety Act was enacted in December 2021 providing a comprehensive framework for proper operations, inspection, surveillance and maintenance of the large (specified) dams thereby helping in safe operations and avoiding dam failure related disasters.

Constructed and under construction dams in India

As per the National Register for Specified Dams (NRSD), May 2026, India has 6,814 specified dams, comprising 6,598 completed (operational) dams and 216 dams under construction. Together, these dams have a total gross storage capacity of 336.6 billion cubic metres (BCM), including 316.8 BCM from completed dams and 19.8 BCM from dams under construction. The total live storage capacity stands at 273.9 BCM, of which 260.0 BCM is contributed by completed dams and 13.9 BCM by projects under construction. Maharashtra has the highest number of specified dams (2,862), followed by Madhya Pradesh (1,374) and Gujarat (525).

Table 9: State-wise List of Large Dams as per NRLD-2026

Sl. No.	States/UT	Operational dams	Under Construction dams	Total number of dams
1	Andhra Pradesh	150	13	163
2	Arunachal Pradesh	5	0	5
3	Assam	3	0	3
4	Bihar	32	2	34
5	Chhattisgarh	317	12	329
6	Goa	6	0	6
7	Gujarat	524	1	525
8	Haryana	3	0	3
9	Himachal Pradesh	26	4	30
10	Jharkhand	68	5	73
11	Karnataka	232	0	232
12	Kerala	65	0	65
13	Madhya Pradesh	1370	4	1374
14	Maharashtra	2713	149	2862
15	Manipur	4	0	4
16	Meghalaya	11	0	11
17	Mizoram	3	0	3
18	Nagaland	1	0	1
19	Odisha	219	2	221
20	Punjab	15	1	16
21	Rajasthan	313	3	316
22	Sikkim	9	1	10
23	Tamil Nadu	123	0	123
24	Telangana	164	11	175
25	Tripura	1	0	1
26	Uttar Pradesh	139	4	143
27	Uttarakhand	33	3	36
28	West Bengal	36	0	36
29	Andaman and Nicobar Island (UT)	3	0	3
30	Jammu and Kashmir (UT)	8	1	9
31	Ladakh (UT)	2	0	2
Total		6598	216	6814

Source: National Register for Specified Dams, May 2026, ICRA Analytics

Table 10: State-wise Storage of Large Dams as per NRLD-2026

Sl. No.	States/UT	Gross Storage (BCM)			Live Storage (BCM)		
		Operational dams	Under Construction dams	Total	Completed dams	Under Construction dams	Total
1	Andhra Pradesh	20.7	10.9	31.5	18.6	6.5	25.1
2	Arunachal Pradesh	1.4	0.0	1.4	0.7	0.0	0.7
3	Assam	0.4	0.0	0.4	0.3	0.0	0.3
4	Bihar	1.0	0.0	1.0	0.9	0.0	0.9
5	Chhattisgarh	7.9	0.1	8.0	7.1	0.1	7.2
6	Goa	0.3	0.0	0.3	0.3	0.0	0.3
7	Gujarat	26.3	0.6	26.9	21.2	0.6	21.8
8	Haryana	0.0	0.0	0.0	0.0	0.0	0.0
9	Himachal Pradesh	19.5	0.0	19.5	15.0	0.0	15.0
10	Jharkhand	7.0	2.3	9.3	6.0	1.8	7.7
11	Karnataka	30.8	0.0	30.8	27.7	0.0	27.7
12	Kerala	7.0	0.0	7.0	6.1	0.0	6.1
13	Madhya Pradesh	47.3	0.1	47.4	39.7	0.1	39.7
14	Maharashtra	50.7	2.7	53.4	40.2	2.5	42.8
15	Manipur	0.3	0.0	0.3	0.2	0.0	0.2
16	Meghalaya	0.4	0.0	0.4	0.3	0.0	0.3
17	Mizoram	1.9	0.0	1.9	1.2	0.0	1.2
18	Nagaland	0.5	0.0	0.5	0.4	0.0	0.4
19	Odisha	22.7	0.3	23.0	17.2	0.3	17.5
20	Punjab	3.4	0.1	3.5	2.4	0.0	2.4
21	Rajasthan	11.5	0.8	12.3	9.2	0.8	9.9
22	Sikkim	0.0	0.0	0.0	0.0	0.0	0.0
23	Tamil Nadu	6.9	0.0	6.9	6.6	0.0	6.6
24	Telangana	21.6	0.8	22.4	15.9	0.7	16.6
25	Tripura	0.2	0.0	0.2	0.2	0.0	0.2
26	Uttar Pradesh	17.8	0.3	18.1	15.5	0.2	15.8
27	Uttarakhand	7.1	0.6	7.6	5.5	0.3	5.8
28	West Bengal	1.3	0.0	1.3	1.1	0.0	1.1
29	Andaman and Nicobar Island (UT)	0.0	0.0	0.0	0.0	0.0	0.0
30	Jammu and Kashmir (UT)	0.7	0.1	0.9	0.6	0.1	0.7
31	Ladakh (UT)	0.1	0.1	0.1	0.0	0.0	0.0
Total		316.8	19.8	336.6	260.0	13.9	273.9

Source: National Register for Specified Dams, May 2026, ICRA Analytics

5.2 Government initiatives for safety and improvement in dam construction

To holistically develop the dams and combat the various dam safety issues, the GoI enacted the Dam Safety Act in December 2021.

- **Dam Rehabilitation and Improvement Project (DRIP):** The GoI also implemented the Dam Rehabilitation and Improvement Project (DRIP) in 2012 to rehabilitate and upgrade over 200 selected dams across the country.
 - Phase I (2012–2021): Implemented with World Bank support at a cost of ~₹2,567 crore, Phase I covered 223 dams across 7 states. It also introduced comprehensive guidelines for Emergency Action Plans (EAPs), laying the foundation for dam-specific disaster preparedness.
 - Phase II & III (2021–2031): Approved by the Union Cabinet, these phases cover 736 dams across 19 States and 3 Central Agencies with a total budget of ₹10,211 crore (Phase II: ₹5,107 crore; Phase III: ₹5,104 crore). DRIP-II became operational on 12th October 2021 and is being co-financed by the World Bank and Asian Infrastructure Investment Bank (AIIB), each

contributing US\$ 250 million. The funding follows a 70:30 pattern for General States, 80:20 for Special Category States, and 50:50 for Central Agencies.

Recent Progress (as of November 2025):

- Under Dam Rehabilitation and Improvement Project (DRIP) Phase II & III, a total of 736 dams across 19 States and 3 Central Agencies have been identified for rehabilitation, including 597 dams under Phase II and 139 dams under Phase III. The total approved outlay for DRIP Phase II and III is ₹10,211 crore, comprising ₹5,107 crore each for Phase II and Phase III.
- As of 15 November 2025, implementing agencies under DRIP Phase II had incurred a cumulative expenditure of ₹1,931.22 crore against the allocated amount of ₹5,107 crore, supporting structural rehabilitation, safety upgrades, and institutional strengthening activities across participating states. Major allocations have been made to states including Rajasthan (₹503 crore), Tamil Nadu WRD (₹510 crore), Karnataka (₹699 crore), Maharashtra (₹379 crore), Uttar Pradesh (₹354 crore), and Gujarat (₹350 crore).
- **Dam Safety Act, 2021:** Under the Dam Safety Act 2021, a four-tier institutional mechanism was implemented, where National Committee on Dam Safety (NCDS) and National Dam Safety Authority (NDSA) were established at Centre level and State Committee on Dam Safety and the State Dam Safety Organization were established at the state level.
 - **Central Level:**
 - National Committee on Dam Safety (NCDS)
 - National Dam Safety Authority (NDSA)
 - **State Level:**
 - State Committee on Dam Safety
 - State Dam Safety Organization

The NCDS is tasked with coming up with necessary dam safety policies and recommend regulations for proper inspection, surveillance and maintenance of specified dams. NDSA acts as the regulatory authority overseeing the implementation of the stipulated policies and regulations. At the state and union territory level, the State/UT Dam Safety Committees & Organisations are also similarly established. Currently all large dams of India fall under the ambit of the Dam Safety Act, 2021.

India's aging dam infrastructure coupled with challenges faced due to climate change can lead to dam failure related disasters. The implementation of the Dam Safety Act helps minimize this risk through regular maintenance, surveillance and upgradation of infrastructure to modern standards. It also helps in maintaining downstream ecosystems and employs sustainable procedures for reduced environmental impacts.

- **Central Water Commission (CWC):** The DRIP Phase-II and III are supervised and implemented by the Department of Water Resources, River Development and Ganga Rejuvenation through Central Water Commission (CWC). The main objective is to promote the safety of selected dams (in the participating States) and strengthen dam safety management in the country through institutional strengthening.

Quest for renewable sources

- India's renewable energy transition is driven by the need to meet rising energy demand while balancing economic growth with climate commitments. Despite being one of the world's fastest-growing economies, India's per capita carbon emissions remain significantly below the global average, reflecting its relatively low-carbon development pathway.
- India has achieved its Nationally Determined Contribution (NDC) target of sourcing 50% of installed electricity capacity from non-fossil fuel sources ahead of the 2030 timeline, fulfilling a key commitment announced under the COP26 Glasgow climate commitments. The country continues to pursue its long-term target of achieving 500 GW of non-fossil fuel capacity by 2030 and net-zero emissions by 2070.
- India's energy demand is expected to increase substantially over the coming decades, supported by industrialisation, urbanisation, rising household consumption, and electrification of transport and other sectors. This growing demand is accelerating investments in renewable generation, grid modernisation, energy storage, and domestic clean energy manufacturing.
- India has emerged as a leading global renewable energy market, ranking among the top countries globally in renewable energy capacity, with the country ranked 4th in renewable energy installed capacity, 4th in wind power capacity, and 3rd in solar power capacity (IRENA, 2025). The rapid expansion of solar capacity has positioned India as one of the fastest-growing solar markets globally.

- As of 30 June 2026, India's renewable energy capacity reached 288.59 GW, while total non-fossil fuel capacity stood at approximately 297.36 GW, including large hydro and nuclear power. Renewable energy capacity increased significantly from approximately 198.75 GW in FY2023–24, supported by large-scale solar deployment, wind additions, hybrid projects, and government-led programmes.
- Solar energy remains the largest contributor to India's renewable energy expansion, with cumulative installed solar capacity reaching 162.15 GW as of June 2026, comprising:
 - Ground-mounted solar: 121.25 GW
 - Grid-connected rooftop solar: 30.11 GW
 - Hybrid solar projects: 4.36 GW
 - Off-grid solar: 6.43 GW
- Other renewable energy capacity additions include:
 - Wind power: 57.44 GW
 - Biomass (bagasse cogeneration): 9.82 GW
 - Biomass (non-bagasse cogeneration): 1.05 GW
 - Waste-to-energy: 0.88 GW (including off-grid capacity)
 - Small hydro power: 5.18 GW
 - Large hydro power: 52.06 GW

5.3 Potential for hydropower in India

India is currently experiencing an energy transition, opting for more renewable alternatives to the traditional fossil-fuel based energy sources. Solar, wind and hydropower take the lion's share, amounting to more than 90% of the renewable energy mix as in June 2026. Hydroelectric power especially has played a key role by providing essential peaking support to the electricity grids, thereby providing stable power. The potential to develop this renewable source is quite high since out of the total assessed hydro power potential of 133.4 GW (projects of over 25MW capacity). This is due to infrastructural challenges faced like remote location, unpredictable terrain, natural disasters, environmental and ecological issues, Rehabilitation and Resettlement (R&R) issues, legal problems, cross-border conflicts etc. To help mitigate these problems, the GoI has enacted various initiatives some of which are mentioned below:

- Large Hydro Power projects (> 25 MW projects) are declared as Renewable Energy source.
- Within Renewable Purchase Obligation (RPO), provision has been created for Hydro Purchase Obligation (HPO) as a separate entity.
- Bringing down hydropower tariff through tariff rationalization measures.
- Budgetary support provided for enabling infrastructure.
- New mechanisms introduced to effectively address contractual disputes.
- Waiving off Inter State Transmission System (ISTS) charges from new hydroelectric projects and Pumped Storage projects (PSPs).
- Reduction of timeline by Central Electricity Authority (CEA) for concurrence of Detailed Project Report (DPR)

All these initiatives are aimed at boosting the efficiency of hydropower generation and developing the country's hydro power potential further.

Table 11: State/UT-wise details of Hydro Potential including Pumped Storage Potential (as on 18.08.2025)

Region/ State/ UT	CONVENTIONAL Exploitable Potential (GW)	PUMPED STORAGE Exploitable Potential*(GW)
NORTHERN		
Jammu & Kashmir	12.3	
Ladakh	0.7	
Himachal Pradesh	18.3	7.3
Punjab	1.3	
Haryana		
Rajasthan	0.4	9.2
Uttarakhand	13.5	1.0
Uttar Pradesh	0.5	13.4
Sub Total (NR)	47.0	30.9
WESTERN		
Madhya Pradesh	2.8	8.6
Chhattisgarh	1.3	8.9
Gujarat	0.6	6.1
Maharashtra	3.1	43.0
Goa		
Sub Total (WR)	7.8	66.6
SOUTHERN		
Andhra Pradesh	2.6	26.4
Telangana	1.3	8.8
Karnataka	4.4	7.6
Kerala	2.5	1.2
Tamil Nadu	1.8	16.5
Sub Total (SR)	12.6	60.5
EASTERN		
Jharkhand	0.3	1.5
Bihar	0.1	
Odisha	2.8	4.8
West Bengal	0.8	5.5
Sikkim	6.1	
Sub Total (ER)	10.1	11.8
NORTH EASTERN		
Meghalaya	2.0	
Tripura		
Manipur	0.6	
Assam	0.6	0.3
Nagaland	0.3	
Arunachal Pradesh	50.4	0.7
Mizoram	1.9	5.6
Sub Total (NER)	55.9	6.5
ALL INDIA	133.4	176.3

Source: MoSPI,- Energy Statistics & PIB, ICRA Analytics

Table 12: Key Projects in the Hydropower Sector in India (as in June 2026)

List of Pumped storage Projects (above 25 MW) -under implementation							
Sl. No.	Name of the Project (Executing Agency)	State / UT	District	I.C. (No. X MW.)	Cap. Under Execution(MW)	River/Basin	Date of finish/ commissioning
	State Sector						
	APGENCO						
1	Upper Sileru PSP (APGENCO)	Andhra Pradesh	Alluri Sitharamaraju	9x150	1350.00	Sileru/Godavari	2028-29 (Feb'29)
	KPCL						
2	Sharavathy Pumped Storage Project	Karnataka	Upper dam (Shimoga) & Lower dam (Uttara Kannada)	8x250	2000.00	Sharavathy/WFR	2032-33 (May'32)
	TANGEDCO						
3	Kundah Pumped Storage Phase-I,II&III)	Tamil Nadu	Nilgiris	4x125	500.00	Kundah/Bhavani/ Cauvery/EFR (Off Stream)	2026-27 (Feb'27)
Sub-Total: State Sector					3850.00		
	Private Sector						
4	MP30 Gandhi Sagar Pumped Storage Project (Greenko MP01 IREP Private Limited)	Madhya Pradesh	Neemuch	7x240 + 2x120	1920.00	Off stream	2026-27 (Dec'26)
5	Chitravathi PSP(M/s Adani Renewable Energy Forty-Two Limited)	Andhra Pradesh	Satya Sai	2x250	500.00	Chitravathi River (Off Stream)	2026-27 (Feb'27)
6	Bhivpuri PSP(M/s Tata Power Company Limited)	Maharashtra	Raigad	4x200 + 2x100	1000.00	Off stream	2028-29 (Feb'29)
7	Saundatti PSP (M/s Greenko KA01 IREP Private Limited)	Karnataka	Belagavi	320x4+160x2	1600.00	Off stream	2027-28 (Dec'27)
8	Bhavali PSP (M/s JSW Energy PSP Two Limited)	Maharashtra	Nashik & Thane	5x250+2x125	1500.00	Dharna, Ulhas (Off Stream)	2028-29 (Dec'28)
9	Gandikota PSP (M/s Adani Renewable Energy Fifty-One Limited)	Andhra Pradesh	Kadapa	4x250	1000.00	Penna River (Off Stream)	2028-29 (Mar'29)
10	Tarali PSP (M/s Adani Renewable Energy One Limited - AREIL)	Maharashtra	Satara	300x4 +150x2	1500.00	Tarali River (Off Stream)	2029-30 (Jun'29)
11	Saidongar-1 Karjat PSP (M/s Torrent Energy Storage Solutions)	Maharashtra	Raigad	300x10	3000.00	Pej River Off Stream)	2029-30 (Dec'29)
Sub-Total: Private Sector					12020.00		
Total:					15870.00		
Note:-Presently 11 no. of Pumped Storage projects (above 25 MW) totaling to 15870 MW are under implementation.							

Source: CEA; ICRA Analytics

5.5 Overview of canals in India

India's canal network forms an important component of the country's inland water transport (IWT) infrastructure, supporting cargo movement, passenger mobility, tourism, irrigation, and regional connectivity. The country has a network of 111 National Waterways (NWs) spanning 20,187 km across 23 States and four Union Territories, of which 32 National Waterways are currently operational. The Union Budget 2026-27 has proposed the operationalisation of 20 additional National Waterways over the next five years, further expanding the navigable inland transport network. Cargo movement on National Waterways reached an all-time high of 145.84 million metric tonnes (MMT) in FY 2024-25, highlighting the increasing role of waterways in India's multimodal logistics ecosystem.

Canal-based waterways, unlike natural river systems, are engineered transport channels designed to provide controlled navigation conditions, stable water levels, and predictable vessel movement. These waterways support the efficient movement of bulk commodities, including construction materials, agricultural products, minerals, and industrial goods, while reducing dependence on road and rail infrastructure. Under India's inland waterways development framework, operational waterways require essential infrastructure such as navigational channels, terminals, jetties, and digital navigation systems to facilitate safe and commercial vessel operations.

Among India's operational National Waterways, several important canal stretches contribute significantly to inland connectivity. National Waterway-3 (West Coast Canal) in Kerala, extending across the state's interconnected canal and backwater network, supports passenger ferry services, tourism, and local freight movement. Other canal-based waterways include NW-8 (Alappuzha–Changanassery Canal) and NW-9 (Alappuzha–Kottayam–Athirampuzha Canal) in Kerala, which provide regional connectivity through navigable inland channels. Kerala's inland water transport network benefits from its extensive approximately 1,680 km long network of waterways, including canals, backwaters, and rivers, making it one of India's most developed canal-linked transport systems.

The economic importance of canal-based waterways is increasing as India focuses on developing low-cost and sustainable freight transportation solutions. Inland waterways can transport large volumes of cargo with lower fuel consumption and emissions compared with road transport. A standard inland vessel with a capacity of around 2,000 tonnes can replace nearly 125 trucks with 16-tonne capacity, demonstrating the efficiency of water-based logistics for bulk cargo movement. As of FY 2024-25, cargo operations were functional on 29 National Waterways, with total cargo movement reaching 145.84 MMT, reflecting the growing commercial utilisation of inland routes.

Government initiatives are accelerating the development of canal infrastructure through investments in fairway improvement, terminal development, dredging, and navigation systems. The National Waterways Act, 2016 provided the legal framework for declaring 106 additional waterways as National Waterways, expanding the network beyond the original five National Waterways. Under ongoing infrastructure development programmes, waterways are being equipped with multimodal terminals, navigation aids, and digital monitoring platforms such as River Information Services (RIS), Least Available Depth Information System (LADIS), and vessel tracking systems to improve operational efficiency.

Community-level infrastructure development is also strengthening the socio-economic impact of inland waterways. As of April 2026, 66 community jetties have been developed and operationalised along National Waterway-1 (NW-1), facilitating local trade, improving last-mile connectivity, and serving approximately 1.22 lakh users daily. These facilities support the movement of local goods and passengers while enabling farmers, fishermen, artisans, and small producers along the Ganga river corridor to access nearby markets more efficiently.

Canal networks are also emerging as important tourism and passenger mobility corridors. The River Cruise Tourism Roadmap 2047 identifies 34 National Waterways, along with the Indo-Bangladesh Protocol route and two State waterways, for cruise tourism development. India's river cruise ecosystem has expanded significantly, with the number of cruise vessels increasing from 3 vessels in FY 2013-14 to 25 vessels in FY 2024-25, operating across 17 circuits on 13 National Waterways in nine states.

Going forward, canal-based waterways are expected to gain greater importance as India targets an increase in the share of inland waterways and coastal shipping in the national transport mix from the current level of around 6% to 12% by 2047. Investments in new National Waterway operationalisation, green vessel adoption, private terminal development, and integration with road and rail corridors are expected to strengthen canals as sustainable logistics and economic development corridors.

5.5.1 Inter-Linking of Rivers (ILR) Programme

- The National Perspective Plan (NPP) was prepared in FY1980 by the then Ministry of Irrigation (now Ministry of Jal Shakti), promoting inter basin transfer of water from water surplus river basins to water deficit ones, using canals and dams.

- 30 such links, 16 under Peninsular Component & 14 under Himalayan Component, were identified by the National Water Development Agency (NWDA) for the preparation of Feasibility Reports.
- As of July 2025, Pre-Feasibility Reports (PFRs) have been completed for all 30 projects, Feasibility Reports (FRs) for 26 projects, and Detailed Project Reports (DPRs) for 11 link projects. The comprehensive status of individual ILR projects under the NPP is maintained by NWDA.
- A special committee has been constituted in September 2014 for the inter-linking of rivers (ILR) program, while a Task Force for Interlinking of Rivers was formed in April 2015.
- Three links namely, Ken-Betwa Link Project (KBLP), Modified Parbati- Kalisindh-Chambal (PKC) Link project duly integrated with the Eastern Rajasthan Canal Project (ERCP) and Godavari-Cauvery link project have been identified as priority link projects under the NPP.
- The first ILR project which has been initiated is the Ken-Betwa Link Project (KBLP) among the states of Madhya Pradesh and Uttar Pradesh. The project was approved by GoI in December 2021.
- The Ken-Betwa Link Project (KBLP) is the first interlinking initiative under the NPP to enter the implementation phase. Approved by the Government of India in December 2021, the project has an estimated cost of ₹44,605 crore, with ₹39,317 crore of central support through the Special Purpose Vehicle, the Ken-Betwa Link Project Authority (KBLPA). The project focuses on water transfer, irrigation expansion, drinking water supply, and hydropower generation across Madhya Pradesh and Uttar Pradesh. Initial activities include land acquisition, resettlement and rehabilitation (R&R), and implementation of the Environmental Management Plan (EMP). The project is targeted for completion by 2030, with construction activities for key components, including the Daudhan Dam, underway. However, the project has faced opposition from local communities, particularly tribal groups, over concerns related to displacement, compensation, rehabilitation, and environmental impacts. In July 2026, protests were reported in Chhatarpur district of Madhya Pradesh, where villagers raised concerns regarding the social and ecological impacts of the project, including rehabilitation and livelihood issues.

6. Urban Infrastructure Sector

6.1 Overview

India's urban population has significantly grown from 381 million people in metropolitan regions in FY2010 (31% of total population) to 530.3 million in FY2024 (representing 37% of the total Indian population). India's population is estimated to be 1.46 billion (146.39 crore) as of April 2025, making it the world's most populous nation, according to a recent United Nations Population Fund (UNFPA) report. According to World Bank's studies, India's urban population is expected to reach 600 million (40% of the total population) by FY2036. Hence, building the essential infrastructure will be key for creating reasonable, climate-resilient, and comprehensive urban areas that drive the economy forward. Indian urban infrastructure is poised for significant growth, driven by the country's rapid urbanisation, government initiatives, technological advancements and participation of the private sector.

The major segments under urban infrastructure- water supply and sanitation, urban waste generation and treatment and metro rail has been discussed in detail.

1. Water Supply and Sanitation (WSS)

- India, possessing ~4% of the world's water resources supports a population of 1.4 billion, which is 18% of the world's total population. The per capita water availability has been declining steadily since FY1951 due to the increase in population. As per the Central Water Commission study, the average annual per capita water availability for FY2021 and FY2031 has been assessed as 1486 cubic meter and 1367 cubic meter respectively. Annual per-capita water availability of less than 1700 cubic meter is considered as water stressed condition whereas annual per-capita water availability below 1000 cubic meters is considered as a water scarcity condition.
- India largely depends on the erratic monsoons for its water requirements which has worsened further due to climate change. Increasing urban population adds further stress to urban water demand and supply. As of 2024, India's urban population stood at 36.87% of the total population, marking a slight increase from 36.36% in 2023. Rapid urbanization leads to unpredictability of water and inadequate management of water resources. It needs adaptive water management strategies including water conservation, efficient water use practices, recycling and reuse, and integrated water resource management.
- The supply of drinking water and sanitation services in urban areas are provided from different sources such as groundwater, surface water and recycled water. According to the Household-level data from the National Sample Survey Office's [NSSO] 76th round survey conducted in FY2018, the main source of drinking water for ~41% of urban households is piped water supply to their houses. This implies that ~59% of the urban households depend on sources like bottled water, community taps, handpumps, tube wells.
- Groundwater is one of the most common sources for rural and urban domestic water supply. However, increasing water stress, lack of sufficient municipal water supply, led to overexploitation and depletion of this resource. In order to improve the management of groundwater in selected states, the government has undertaken a national groundwater program called Atal Bhujal Yojana (ABHY). It has been implemented in 8,220-gram panchayats across seven Indian states. It aims at monitoring and evaluating the water demand and supply while helping the villagers understand the importance of water availability and usage.
- Industry water demand is projected to increase from 67 billion cubic meters (BCM) in FY2025 to 81 BCM FY2050 marking a 21% increase from FY2025 to FY2050. The industrial demand of water increases as commercial and manufacturing sector growth accelerates in India. A huge toll is also placed on India's water bodies especially rivers which are blocked by large scale development ventures. Major river bodies such as Ganga and Yamuna are becoming one of the most polluted rivers in the world due to heavy discharge of untreated sewage and sludge along the tributaries. Indian government is working with World Bank to rejuvenate it by building and maintaining sewage treatment plants along with a network of drains. It would help in sewage treatments before reaching the rivers. As per the survey by Central Pollution Control Board (CPCB) in FY2023, out of 603 rivers in 1920 locations all over the country, 311 were identified as polluted river stretches.
- Another challenge in the urban water supply is the supply leakages. As per estimations, around 25-50% of the water is lost during distribution through the public supply networks in Indian cities.
- Indian government launched various reforms and initiatives to ensure quality drinking water supply in the rural and semi urban areas in efforts to reduce the gap with the urban areas. Under Jal Jeevan Mission (JJM), focus was shifted from providing water at habitation level (included hand pumps and public standposts) to household level through tap water on regular basis. Village Water & Sanitation

Committee/Pani Samiti is being established in every village to ensure water conservation, maintain water quality and spread public awareness.

- Water Quality Monitoring & Surveillance enables the provision of clean tap water supply to every rural home and public institution in the rural areas. Testing and monitoring of the water supply and regular water surveillance provides confidence in consuming water directly from tap.
- The Department of Drinking Water and Sanitation (DoDWS) under the Ministry of Jal Shakti continues to focus on improving access to safe drinking water and strengthening sanitation infrastructure across rural and urban areas. As per the Union Budget FY2026-27, the allocation for Drinking Water and Sanitation has been increased to ₹74,895 crore (Budget Estimate), compared with the Revised Estimate of ₹23,031 crore in FY2025-26, representing a significant increase of approximately 225%. The allocation reflects the government's continued emphasis on expanding water supply coverage, strengthening sanitation systems, improving wastewater management, and supporting flagship programmes related to drinking water security and sanitation development.

2. Urban Waste Generation and Treatment

Union Ministry of Environment, Forests, and Climate Change oversees the Waste Management in India. Each year around 62 million tonnes (mt) of waste is generated in urban areas which comprises of around 377 million people. Out of this, only 43 mt is collected, and rest remains untreated or in landfills. By FY2030, the total waste generated by urban cities is expected to rise to 165 mt, resulting from rapid urbanization and economic growth.

Urban Waste management components:

The urban waste management components can be segregated into the following:

- Segregation of waste
- Biodegradable waste management
- Material Processing
- Plastic waste management
- Construction and Demolition (C&D) waste management
- Sanitary waste management
- Landfill management
- Technological innovation

Currently, the waste management in India faces significant challenges.

- India produces various kinds of waste of which e- waste generation has been a growing concern especially due to rapid advancement in technology and growth.
- India's recycling rate currently stands at only 18 percent, which is well below the global average of 35 percent.
- Only ~30% waste is sorted. Hence, valuable materials like aluminium and plastics instead of being recycled, end up in landfills. Also, only 5% of the total waste generated by the country is being recycled and reused.

6.2 Urban waste treatment

India needs sustainable waste management solutions to solve the environmental issues and achieve further economic growth. Through Swachh Bharat Mission (Urban) [SBM(U)] and AMRUT programs, Ministry of Housing and Urban Affairs (MoHUA) has been working on ensuring complete management of liquid and solid waste (including faecal sludge and plastic waste) in urban areas. Additionally, sewerage infrastructure is created under these programs for better treatment of waste. Although, the government has implemented various policies and regulations, there is a need for responsible practices, along with investment in infrastructure finance, technology, and awareness, to ease the challenges and achieve better management of waste. Some of them are:

- Scientific planning and use of innovative technologies
- Improving waste collection methods
- Waste-to-energy conversion practices
- Improving funding for modernization of landfills
- Introduction of stricter governmental policies and regulations
- Public awareness and education on waste management

6.3 Regulatory framework for water industry in India

Some of the institutions that work together to address the growing scarcity of water in India and manage the water supply needs are:

- Central Water Commission (CWC) oversees the water resources development and management.
- Ministry of Jal Shakti, formulated in 2019, is responsible for water resources, drinking water and sanitation.
- State Water Resources Departments are responsible for implementing water related projects and policies.
- Water Board/Utilities manage the water supply and treatment in urban areas.
- Water regulatory authorities are established in some states, for regulating the water use and allocation of resources.
- National Water Policy 2012 provides detailed guidance for water management and allocation.

Some of the key initiatives/policies taken by the regulatory authorities for water management are:

- **Jal Jeevan Mission (JJM):** Launched by the Indian government in partnership with state governments, the mission aims to provide tap water connections to all rural households by FY2024. As per the latest data (August,2026), 82% of rural households (15.84 crore) have access to tap water.
- **Atal Mission for Rejuvenation and Urban Transformation (AMRUT) 2.0:** Launched in October 2021, this mission aims to ensure universal water supply coverage in all statutory towns and to make cities "water secure."
- **Namami Gange Programme:** An initiative launched in 2014 to improve the water quality of the Ganga River.
- **National Water Policy (NWP) Revision:** The Ministry of Jal Shakti is revising the 2012 NWP, focusing on water recycling, decentralized wastewater management, and eco-restoration of urban river stretches.
- **National Water Mission (NWM):** A key component of India's National Action Plan on Climate Change, the mission focuses on water conservation, rainwater harvesting, pollution control, water infrastructure, and public awareness on efficient water use.
- **Sahi Fasal Campaign:** Launched in FY2019, this campaign encourages the cultivation of water-efficient crops in water-stressed areas, with workshops held in locations such as Amritsar, Aurangabad, Kurukshetra, and New Delhi.
- **Catch the Rain Campaign:** Under NWM, this initiative promotes the creation of rainwater harvesting structures (RWHS) tailored to local climatic conditions, encouraging the effective storage of rainwater before the onset of the monsoon season.

Regulatory framework for waste management

Waste management framework provides a structured approach covering technical, financial and evaluation aspects of waste management while setting the standards, enforcing regulations for effective urban waste management in India.

- The **Environment (Protection) Act, 1986** allows regulatory authorities to enforce pollution control measures and penalties for non-compliance. Industries must obtain consent before operating in specific areas, adhering to safety standards for effluent discharge.
- The **Central Pollution Control Board (CPCB), 1974**, under the **Water (Prevention & Control of Pollution) Act, 1974**, ensures environmental protection by managing pollution, providing data, technical input for policy formation, and raising public awareness.
- **Ministry of Housing and Urban Affairs (MoHUA)** oversees urban development and waste management.
- **State-level authorities** (State Pollution Control Boards, Urban Local Bodies, etc.) implement waste management at the state level.
- The **Water (Prevention and Control of Pollution) Act, 1974**, addresses water pollution by regulating wastewater discharge. The **Water (Prevention and Control of Pollution) Amendment Bill, 2024** imposes stricter penalties for violations and applies to select regions.
- The **Water (Prevention and Control of Pollution) Cess Act, 1977** levies taxes on wastewater discharge and offers a 25% rebate on cess for installing treatment plants.

6.4 Key Drivers for Water Supply Management

Adoption of water saving technologies, efficient agricultural practices and better infrastructure for water supply and wastewater treatment can improve the overall water supply management. Some of the key drivers for water supply management are:

1. **Increase in population and rapid urbanisation:** As India's population keeps growing, the requirement for water supply also increases, putting pressure on water resources. Furthermore, urbanization and industrialization contribute to water pollution, limiting the water supply from freshwater resources.
2. **Overuse and depletion of groundwater:** Groundwater is one of the largest sources of fresh water. Overexploitation of groundwater for industrial activities, domestic use and irrigation purposes can lower the groundwater table and reduce the surface water supplies.
3. **Agricultural needs:** Inefficient water management in agriculture reduces the availability of water and declines the quality of water. Excess irrigation pollutes the surface and groundwater as it induces nutrient and pesticides losses.
4. **Inefficient use of water:** Inefficient water use is driven by poor infrastructure, outdated pipelines, and lack of water-saving technologies. Water leakage, often caused by cracked and worn-out pipes, leads to significant wastage. Implementing advanced leak detection technologies and strengthening the water supply system can mitigate these losses.
5. **Water energy nexus:** Harnessing energy requires huge amount of water just as power is needed for water treatment and supply. Renewable energy sources are integrated in water pumps, water supply and distribution systems and wastewater treatment plants thereby reducing emissions.
6. **Government policies:** Coordination between different government agencies and states is required for proper water supply management across all states and cities.
7. **Climate change:** Change in monsoons and increased frequency of extreme weather events also impacts the water supply and availability.
8. **Technological advancements:** Modern technologies such as Digital Water Management, leveraging AI, IoT sensors, and advanced meters, are revolutionizing water supply management. Advanced wastewater treatment methods like oxidation processes, adsorption/biosorption, and biological/anaerobic treatments enhance efficiency. Additionally, water-saving technologies facilitate the repurposing of water, addressing critical challenges like aging infrastructure, inefficient waste treatment, water leakage, and inconsistent or contaminated water supply. These innovations are optimizing operations, maintenance, and monitoring of water networks, driving improvements across the sector.
9. **Public awareness and education:** The government has introduced multiple initiatives and schemes for raising public awareness and educate the citizens regarding water supply management like Jal Shakti Abhiyan, Jal Jeevan Mission, National Water Mission etc. These initiatives help engage local communities through outreach programs and build awareness while encouraging collective ownership in water conservation efforts.

6.5 Storm water drainage

Storm water drainage systems are used to protect urban areas against flooding in a phased manner. These need to be planned and then employed in a structured manner, keeping design, operation, maintenance, rainfall analysis, construction and economics in mind. In India, these projects are prioritized, coming behind only drinking water supply and sewerage projects in most cases. Urban flooding might be caused by heavy rainfall, high intensity rainfall, unplanned urbanization which becomes unable to support excess population growth, incorrect disposal of storm run-off etc. This can be mitigated if the storm water drainage system is properly developed along with accurate rainfall intensity analysis and strategic planning and implementation, protecting both property and citizens' lives.

The flood control and mitigation measures usually fall under the purview of the state government and Urban Local Bodies/Urban Development Authorities at city level, while the GoI supports the efforts through schematic interventions/ advisories, financial and technical support. The GoI has also published various documents and advisory guidelines:

- Urban and Regional Development Plans Formulation and Implementation (URDPFI) Guidelines, 2014
- Standard Operating Procedure (SOP) for Urban Flooding
- River Centric Urban Planning Guidelines in 2021
- Creation of Rainwater Harvesting Parks (by MoHUA)

Furthermore, under the AMRUT Mission, storm water drainage is a key component. As reported by the states, currently 772 Storm Water Drainage projects worth Rs. 2,140 crore have been completed, resulting in elimination of 3,556 water logging points. Additionally, 69 projects worth Rs. 878 crore are currently under the implementation stage across 19 States/ Union Territories (UTs), estimated to tackle another 372 water logging points.

AMRUT 2.0 also aims at rejuvenation of water bodies and wells, by harvesting rainwater through storm water drains into water body (which is not receiving sewage or effluents). Under the mission, 2,713 water body rejuvenation projects worth Rs. 5,432 crore have been approved till date.

6.6 Key Drivers for Wastewater Treatment

India requires a multi-faceted approach involving government initiatives, private sector participation, efficient technologies and enhanced public awareness for improving the wastewater treatment in India. Some of the key drivers for wastewater treatment are:

1. **Persistent water scarcity:** Urban water scarcity is an emerging systemic risk driven by the growing population. Hence, conservation of water, recycling and reuse of water after wastewater treatment becomes necessary.
2. **Compliance with regulatory requirements:** Both Industries and individuals are required to comply with the laws, regulations and standards set for wastewater discharges. Furthermore, rules and regulations should be monitored regularly to check whether they meet current needs. In case where upgradations are required, they should also be duly revised by the required bodies, to align with new standards.
3. **Leveraging technological advancements:** Wastewater treatment can be effectively done using advanced treatment processes and innovative technologies such as Ultrasonic reactors, Electrocoagulation and electrooxidation, Photocatalytic oxidation and so on.
4. **Climate change impacts and environmental protection:** The wastewater treatment not only helps in reducing the impacts of climate change but also helps in protecting the environment by preventing pollution of water bodies, soil and so on.
5. **Promoting circular economy:** Circular economy considers wastewater as a valuable resource instead of a nuisance. Water reuse and recycling is suitable for irrigation and industrial activities, thereby reducing the demand for freshwater sources.
6. **Better health of citizens:** Wastewater treatment reduces the risk of water borne diseases and protects human health.

6.7 Metro Rail Segment Overview

The Government of India has undertaken various initiatives to transform the country's urban infrastructure landscape, with the expansion of metro rail systems emerging as a key driver of efficient and sustainable mass mobility. India's metro network has witnessed significant growth, expanding from 248 km across 5 cities in 2014 to 1,095 km across 26 cities in 2025, positioning India as the third-largest metro network in the world. Daily metro ridership has increased from 28 lakh passengers in 2013-14 to over 1.15 crore passengers in 2026, reflecting the growing adoption of metro systems as a preferred mode of urban transportation.

The pace of metro infrastructure development has accelerated substantially, with the rate of network commissioning increasing nearly nine times from 0.68 km per month before 2014 to approximately 6 km per month. Government support for metro expansion has also strengthened, with budgetary allocation rising from ₹5,798 crore in FY2013-14 to ₹29,550 crore in FY2025-26, enabling large-scale investments in urban transport infrastructure. India's metro expansion has been accompanied by several technological and engineering milestones. Kolkata Metro inaugurated India's first underwater metro tunnel beneath the Hooghly River in 2024, while Kochi became the first Indian city to operationalise a Water Metro service, connecting 10 islands through electric hybrid boats. Metro systems are increasingly incorporating advanced technologies, including driverless operations, regenerative braking systems, solar-powered stations, advanced signalling solutions such as European Train Control System (ETCS) Level II, and automated train supervision systems such as i-ATS, improving operational efficiency and sustainability.

Policy frameworks such as the Metro Rail Policy 2017 continue to guide metro development by emphasising economic viability, sustainable urban mobility, preparation of Comprehensive Mobility Plans (CMPs), establishment of Unified Metropolitan Transport Authorities (UMTAs), and greater private sector participation through Public-Private Partnerships (PPP). The expansion of metro infrastructure across cities such as Delhi, Bengaluru, Ahmedabad, Pune, Mumbai, and other emerging urban centres reflects India's integrated approach towards reducing congestion, lowering emissions, and improving urban connectivity.

Table 13: Metro rail network details in brief details

Metro Network	Area under routes (in KM)
Total metro network (in 2014)	248
Total metro network (in 2025)	1,095
Under construction (new lines and extensions)	1,000
Metro Network operational cities	No. of cities
Operational metro network (in 2025)	26

Source: Ministry of Housing and Urban Affairs (MoHUA), PIB, ICRA Analytics

6.8 Metro Projects in India

India has come a long way in terms of urban infrastructure and transportation, and the metro rail system has played a crucial role in this development. The first ever metro network was the Kolkata Metro Rail system which started in October 1984. Currently, the Delhi Metro Rail boasts the largest and busiest urban metro rail network in India. A list of key metro rail networks across the country is provided as under:

Table 14: Key Metro Rail Projects

City & State	Operational Network	Under Construction (New Routes)	Approved New Routes	Proposed New Routes	Operator
Agra Metro, Uttar Pradesh	5.20 km	6.70 km	17.50 km	0 km	UPMRCL
Ahmedabad Metro, Gujarat	67.51 km	0 km	0 km	13.00 km	GMRC
Bangalore Metro, Karnataka	94.34 km	75.67 km	44.65 km	37.00 km	BMRCL
Bhopal Metro, Madhya Pradesh	6.22 km	21.65 km	0 km	77.13 km	MPMRCL
Chennai Metro, Tamil Nadu	54.10 km	116.10 km	0 km	15.30 km	CMRL
Delhi Metro, Delhi-NCR	353.31 km	63.07 km	47.22 km	10.17 km	DMRC
Gurgaon Rapid Metro, Haryana	12.10 km	0 km	0 km	200.00 km	RMRG (now DMRC)
Hyderabad Metro, Telangana	67.00 km	10.43 km	0 km	70.00 km	HMRL
Indore Metro, Madhya Pradesh	5.80 km	16.23 km	15.31 km	57.18 km	MPMRCL
Jaipur Metro, Rajasthan	11.98 km	0 km	0 km	27.71 km	JMRC
Kanpur Metro, Uttar Pradesh	16.00 km	12.09 km	0 km	4.08 km	UPMRCL
Kochi Metro, Kerala	27.96 km	11.20 km	0 km	0 km	KMRL
Kolkata Metro, West Bengal	73.11 km	27.52 km	28.20 km	15.70 km	Metro Railway & KMRC
Lucknow Metro, Uttar Pradesh	22.90 km	0 km	0 km	85.00 km	UPMRCL
Meerut Metro, Uttar Pradesh	0 km	20.00 km	0 km	15.00 km	NCRTC, UPMRC
Mumbai Metro, Maharashtra	79.50 km	134.34 km	0 km	115.80 km	MMOPL, MMRC & MMOCL
Nagpur Metro, Maharashtra	38.22 km	0 km	48.30 km	0 km	Maha-Metro
Navi Mumbai Metro, Maharashtra	11.10 km	0 km	0 km	95.30 km	CIDCO
Noida Metro, Uttar Pradesh	29.70 km	0 km	14.95 km	70.00 km	NMRC
Patna Metro, Bihar	3.20 km	27.71 km	0 km	0 km	PMRC
Pune Metro, Maharashtra	31.25 km	27.85 km	0 km	106.50 km	Maha-Metro & Pune IT City Metro Rail Ltd.
Surat Metro, Gujarat	0 km	41.93 km	0 km	0 km	GMRC

Source: Metro Rail websites of different states and cities, Metrorail guy, PIB, ICRA Analytics

Note: DMRC- Delhi Metro Rail Corporation; BMRCL-Bangalore Metro Rail Corporation Limited; CMRL- Chennai Metro Rail Limited; MAHA-Metro- Maharashtra Metro Rail Corporation Limited; KMRL- Kochi Metro Rail Ltd; MMOPL- Mumbai Metro One private Limited; MMRCL- Mumbai Metro Rail Corporation Limited; GMRC- Gujarat Metro Rail Corporation Limited; UPMRCL- Uttar Pradesh Metro Rail

6.9 Progress of Key Metro Projects Across the Country

During the last five years, the Government of India has approved several metro rail projects across major cities to enhance urban mobility and support sustainable transport infrastructure.

Table 15: Metro Rail Projects Approved During Five Years (FY 2021-22 to FY 2025-26):

Metro Rail Project	Length (in km)	Cost (Rs Cr)	Ridership (as per DPR)
FY 2021-22	Bangalore Metro Rail Project Phase 2A & 2B	58.19	14,788.10
FY 2022-23	Kochi Metro Phase 1A	2	710.92
FY 2022-23	Kochi Metro Phase II	11.2	1,957.05
FY 2022-23	Nagpur Metro Phase II	43.8	6,708.00
FY 2023-24	Millenium City Centre to Cyber City Gurugram (Part of NCR)	28.5	5,452.72
FY 2023-24	Extension of Corridor 1 of Pune Metro Phase 1 - PCMC - Nigdi	4.413	910.18
FY 2023-24	Delhi Metro Phase IV (2 Balance Corridor)	20.7	8,400.00
FY 2024-25	Bangalore Metro Rail Project Phase 3	44.65	15,611.00
FY 2024-25	Thane Integral Metro Rail Project (Part of MMR)	29	12,200.10
FY 2024-25	Pune Metro Rail Project Phase 1 Extension from Swargate to Katraj	5.46	2,954.53
FY 2024-25	Chennai Metro Rail Project Phase II	118.9	63,246.00
FY 2024-25	Delhi Metro Rithala Kundli	26.43	6,230.99
FY 2025-26	Pune Metro Phase 2 Extension Line 4 Kharadi to Khadakwasla	12.75	3,626.24
FY 2025-26	Extension of Noida Metro Aqua line from Depot Station to Boraki MMTH	2.6	416.34
-	Lucknow Metro Rail Project Phase 1B	11.165	5,801.05
-	Pune metro Phase 2 Line 4 Kharadi to Khadakwasla (Additional Section)	31.63	9,857.85
-	Delhi Metro Phase VA (Part of NCR)	16.07	12,014.91

Source: Ministry of Housing and Urban Affairs, ICRA Analytics

6.10 Trend in Investments in Metro Rail Network and Smart Cities Projects

The metro rail projects are primarily financed by the central government in the form of grants, equity, subordinate debt, pass through assistance etc. along with state governments and private players in some cases. India also receives foreign investments in the metro rail sector, mainly in the form of loans with flexible arrangements.

- The Asian Development Bank (ADB) approved a \$240 million loan as the second tranche of the Chennai Metro Rail Investment Project. This funding is part of a broader \$780 million multi-tranche financing facility originally approved in December 2022, following an initial \$350 million first-tranche loan.
- The European Investment Bank (EIB) approved a € 450 million loan for a 23 km metro line and 80 metro cars in Lucknow.
- The Japan International Cooperation Agency (JICA) has sanctioned loans totalling JPY 3.7 trillion (US\$ 23.5 billion) for metro projects in multiple Indian cities, including Delhi, Mumbai, Kolkata, Chennai, Bengaluru, Ahmedabad, and Patna. Recent agreements include JPY 84.2 billion (US\$ 536.45 million) for Mumbai Metro Line 3 and JPY 103 billion (US\$ 655.3 million) for Delhi Metro Phase 4.
- Germany's KfW Development Bank provided EUR 500 million for the Nagpur Metro project.
- Foreign technical assistance has played a key role in India's metro development, with companies like Mitsubishi Electric India, Nippon Signal, Hyundai Rotem, Siemens, Bombardier, and Alstom providing advanced technologies.
- Siemens plans to invest Rs. 186 crore to build a metro train manufacturing facility in Aurangabad by 2028, positioning the region as an export hub for metro turnkey projects.

6.11 Smart cities

The Smart Cities Mission (SCM), launched in June 2015, represents one of India's largest urban transformation initiatives, aimed at improving quality of life, enhancing urban infrastructure, and promoting technology-enabled governance across selected cities. With India's urban population expected to reach around 40% of the total population by 2030, contributing nearly 75% of the country's GDP, the need for efficient, sustainable, and digitally enabled urban ecosystems has become increasingly important. The Mission initially targeted the development of 100 smart cities during FY2015–FY2020, with the implementation timeline subsequently extended to 31 March 2025 to complete ongoing projects.

The Smart Cities Mission introduced several innovative approaches to urban development, including a competitive selection process for identifying 100 cities, creation of Special Purpose Vehicles (SPVs) for project implementation, stakeholder-driven project planning, adoption of digital technologies for urban governance, and third-party impact assessments by leading academic and professional institutions. The Mission focused on area-based development through retrofitting, redevelopment, and greenfield projects, along with pan-city solutions covering mobility, water supply, sanitation, energy efficiency, public safety, environmental management, and digital governance.

As of March 31, 2026, the Smart Cities Mission had sanctioned 8,064 projects worth ₹1.64 lakh crore (₹1,64,811 crore) across the 100 selected cities. Of these, 7,790 projects worth ₹1,56,257 crore have been completed, representing approximately 97% project completion and 94.8% completion in terms of project value. The remaining 274 projects worth around ₹8,554 crore are at various stages of implementation. Against the central government allocation of ₹48,000 crore, states and Union Territories have claimed ₹47,458 crore (99%) and utilised approximately ₹46,377 crore (98%), indicating strong financial execution under the Mission.

A key achievement of the Mission has been the implementation of Integrated Command and Control Centres (ICCCs) across all 100 smart cities, enabling real-time monitoring and data-driven decision-making through technologies such as Artificial Intelligence (AI), Internet of Things (IoT), and advanced analytics. These centres support applications related to traffic management, public safety, emergency response, utility monitoring, and urban service delivery. The Mission has also delivered significant infrastructure improvements, including smart roads, cycle tracks, public spaces, digital classrooms, healthcare facilities, water management solutions, and citizen-centric initiatives such as Cycles4Change and Streets4People.

Performance across cities, however, has varied based on project execution capacity, governance structures, and financial management. Several cities have emerged as strong performers, including Indore, Guwahati, Chandigarh, Varanasi, Surat, Rajkot, Vadodara, Patna, Agartala, and Kohima, which have completed most or all sanctioned projects. Indore completed all 231 projects worth ₹3,751 crore, while Guwahati completed all 21 projects worth ₹755 crore. Similarly, Chandigarh completed 97 projects worth ₹2,694 crore, and Varanasi completed 117 projects worth ₹3,342 crore, highlighting effective implementation of smart city initiatives. Gujarat cities demonstrated strong performance, with Surat completing all 87 projects, Rajkot all 71 projects, and Vadodara all 52 projects.

The smart cities mission aims to provide clean and sustainable environment incorporating modern technologies and to create a replicable model which can be implemented easily to other cities as well. Some basic urban planning and management features include:

- Adequate power supply
- Improved sanitation (including waste and water)
- Adequate water supply
- Smooth urban mobility and transportation
- Affordable housing
- Health and educational development
- Safety and security of citizens
- Robust IT connectivity and digitalization
- Sustainable environment

Smart cities also stress on green and open spaces, encompassing parks, playgrounds, and recreational spaces which enhance the quality of life, reduce negative effects of urban heat and promote eco-balance. Furthermore, the cities also try to incorporate renewable and green energy sources like EV and solar infra, green hydrogen, alternative fuels etc. to reduce emissions and increase sustainable practices.

6.12 Overview of Share of PPP Model in Metro Projects

Central government is the primary financier of metro rail projects along with state governments. But recently, the government has tried to boost private participation in this sector. The Metro Rail Policy 2017 mandates the involvement of public private partnership (PPP) in some form or the other in a metro project like operation and maintenance or fare collection. Due to this, PPP mode has become important for current metro rail projects.

PPP model has become an increasingly popular mode in the urban infrastructure segment. Key PPP metro projects are given below.

- Pune Metro Line III is a recent under-construction metro project which is being developed in PPP mode spanning 23.3 KM.

- Hyderabad Metro's three lines is one of the largest PPP projects in Metro sector globally.
- The Phase IV expansion of the Delhi Metro has also been developed under this model, which aims to connect various parts of the city with the outskirts.
- The Bangalore metro's Phase II aims at adding extensions to existing lines and the addition of new lines, which was significantly financed by the PPP model.

6.13 Key announcements and latest metro projects

The Union Minister for Housing and Urban Affairs recently announced the approval of three major Metro Rail projects by the Union Cabinet, highlighting the government's role in urban planning and infrastructural development:

- **Jaipur Metro Phase-II Project:** In April 2026, the Union Cabinet approved the 41 km Jaipur Metro Phase-II corridor from Prahladpura to Todi Mod, comprising 36 stations, at an estimated cost of ₹13,037.66 crore. The project will be implemented by the Rajasthan Metro Rail Corporation Limited (RMRCL), a 50:50 joint venture between the Government of India and the Government of Rajasthan. The corridor will improve connectivity to key locations including Jaipur Airport, Sitapura Industrial Area, Tonk Road, SMS Hospital, VKIA, Ambabari, and Vidhyadhar Nagar.
- **Delhi Metro Phase-IV and Phase-V(A) Expansion:** The Union Cabinet has approved additional corridors under Delhi Metro expansion plans to strengthen connectivity within Delhi and adjoining regions. The Rithala–Narela–Nathupur (Kundli) corridor under Phase-IV covers 26.46 km with 21 stations at an estimated cost of ₹6,230 crore, improving connectivity between Delhi and Haryana. Further, Delhi Metro Phase-V(A) received approval for three new corridors covering 16.08 km with an estimated investment of ₹12,014.91 crore, including R.K. Ashram Marg–Indraprastha, Aerocity–IGD Airport Terminal-1, and Tughlakabad–Kalindi Kunj corridors.
- **Bengaluru Metro Phase-3 Expansion:** The Bengaluru Metro Phase-3 project has been approved to expand the network by 44.65 km across two corridors with an estimated investment of ₹15,611 crore. The project is expected to improve connectivity across Bengaluru's rapidly expanding urban areas and is targeted for completion by FY2029.
- **Thane Metro Project:** The Union Cabinet approved the Thane Metro project, a 29 km corridor aimed at improving connectivity and reducing road congestion in the Mumbai Metropolitan Region. The project has an estimated cost of approximately ₹12,200 crore and is expected to strengthen urban mobility links within Thane.
- **Pune Metro Expansion:** Pune continues to witness metro network expansion with the development of additional corridors to address rising commuter demand. The 5.5 km Pune Metro extension project, approved at an estimated cost of around ₹2,955 crore, is expected to improve connectivity across key urban areas.

Initiatives such as Make in India and Atmanirbhar Bharat have strengthened domestic metro rolling stock manufacturing capabilities. India has developed multiple modern metro coach manufacturing facilities, supporting increased localisation of metro components and rolling stock production.

India's expertise in metro rail system has led to the country acting in advisory capacity in international landscape. The Delhi Metro Rail Corporation (DMRC) is currently engaged in implementing a metro rail system in Bangladesh, while also providing consultancy services in Jakarta. Other countries like Israel, Saudi Arabia (Riyadh), Kenya, and El Salvador have shown interest to partner with DMRC too, to develop metro rail systems in their cities.

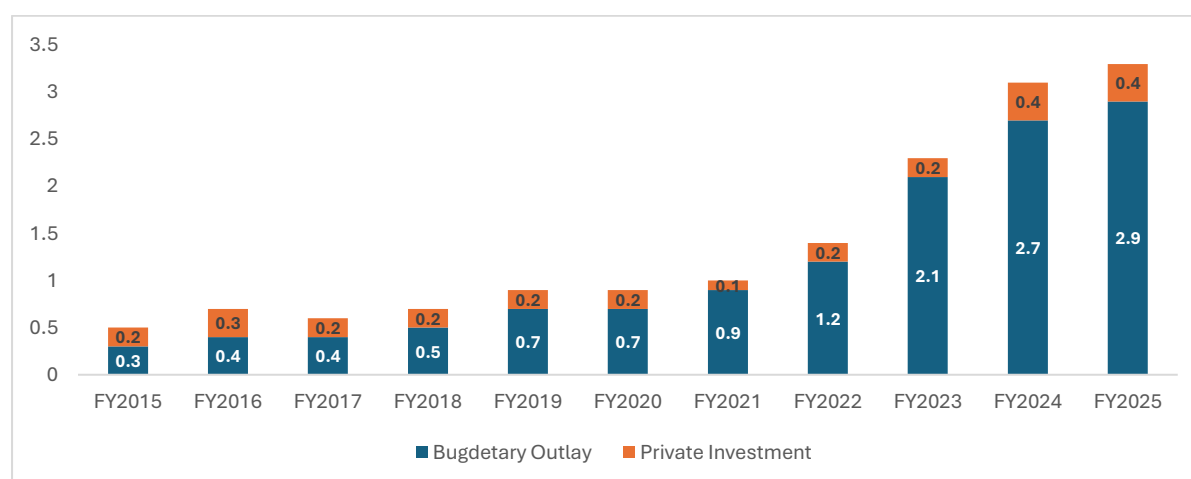
7. Road Infrastructure in India

Public Private Partnership (PPP) model initiatives: The government is taking initiatives to attract and involve the private sector participation into making significant investments in the construction of infrastructures in India. Some of the initiatives include government bearing the cost of project feasibility study, shifting of utilities, environmental clearances and so on. The sector has drawn its highest-ever investment from the private sector in FY2024. Some of the popular models under PPP initiatives are:

- a. **VGF- Viability gap funding** addresses the funding gap, making the project viable for private sector participation. In order to bridge the gap, the government provides a grant typically upto 20% of the project cost. The VGF grant is repaid by the private sector partner through annuity payments or other agreed mechanisms. This has been used successfully for various infrastructural projects including highways, roads, port and airports.

- b. HAM- Under this the government: private sector has a 40:60 ratio and thereby sharing the risk of execution. This method has reduced the element of risk, increased investment, improved quality and faster execution.
- c. Skill development- This involves collaborative efforts between the government and private sector to develop skills relevant to infrastructure development and operations. This includes training programs, capacity building, transferring of knowledge, apprenticeships, certification programs and so on. By focusing on skill development, PPP projects in India can create a sustainable and skilled workforce, supporting infrastructure growth and economic development.

Chart 13: Government and Private investment along with total capital outlay in road transport



Source: Economic Survey 2025-2026, ICRA Analytics

7.1 Key budget announcements for the roads sector

As per Union Budget FY2026, the following are the key takeaways for Road and Highway sector:

1. **Budget Allocation:** The Ministry of Road Transport and Highways (MoRTH) has been allocated ₹3,09,875.30 crore (approximately ₹3.10 lakh crore) for FY2026-27, representing a 7.8% increase from ₹2,87,333.16 crore allocated in FY2025-26. The allocation reflects continued government emphasis on highway expansion, connectivity improvement, and logistics infrastructure development.
2. **NHAI Project Pipeline:** The National Highways Authority of India (NHAI) has identified 54 highway projects covering 2,442 km with an estimated capital cost of ₹1,80,017 crore for award during FY2026-27. These projects are expected to support highway capacity expansion and improve connectivity across key economic corridors.
3. **Pradhan Mantri Gram Sadak Yojana (PMGSY-IV):** Under PMGSY Phase IV (FY2024-25 to FY2028-29), the government has approved an outlay of ₹70,125 crore to construct 62,500 km of all-weather rural roads, connecting 25,000 unconnected rural habitations based on Census 2011 population criteria. The initiative aims to strengthen last-mile connectivity and improve access to markets, healthcare, and education facilities in rural areas.
4. **National Monetisation Pipeline 2.0 (NMP 2.0):** The government launched National Monetisation Pipeline 2.0, which estimates an aggregate monetisation potential of ₹16.72 lakh crore during FY2026-FY2030. The programme includes asset recycling across central ministries and public sector entities, with an estimated private sector investment potential of ₹5.8 lakh crore, enabling reinvestment of proceeds into new infrastructure development.

7.2 Growth drivers and emerging trends for the road sector

India's road and highway infrastructure is experiencing a substantial growth and is projected to showcase robust growth till FY2030. The major growth drivers are as discussed below:

1. **Rapid Urbanisation:** The increase in urban population leads to an increase in vehicle ownership supported by rising income and better standard of living. This increase led to a surge in demand for efficient

transportation infrastructure including extensive road networks, thereby contributing to the development of road sector.

2. **Economic growth:** As the economy grows, the demand for transportation and goods also increases, which requires a sound road infrastructural development. The logistics and transportation sector are dependent closely on the road and highway sector. Better road infrastructure would boost trade and commerce by reducing transportation costs and time.
3. **Government initiatives:** As the government prioritizes and undertakes the implementation of various projects like Bharatmala Pariyojana, PMGSY, better focus on the growth of road construction and connectivity takes place ensuring overall growth.
4. **Public Private Partnership (PPP) model:** It enables the private sector to participate in the road infrastructural development investments and thereby contribute to overall growth of the sector.
5. **Technological advancements:** As India embraces digital advancements such as intelligent traffic management and automated toll collection, better efficiency and safety of road operations will contribute to the growth of overall road infrastructure.
6. **Foreign investments:** Increase in influx of foreign capital as the international investors recognize the growth potential of road and highway sector.
7. **Multimodal transportation:** Integrating Road infrastructure with other modes of transport such as railway, airport and ports would enhance the movement of goods and people, reducing costs and making it more efficient.
8. **Smart Cities Mission:** It is an initiative by the government to develop 100 smart cities across the country. The mission has led to the development of
 - Intelligent Transportation Systems
 - Smart traffic management
 - Energy efficient streetlights
 - Dedicated bus lanes
 - Pedestrian friendly infrastructure
 - Green corridors including tree-lined roads, green roofs and walls, urban forests.
9. **Sustainable Development:** It focuses on creating environmentally friendly, socially responsible and economically viable transportation infrastructure. It includes Green Highways, recycling of asphalt in road construction and use of other eco-friendly materials, conservation of water, climate resilient road designs to withstand the climate change and so on.
10. **Rural Connectivity:** It aims at connecting the rural areas with the urban regions, thereby improving the accessibility to larger urban markets, education, healthcare and employment opportunities. Prioritising this would help India bridge rural-urban divide, fostering an inclusive growth and development.

7.3 Challenges for the road and highway sector

Despite the significant growth, the road sector faces certain challenges that block its growth and development. They are as discussed below:

1. **Funding constraints:** The scale of investment required is much more than the funding from government budgetary allocation and private sectors, thereby leading to delays and slowdowns in project implementation.
2. **Land Acquisition issues:** Acquisition of land for road projects could involve lengthy legal proceedings, disputes and resistance from the landowners thereby slowing down the project implementation.
3. **Bureaucratic delays:** Multiple approvals, compliance requirements and slow decision making can delay the project implementation. Private investors hesitate to invest in such cases as it increases the project timeline and administrative costs.

4. **Quality control and safety concerns:** India's roads are considered among the unsafe roads globally with a high accident rate. Hence ensuring quality construction and maintenance of the roads can also contribute to one of the challenges in the road and highway sector. Most of the times, the roads are inadequately maintained leading to deterioration and reduction of its lifespan.
5. **Environmental concerns:** Construction of roads involve deforestation and pollution, thereby creating environmental impacts. Roads are also vulnerable to climate change- extreme weather conditions which call for resilient design and construction practices.
6. **Lack of standardisation:** Roads created across the states vary from one to another due to lack of consistency including inconsistent road designs.
7. **Technological gaps:** The road and highway sector face significant challenges in bridging technological gaps which includes
 - outdated construction techniques
 - inadequate adoption of advanced technologies
 - lack of skilled workforce
 - incompatibility between different systems and technologies
 - vulnerability to cyber threats and inadequate research and development
8. **Maintenance and upgradation:** Some of the road and highways are old and deteriorating, requiring regular maintenance and upgradation. However, insufficient allocation of funds for maintenance, lack of regular inspections and poor-quality construction using substandard materials remain key areas of concern for the road and highway sector. This leads to safety risks, traffic congestions and economic losses.

Addressing these challenges is crucial as it will help tap into the immense potential of the road and highway sector.

7.4 Outlook on investments in national and state highways (FY2016-FY2026)

In the last ten years, India's road network has witnessed a growth of ~60%. Some of the investments made by NHAI to build smart highways are discussed as below:

- **National Highways Infra Trust (NHIT):** In February 2026, NHAI further accepted NHIT's offer of ₹6,220.90 crore for the acquisition of two additional National Highway assets spanning 310.35 km across Maharashtra and Andhra Pradesh. With this transaction, the total value of assets monetised through NHIT increased to approximately ₹49,858 crore. NHIT has raised capital from leading institutional investors, including CPPIB, Ontario Teachers' Pension Plan (OTPP), EPFO, NHAI, and SBI Group, and has more than 700 investors. Asset monetisation through models such as InvITs and Toll-Operate-Transfer (TOT) continues to support NHAI's strategy of unlocking value from completed highway assets and recycling capital into new infrastructure projects. During FY2025-26, NHAI monetised highway assets worth approximately ₹28,077 crore, strengthening private sector participation in the road infrastructure sector.
- **E-Vehicle Infrastructure & Road Safety:** India has allocated ₹2,000 crore under the PM E-DRIVE scheme to deploy public EV charging infrastructure, supporting over 52,700 public charging stations nationwide. Funding prioritizes major highway corridors, urban congestion points, and traffic safety integration to prevent vehicle queuing hazards.
- **Major Expressways & Digital Initiatives:** The ₹1 lakh crore, 29.6 km, eight-lane **Dwarka Expressway** was inaugurated in March 2024. NHAI launched the '**Rajmargyatra**' app in FY2023 for highway information and complaint filing. '**One Vehicle, One FASTag**' was introduced to streamline toll collection.
- **Wayside Amenities & OFC Infrastructure:** As of April 2025, NHAI has awarded 501 Wayside Amenities (WSAs) along National Highways and Expressways, with 94 WSAs already operational. These amenities provide facilities such as fuel stations, electric vehicle charging stations, toilets, drinking water, parking, dhabas/restaurants, and digital feedback systems for quality monitoring. Operators are selected through private bidding, with dedicated spaces for kiosks to promote local artisans and provision for Village Haats under the Khadi and Village Industries Commission. NHAI, through National Highways Logistics Management Limited (NHLML), plans to develop WSAs at approximately 40–60 km intervals, with more than 700 WSAs expected to be completed by FY2028–29.
- **Multimodal Logistics Parks (MMLPs):** A ₹46,000 crore investment is planned for 35 MMLPs, expected to handle 700 MMT of cargo.

- **State Highway Development Programs:**

- **Maharashtra:** The **MSRIP Phase 1**, funded by the Asian Development Bank, aims to improve state highways, enhance remote area connectivity, and reduce interstate disparities.
- **Madhya Pradesh:** A **World Bank-funded project** focuses on improving rural connectivity, road safety, and climate resilience while supporting industrial corridors.

These initiatives reflect a comprehensive approach to strengthening India's highway infrastructure and logistics ecosystem.

The government has actively integrated new technologies and initiatives while setting ambitious infrastructure targets. Increased budget allocations and private sector collaboration have driven investments. As per the Official PPP in India Database, there are 2,872 road and bridge infrastructure projects tracked under public-private partnership (PPP) frameworks across the country. The 100% FDI policy has further attracted global partnerships, boosting sector growth.

8. Tunnelling

8.1 Overview

In the past few years, growth of infrastructure coupled with rapid urbanization has increased the tunnel requirements. The demand for tunnel construction has been crucial for the development of better urban mass transit systems, road and rail infrastructure, hydropower projects and water and sewerage systems. Methods such as New Austrian Tunnelling Method (NATM), tunnel boring method (TBM) are being adopted by the sectors for efficient tunnel construction.

8.2 Sector-wise tunnel projects: completed, under construction and upcoming

Tunnel construction projects across various sectors are given below:

Railways:

According to India Infrastructure Research (June 2023), more than 650 railway tunnels have been constructed in India, covering a cumulative length of over 250 km. As of May 2024, more than 370 railway tunnels (~330 km length) were under implementation, bidding, or planning stages. The development of railway tunnels has gained importance due to increasing investments in mountainous and difficult terrains, particularly in Jammu & Kashmir, Uttarakhand, the Northeast, and high-speed rail corridors.

During June 2024–May 2025, around 19 km of railway tunnels were completed across 39 tunnels, improving connectivity in remote and strategically important regions. Key achievements included the completion of the 6 km Bhairabi–Mualkhang section of the Bhairabi–Sairang New Railway Line in Mizoram (May 2025) and the 4 km Sukhovi–Molvom section of the Dhansiri–Sukhobi–Zubza New Line in Nagaland/Assam (March 2025). Additionally, the Budni–Indore New Railway Line Project in Madhya Pradesh was awarded in March 2025, involving two tunnels with a combined length of around 10 km.

Few under construction key projects are:

- **Mumbai–Ahmedabad High Speed Rail Corridor:** The project includes 21 km of tunnel works, including 7 km of undersea tunnel near Thane Creek, out of which 4.8 km of tunnel between Ghansoli and Shilphata in Maharashtra has been completed.
- **Jiribam–Tupul–Imphal Railway Line Project:** The project includes 50 tunnels with a cumulative length of more than 70 km, enabling rail connectivity between Manipur and the rest of India through challenging hilly terrain.
- **Rishikesh–Karnaprayag New Railway Line Project:** The 125 km project includes 17 tunnels covering around 105 km. In September 2025, a 14.57 km tunnel between Devprayag and Janasu in Uttarakhand was completed, becoming India's longest railway tunnel. The project is targeted for operationalisation by December 2026.

Key achievements:

- The Rapuru Railway Tunnel in Andhra Pradesh, with a length of 6.65 km, is among India's longest electrified railway tunnels.
- The Udhampur–Srinagar–Baramulla Rail Link (USBRL) Project includes 38 tunnels spanning around 272 km, significantly improving all-weather connectivity to Jammu & Kashmir.

- The Rishikesh–Karnaprayag Rail Link Project is one of India’s largest tunnelling projects, with tunnels accounting for the majority of the project alignment.

Upcoming projects:

- Mumbai–Ahmedabad High Speed Rail Corridor: National High Speed Rail Corporation Limited (NHSRCL) is developing India’s first 7 km undersea rail tunnel as part of the 21 km tunnel network planned for the corridor.
- Dimapur–Kohima New Railway Line Project: The project includes 21 tunnels covering around 31 km, improving railway connectivity and supporting economic development in Nagaland.
- Sivok–Rangpo New Rail Link Project: The 45 km railway project connecting West Bengal and Sikkim includes 14 tunnels, 13 major bridges, 9 minor bridges, and 5 stations. The longest tunnel (T-10) has a length of 5.3 km.
- Gohpur–Numaligarh Corridor (Assam): Approved at an estimated cost of ₹18,662 crore, the project includes India’s first road-cum-rail tunnel beneath the Brahmaputra River, with a tunnel length of around 15.79 km, improving connectivity between northern and southern banks of Assam.

Roads:

Table 16: List of road tunnel projects across the country

Year	Tunnel Name	Location	Length	Status
2023	Mumbai Coastal Road Tunnel	Mumbai	2.07 Kms	Completed
2023	Z-Morh tunnel	Jammu and Kashmir	6.5 Kms	Completed
2023	Nechiphu Tunnel	Arunachal Pradesh	500 m	Completed
2023	Marog Tunnel	Jammu and Kashmir	645 m	Completed
2023	Zojila Tunnel	Jammu and Kashmir	14.15 Kms	Ongoing
2024	Sela Tunnel	Arunachal Pradesh	980 m	Completed
2024	Shinkula Tunnel	Ladakh	4.1 Kms	Ongoing
2024	Goregaon – Mulund Link Road Tunnel	Maharashtra	6.3 Kms	Ongoing
2024	Thane Borivali Twin Tunnel	Maharashtra	11.8 Kms	Ongoing
2025	The Pragati Maidan Tunnel – Final Underpass	Delhi	110 m	Ongoing
2025	Orange Gate Marine Drive twin tunnels	Maharashtra	9.239 Kms	Ongoing

Source: IMARC Group, ICRA Analytics

Between June 2024 and May 2025, India completed over 25 km of 16 road tunnels across nine projects, easing urban congestion and improving connectivity. Key milestones include the April 2025 breakthrough of the 4.5 km Dharasu–Yamunotri Silkyara tunnel in Uttarakhand (NATM, Rs 8.5 billion) and the March 2025 completion of the 4.89 km Mukundra Tiger Reserve twin tunnels on the Delhi–Vadodara expressway. Large contracts continue, such as PNC Infratech’s October 2024 award for the 13.8 km Indori–Chimbali tunnel (east stretch) in Maharashtra.

Upcoming projects:

- Assam’s Tunnel project under Brahmaputra River by National Highways and Infrastructure Development Corporation (NHIDC) is under bidding stage. The total length of the project would be a length of ~34.6 km connecting Gohpur village on NH-52 and Numaligarh village on NH-715.
- Construction of twin tube unidirectional tunnel with a total length of 10.8 km connecting Sheshanag to Panchtarni under Ganesh top hill is under bidding stage.
- Singhpora–Vailoo Tunnel, Jammu & Kashmir: Approved in 2026 as part of the NH-244 connectivity project, the tunnel section will have a length of around 10 km (twin-tube configuration) and will improve all-weather connectivity between the Kashmir Valley and Chenab region.
- Sudhmahadev–Dranga Tunnel, Jammu & Kashmir: Approved along with approach roads under the NH-244 corridor, the project includes an 8 km twin-tube tunnel aimed at reducing travel time and strengthening connectivity in Doda, Kishtwar, and Udhampur districts.

Metro:

Between June 2024 and May 2025, over 18 km of metro tunnels across six projects were completed in India, boosting urban rail connectivity. Key milestones include the 7.2 km twin tunnels of Kolkata East-West Metro and 4.6 km of Bengaluru Metro Phase II. The 8.6 km IN-05R tunnelling package for Indore Metro, awarded to HCC–Tata JV, highlights ongoing momentum. TBM remains the primary tunnelling method, complemented by NATM and cut-and-cover techniques, as seen in Chennai Metro Phase II with breakthroughs at Adyar Junction (Feb 2025) and Perambur station (May 2025).

Upcoming projects:

- Paroul (New Chandigarh) to Sector 28 (Panchkula)- covering 26 stations of a length of 32.2km, Sukhna Lake (Chandigarh) to Zirakpur ISBT (via Mohali ISBT and Chandigarh Airport) covering 29 station of a length of 36.4 km.
- Guwahati Metro Phase 1 Routes proposed- MG Road to Khanapara covering a length of 10 km.
- Thane Metro Route with an underground tunnel of 2-3 kms. It is popularly known as Thane Integral Ring Metro and was approved by India's Central Government in August 2024. It is expected to be completed by FY2029.

Hydro:

Between June 2024 and May 2025, around 32 km of hydro tunnels across seven projects were completed, supporting water conveyance and pressure management in hydropower initiatives. A major milestone was NHPC's Himachal Pradesh project (April 2025), featuring a 32 km headrace tunnel using both drill-and-blast and TBM methods. During the same period, 25 new tunnel contracts totaling over 15 km were awarded to contractors including PES Engineers, Patel Engineering, and RVNL. Notably, the 240 MW Heo Hydro Electric Project (May 2025) comprises five tunnels spanning 3.65 km, highlighting tunnels' critical role in expanding renewable energy capacity.

Upcoming projects:

- Stage I of the Luhri Hydro Electric Project consisting of 2 tunnels of a length of ~38.6 km, developed on the Satluj river, in the Shimla and Kullu districts of Himachal Pradesh.
- Stage II of the Parbati Hydro Electric Project consisting of 6 tunnels of length of ~35km, planned on Parbati river in Himachal Pradesh, India.

Irrigation, water supply and sewerage:

Between June 2024 and May 2025, around 41 km of tunnelling works were awarded in water supply and irrigation projects across six contracts. Key players included Apco Infratech, Afcons, Prasad & Company, Sarala Project Works, and Welspun Enterprises. Notable projects include the 8.5 km Dharavi WWTF–Ghatkopar tunnel in Maharashtra (awarded to Welspun in October 2024) and the 23.45 km Khadakwasla–Phursungi Underground Tunnel Irrigation Project in Maharashtra (awarded to Megha Engineering in October 2024), involving shafts, intake structures, cofferdams, and approach works, highlighting continued expansion of tunnel-based water infrastructure.

Upcoming projects: Kaleshwaram irrigation project of a length of 56 km is one of the key ongoing projects in irrigation sector.

1. Irrigation tunnelling:

Tunnelling assumes a vital part in India's irrigation infrastructure, particularly in areas with challenging terrains like mountains or regions with restricted surface water accessibility. Tunnels are built to divert water from rivers, reservoirs, or other sources to agricultural fields, making it possible to water crops even in remote or dry areas. Advanced concrete lining and reinforcement methods are utilized in irrigation tunnels to ensure their structural integrity and long-life span. This helps prevent leaks and collapse, ensuring a consistent flow of water.

Key Projects:

- Narmada Valley Project: This project incorporates several tunnels that channel water from the Narmada River to dry spell inclined regions in Gujarat, Madhya Pradesh, and Maharashtra. The tunnels make sure that water gets to areas that are hard to irrigate using traditional methods.

- **Tehri Dam and Irrigation Tunnel:** Located in Uttarakhand, the Tehri Dam is one of India's largest hydroelectric projects. It also includes tunnels that divert water for irrigation purposes, helping to irrigate large areas of land in the surrounding states.

2. Water supply Tunnelling:

Water supply tunnelling is essential for transporting water to metropolitan and rural regions, especially in areas where surface pipelines are not feasible because of geological hindrances or where there is a need to safeguard land surface for different purposes. Tunnelling permits safe and secure transportation of water over long distances, often from reservoirs or treatment plants to distribution networks.

Key Projects:

- **Mumbai Water Supply Project:** Mumbai, one of India's largest cities, relies heavily on tunnelling for its water supply. Several tunnels, including the Vaitarna and Bhatsa tunnels, bring water from distant reservoirs to the city, ensuring a consistent water supply for millions of residents.
- **Bangalore Water Supply:** Bangalore's Cauvery Water Supply Scheme includes tunnels that transport water from the Cauvery River to the city. These tunnels help address the city's growing water demand due to rapid urbanization.

3. Sewerage Tunnelling:

With the rapid development of India's urban areas, sewage management remains critical. Tunnelling provides a solution by assisting the development of large-diameter sewer lines that can transport wastewater to treatment plants. This is especially important in urban areas where there is limited surface area and a high risk of contamination.

Key Projects:

- **Delhi Sewer Tunnelling:** The Delhi Jal Board has implemented several sewage tunnelling projects to upgrade the city's aging sewer network. These tunnels help divert sewage away from residential areas and transport it to modern treatment plants.
- **Mumbai Sewerage Disposal Project:** Mumbai's vast sewerage system includes deep tunnels that collect and transport wastewater to treatment facilities. This project is part of the city's efforts to modernize its sewage infrastructure and reduce the pollution of local water bodies.

8.3 Technological Trends

The tunneling sector in India has a robust pipeline of projects across hydro, irrigation, road, and railway sectors. Various techniques are used based on project requirements, including conventional methods like Drill-and-Blast Method (DBM), Tunnel Boring Machines (TBM), New Austrian Tunneling Method (NATM), and micro-tunneling, alongside modern techniques such as sequential excavation and ground freezing.

Tunneling Techniques & Applications

- **DBM:** Preferred for its adaptability, particularly in the Himalayan region, where TBM setup is challenging. It is widely used in the hydro sector (470 km of tunnels) and irrigation (22 km). Innovations like blast fragmentation modelling, remote monitoring, and vibration assessments enhance accuracy and cost-efficiency. However, worker safety risks and complex geological conditions lead to delays and cost overruns.
- **TBM:** Suitable for urban settings due to minimal ground disturbance and lower lining costs. Used primarily in metro and water supply projects, notable examples include Mumbai's Coastal Road (12.2m TBM) and the Mumbai-Ahmedabad bullet train (India's first underwater rail tunnel, 13.1m TBM). Challenges include geotechnical uncertainties, skilled labour shortages, and logistical hurdles in mobilization.
- **NATM:** Effective in uncertain geological conditions, using deformation monitoring to optimize support systems. Applied in hydro projects, metro rail, and approach roads.

- **Micro-tunneling:** A trenchless method used for pipelines beneath roads and waterways, first deployed in Mumbai's sewage project and later in Delhi and Kolkata. It faces challenges due to soil-dependent performance and structural limitations.

Modern Innovations in Tunneling

Advanced materials such as fiber bolts, self-drilling rock bolts, and steel/fiber-reinforced anchors enhance tunnel strength. Technologies like ground freezing, integrated control systems, wireless communication, and advanced geological investigations improve efficiency.

Outlook

DBM is expected to remain dominant due to its flexibility and resilience in challenging conditions, despite the rise of advanced tunneling technologies.

8.4 Challenges faced by the industry

The tunnelling industry in India faces several significant challenges that impact the efficiency, safety, and success of tunnelling projects. Here are few key challenges:

1. Geological and environmental challenges

India's varied geology acts as significant challenge during tunnelling. The unpredictable nature of the geological strata can lead to difficulties in excavation, increased wear and tear on equipment, and unexpected delays. Also, water resources and natural habitats can be negatively impacted by tunnelling projects, especially in environmentally sensitive areas.

2. Technological and equipment limitations

Modern technologies like TBM are still inaccessible with limited application in specific areas because of significant expenses and a lack of technical expertise. Equipment can frequently fail due to the harsh conditions of tunnelling. Ensuring the timely maintenance and accessibility of spare parts, particularly in remote or difficult-to-access regions, represents a challenge that can cause project delays.

3. Financial constraints and project management

Tunnelling projects are capital-intensive and frequently subject to cost overruns because of unexpected land conditions, delays in project approvals, and escalating material expenses. Delays in land procurement, acquiring environment clearances, and other regulatory approvals can slow down tunnelling projects.

4. Safety and skilled labour shortages

Risks inherent in tunnelling include flooding, collapses, and exposure to hazardous gases. In any case, maintaining high safety standards is challenging, especially in projects where cost-cutting measures may compromise worker safety. Also, due to a lack of such skilled labour in India, project execution may be suboptimal, and accidents may occur more frequently. The industry faces significant challenges in terms of training and retaining skilled workers.

Addressing these challenges is crucial for the successful execution of tunnelling projects in India. It requires a combination of advanced technology, efficient project management, skilled labour, and a strong commitment to safety and environmental sustainability.

8.5 Outlook

Despite various challenges, the tunnel industry has the potential to transform itself into a promising sector. It is expected to experience significant growth in the coming years, driven by increased investment in infrastructure development across various sectors.

Few key growth drivers are given below:

- Gati Shakti Master Plan, Jawaharlal Nehru National Urban Renewal Mission, Pradhan Mantri Krishi Sinchayee Yojana, Interlinking of Rivers program and other schemes of the government play an important role in providing an incentive to the tunnelling sector.
- Public Partnership model promotes private investments in infrastructure thereby drawing the interest of many foreign and private players in tunnel construction projects.

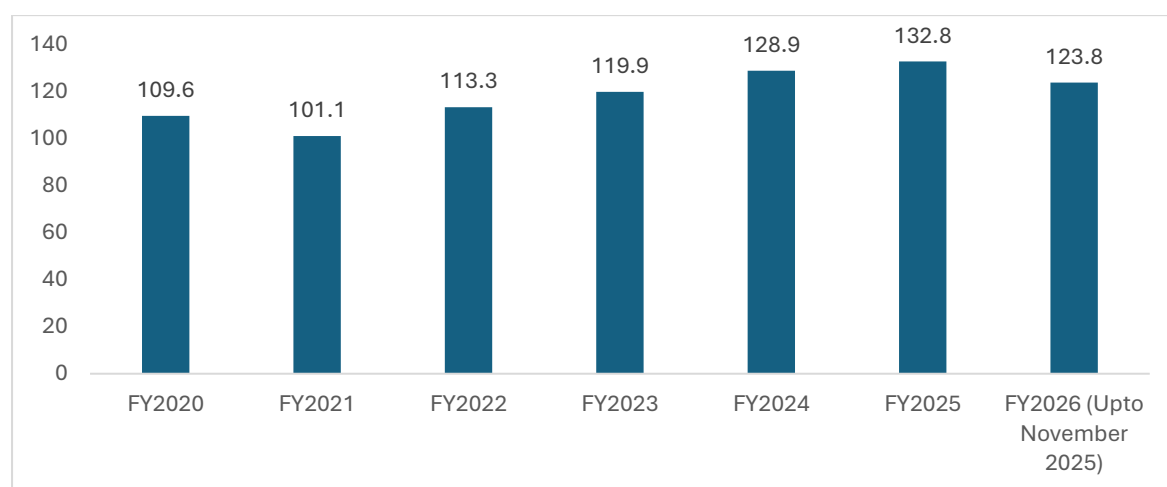
- Rapid urbanisation with the requirement of better road and rail connectivity are increasing the scope of tunnel projects while several tunnel construction opportunities are upcoming in hydropower segment, roads and railway projects.

9. Mining sector in India

9.1 Overview

India holds an advantageous position in the minerals and mining sector, supported by abundant mineral resources and a strategic location that enhances export opportunities. According to the Ministry of Mines, the total value of mineral production (excluding atomic, fuel, and minor minerals) is estimated at ₹1,71,460 crore in FY2025–26, representing a 12.5% increase over the previous year. Metallic minerals accounted for ₹1,57,415 crore (91.8%) of the total value, while non-metallic minerals contributed ₹14,045 crore (8.2%). The Index of Mineral Production (base year 2011–12) was estimated at 123.8 up to November FY2025–26, compared with 132.8 in FY2024–25.

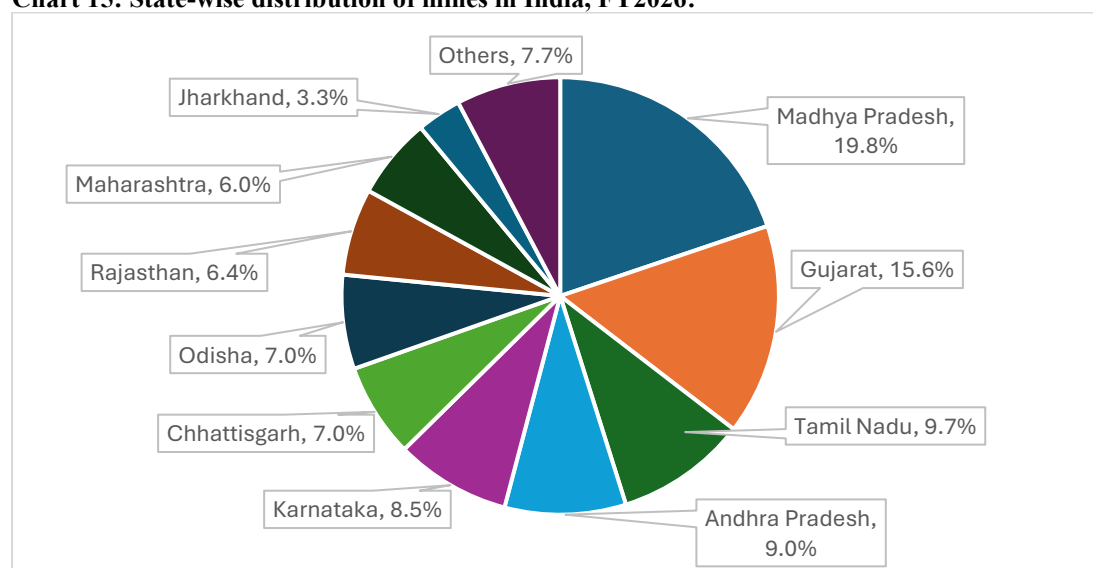
Chart 14: Index of Mineral Production



Source: Ministry of Mines; ICRA Analytics
Base 2011-12=100

As per the Ministry of Mines Annual Report 2025–26, India had 1,852 reporting mines. Madhya Pradesh had the highest number of reporting mines (367), followed by Gujarat (289), Tamil Nadu (180), Andhra Pradesh (166), Karnataka (158), Chhattisgarh (129), Odisha (129), Rajasthan (119), Maharashtra (111) and Jharkhand (61). These states constitute the country's major mining hubs, reflecting their rich mineral resource base and significant contribution to India's mineral production.

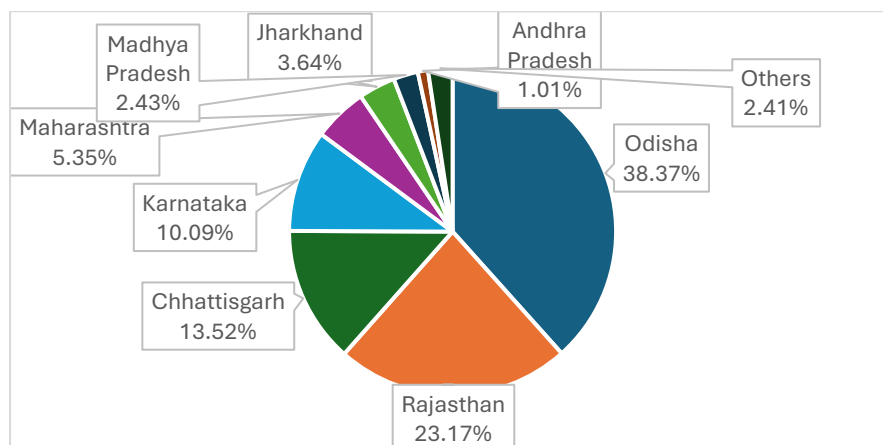
Chart 15: State-wise distribution of mines in India, FY2026:



Source: Ministry of Mines; ICRA Analytics

During FY2025–26, mineral production (excluding atomic, fuel, and minor minerals) was reported from 20 states. Around 97.6% of the total value of mineral production was concentrated in eight mineral-rich states. Odisha remained the largest producer, contributing 38.4% of the total mineral production value, followed by Rajasthan (23.2%), Chhattisgarh (13.5%), Karnataka (10.1%), Maharashtra (5.4%), Jharkhand (3.6%), Madhya Pradesh (2.4%), and Andhra Pradesh (1.0%). The remaining states together accounted for only 2.4% of the total mineral production value, highlighting the concentration of India's mining activity in a few resource-rich states. The figure below provides detailed analysis of the same.

Chart 16: Share of States in Value of Estimated Mineral Production FY2026 (Excluding Atomic, Fuel Minerals, minor minerals)



Source: Ministry of Mines; Statutory returns submitted to IBM; ICRA Analytics

9.2 Global contribution and rank of India

According to the British Geological Survey's World Mineral Production 2019–2023, India remains one of the world's leading mineral producers. It ranked 2nd globally in primary aluminium and crude steel production, 3rd in chromite, iron ore, and zinc, 5th in manganese ore, 6th in bauxite, 10th in refined copper and refined lead, 15th in magnesite, and 18th in apatite & rock phosphate, highlighting the country's strong position in the global mining and metals industry. Further details are provided in the table below:

Table 17: Contribution and Rank of India in World Production of Principal Minerals & Metals (2023):

Sector	Unit	Production quantity globally	Production quantity of India*	Contribution (%)	Global Rank
Metallic Minerals					
Bauxite	'000 tonnes	416300	23962	5.75	6th
Chromite	'000 tonnes	37500	3148	8.39	3rd
Iron Ore	Million tonnes	2507	277	11.05	3rd
Manganese Ore	'000 tonnes	53000	3442	6.49	5th
Industrial Minerals					
Magnesite	'000 tonnes	24200	132	0.55	15th
Apatite & Rock Phosphate	'000 tonnes	237000	1558	0.66	18th
Metals					
Aluminium (Primary)	'000 tonnes	69900	4159	5.95	2nd
Copper (Refined)	'000 tonnes	27600	509	1.84	10th
Steel (Crude/Liquid)	Million tonnes	1877	141	7.51	2nd
Lead (Refined)	'000 tonnes	15000	216	1.44	10th
Zinc (Slab)	'000 tonnes	14200	817	5.75	3rd

Source: Ministry of Mines; ICRA Analytics

Notes: World Mineral Production 2019–2023, British Geological Survey (BGS); Ministry of Mines, Annual Report 2025–26 (*India production based on FY2023–24 provisional data).

9.3 Self-reliance in minerals and mineral based products

Minerals are essentially the primary mineral raw materials that are supplied to industries like iron and steel, cement, and so on. India has largely been self-sufficient in major minerals such as bauxite, chromite, iron ore, kyanite, limestone, sillimanite, etc. Despite significant production, a few metals/minerals are also imported to fulfil the demand either for mixing with locally accessible mineral raw materials or to meet special requirement for manufacturing of exceptional qualities of mineral based items. Magnesite, manganese ore, rock phosphate, and other items are imported to meet domestic demand as they are deficient in India. India imports raw uncut stones for their value-added re-exports in order to meet the domestic Cutting and Polishing Industry's rising demand for uncut diamonds, emeralds, and other precious and semi-precious stones.

Table 18: Degree of Self-sufficiency in Principal Minerals & Metals for FY2025(P):

Sl. No.	Commodity	Apparent Consumption# ('000 tonnes)	Domestic Supply ('000 tonnes)	Order of self-sufficiency (%)
Minerals*				
1	Bauxite	27405	24742	90
2	Chromite	3228	2971	92
3	Iron Ore	270163	293773	100
4	Kyanite	3	2	59
5	Limestone*	485511	456686	94
6	Magnesite	659	115	17
7	Manganese Ore	10365	3805	37
8	Rock Phosphate	13756	1806	13
Metals				
9	Aluminium	4769	3990	84
10	Copper (Cathode)**	1542	536	35
11	Lead (Primary)***	409	225	55
12	Zinc****	876	827	94

Source: Ministry of Mines; ICRA Analytics

Note: P: Provisional

#Apparent Consumption = Production + Imports – Exports.

*Limestone excludes production as a minor mineral, calcite and chalk; includes limeshell, limekankar and marl.

**Copper figures are based on copper cathode production and imports/exports of copper & alloys.

***Lead figures are based on primary lead production and imports/exports of lead & alloys.

****Zinc figures are based on zinc ingot production and imports/exports of zinc & alloys.

9.4 Production Trends

Metallic Minerals

The estimated value of metallic minerals increased to ₹1,57,415 crore in FY2025-26, registering a 13.66% YoY growth. Iron ore remained the largest contributor with ₹1,09,623 crore (69.64%), followed by zinc concentrate (₹23,225 crore; 14.75%), silver (₹7,359 crore; 4.68%), and chromite (₹4,511 crore; 2.87%).

- **Bauxite:** Production reached 25.78 million tonnes (MT) in FY2025-26, increasing 4.18% YoY. Odisha (75.13%), Gujarat (8.35%), and Jharkhand (7.94%) were the major producing states. Key producers included NALCO, Utkal Alumina, Odisha Mining Corporation, and Hindalco.
- **Chromite:** Production stood at 3.05 MT, registering a 2.79% YoY increase. Odisha accounted for 100% of India's chromite production, with major producers including Odisha Mining Corporation, Indian Metals and Ferro Alloys, and Tata Steel Mining.
- **Copper Concentrate:** Production was estimated at 105.98 thousand tonnes, increasing 0.92% YoY. Madhya Pradesh (66.10%) and Rajasthan (33.90%) were the key producing states, with Hindustan Copper Limited as the sole producer.
- **Primary Gold:** Production stood at 1,302 kg in FY2025-26, declining 19.98% YoY. Karnataka contributed 92.40% of total production, with remaining output from Andhra Pradesh and Jharkhand. Hutti Gold Mines Company Ltd remained the leading producer.

- **Iron Ore:** Production was estimated at 289.19 MT, declining 1.56% YoY. Odisha (50.28%), Chhattisgarh (17.08%), and Karnataka (16.55%) were the leading producers. Major producers included NMDC, SAIL, Odisha Mining Corporation, Tata Steel, Lloyds Metals, JSW, and Rungta Sons.
- **Lead & Zinc Concentrate:** Lead concentrate production declined 14.17% YoY to 336.94 thousand tonnes, while zinc concentrate increased 0.35% YoY to 1,727.48 thousand tonnes. Rajasthan accounted for 100% of production, with Hindustan Zinc Limited as the sole producer.
- **Manganese Ore:** Production reached 3.58 MT, declining 5.81% YoY. Maharashtra (32.80%), Madhya Pradesh (29.75%), Odisha (15.97%), and Andhra Pradesh (12.41%) were the major producing states. MOIL remained the largest producer, followed by Tata Steel and other mining companies.

Non-Metallic Minerals:

The estimated value of non-metallic mineral production increased to ₹14,045 crore in FY2025-26, registering a 0.79% YoY growth. Limestone remained the largest contributor, accounting for 91.09% (₹12,793 crore) of the total value, followed by phosphorite (₹989 crore; 7.04%).

- **Limestone:** Production reached 461.50 MT in FY2025-26, increasing 1.06% YoY. Rajasthan (23.44%), Madhya Pradesh (13.99%), Andhra Pradesh (13.54%), Chhattisgarh (10.33%), and Karnataka (8.76%) were the leading producing states. Major producers included UltraTech Cement, Shree Cement, Ambuja Cements, ACC, Dalmia Cement, and JK Cement.
- **Magnesite:** Production declined 34.57% YoY to 75.33 thousand tonnes in FY2025-26. Tamil Nadu (69.42%) and Uttarakhand (23.38%) were the key producing states. Major producers included Sri Ponguru Magnesite Mine, Pithoragarh Magnesite & Minerals, and India Magnesia Products Ltd.
- **Phosphorite:** Production stood at 1.21 MT in FY2025-26, declining 32.85% YoY. Rajasthan contributed 77.07% of total production, while the remaining output came from Madhya Pradesh. Major producers included Rajasthan State Mines & Minerals Ltd. (RSMML) and Madhya Pradesh State Mining Corporation Ltd.

Table 19: List of successful auctions since FY2016, as on 31.12.2025:

State	FY2016	FY2017	FY2018	FY2019	FY2020	FY2021	FY2022	FY2023	FY2024	FY2025	FY2026	Total
Andhra Pradesh	–	1	2	2	–	–	4	11	3	3	8	34
Arunachal Pradesh	–	–	–	–	–	–	–	–	–	–	4	4
Assam	–	–	–	–	–	–	–	–	5	2	–	7
Bihar	–	–	–	–	–	–	–	–	4	–	–	4
Chhattisgarh	3	–	2	–	–	2	2	20	6	8	16	59
Gujarat	–	–	3	–	–	4	3	2	6	7	18	43
Jharkhand	2	1	1	3	–	–	–	–	3	1	–	11
Karnataka	–	7	–	7	4	1	8	11	6	3	17	64
Madhya Pradesh	–	1	–	5	2	5	4	29	22	34	16	118
Maharashtra	–	–	2	1	10	–	9	6	10	3	2	43
Odisha	1	2	2	–	25*	1	9*	10	3	9	–	62
Rajasthan	–	3	1	1	–	3	7	8	31	34	26	114
Tamil Nadu	–	–	–	–	–	–	–	–	–	–	2	2
Telangana	–	–	–	–	–	–	–	–	–	2	–	2
Uttar Pradesh	–	–	–	–	–	–	–	4	3	3	3	13
Uttarakhand	–	–	–	–	–	–	–	–	–	–	1	1
Goa	–	–	–	–	–	–	–	4	5	3	–	12
Total	6	15	13	19	41*	16	46*	105	107	112	113	593**

Source: Ministry of Mines, ICRA Analytics

*Note: 2 iron ore blocks auctioned in 2019-20 in Odisha were forfeited and re-auctioned in September 2021. Therefore, total mineral blocks auctioned were 594, while the net figure considered is 592.

** Includes 34 critical mineral blocks auctioned by the Ministry of Mines.

Table 20: Mineral-wise Auction Summary as on 31.12.2025

Minerals	FY2016	FY2017	FY2018	FY2019	FY2020	FY2021	FY2022	FY2023	FY2024	FY2025	FY2026	Total
Limestone	4	5	10	5	4	9	18	20	35	55	31	196
Iron Ore	1	7	2	9	17	1	13*	32	24	10	25	141
Iron Ore & Manganese	0	0	0	0	6	0	1*	2	1	1	5	16
Gold	1	1	1	1	0	2	2	5	4	5	4	26
Manganese	0	1	0	1	3	0	3	19	11	5	6	49
Limestone & Manganese	0	0	0	0	0	0	0	0	0	0	1	1
Manganese & Dolomite	0	0	0	0	0	0	0	0	0	0	1	1
Diamond	0	1	0	0	1	0	0	0	1	0	1	4
Cement Grade Limestone & Bauxite	0	0	0	0	0	0	0	0	0	0	1	1
Bauxite	0	0	1	0	5	1	5	14	8	13	23	70
Graphite	0	0	0	3	2	0	1	5	1	9	2	23
Vanadium & Graphite	0	0	0	0	0	0	0	0	0	3	1	4
Chromite	0	0	0	0	3	0	0	0	0	0	0	3
Copper	0	0	0	0	2	0	0	0	2	3	0	7
Kyanite	0	0	0	0	0	0	1	0	0	0	0	1
Rock Phosphate	0	0	0	0	0	0	1	3	0	0	0	4
Copper & Gold	0	0	0	0	0	0	1	0	0	0	0	1
Phosphorite	0	0	0	0	0	0	0	3	2	2	1	8
Phosphorite & Limestone	0	0	0	0	0	0	0	0	0	0	2	2
Phosphate & REE	0	0	0	0	0	0	0	0	0	0	1	1
Potash & Halite	0	0	0	0	0	0	0	0	0	0	2	2
REE	0	0	0	0	0	0	0	0	0	0	1	1
Ni, Cr & associated PGE	0	0	0	0	0	0	0	0	2	2	0	4
Ni, Cr, Co	0	0	0	0	0	0	0	0	0	0	1	1
Glauconite (Potash)	0	0	0	0	0	0	0	0	2	3	0	5
Base Metal	0	0	0	0	0	0	0	0	5	3	0	8
Siliceous Earth	0	0	0	0	0	0	0	0	0	2	2	4
Semi-Precious Stone	0	0	0	0	0	0	0	0	0	1	0	1
Lithium & REE	0	0	0	0	0	0	0	0	0	1	0	1
Co, Mn & Iron	0	0	0	0	0	0	0	0	0	0	1	1
Tungsten	0	0	0	0	0	0	0	0	0	2	0	2
Garnet	0	0	0	0	0	0	0	0	0	0	1	1
Aluminous Laterite & Laterite	0	0	0	0	0	0	0	0	0	0	2	2
Magnesite	0	0	0	0	0	0	0	0	0	0	1	1
Lead & Zinc	0	0	0	0	0	0	0	0	0	0	1	1
Fluorite	0	0	0	0	0	0	0	0	0	0	1	1
Emerald	0	0	0	0	0	0	0	0	0	0	1	1
Total	6	15	14	19	43	13	46*	103	98	120	119	596*

Source: Ministry of Mines, ICRA Analytics

*Two Iron Ore blocks auctioned in Odisha during 2019-20 were forfeited and re-auctioned in September 2021. Hence, although 594 auctions were conducted, the net number of auctioned mineral blocks is 592.

9.5 Overview of mining regulations and compliance framework in India

1. **The Ministry of Mines** is the apex body operated by GoI. It is responsible for setting regulations governing the mining sector, formulating of policies, functioning and overall administration of mines and minerals in the country. It comprises of the following departments:
 - The Geological Survey of India (GSI)
 - The Indian Bureau of Mines
 - The Controller of Mining Leases
 - The Directorate General of Mines Safety
2. **Mines and Minerals (Development & Regulation) Act (MMDR):**
 - The MMDR Act, 1957, regulated India's mining sector, requiring leases for mining operations. The allocation followed a discretionary "first come, first serve" approach, lacking transparency. Lease renewal issues hindered large-scale investment.
 - The MMDR Amendment Act, 2015, introduced auction-based allocation to eliminate discretion and enhance transparency.

- The Minerals Laws (Amendment) Act, 2020, ensured seamless transfer of valid clearances for two years post-auction, allowing states to auction blocks before lease expiry to sustain mineral production.
 - The MMDR Amendment Act, 2021, aimed to expand mineral production, streamline mine operations, attract investment, and accelerate exploration and auctions.
 - The MMDR Amendment Act, 2023, introduced an exploration license for deep-seated and critical minerals, encouraging private sector participation. It also delisted six atomic minerals to boost exploration, crucial for India's net-zero commitments.
 - The MMDR Act empowers the Central Government to regulate environmental protection, ensuring sustainable mineral development.
3. **Offshore Areas Minerals (Development & Regulation) Act, 2002 (OAMDR Act):** It is administered by the Ministry of Mines. It is responsible for the regulation of the mines and development of mineral resources in the territorial waters, continental shelf, exclusive economic zone and other maritime zones of India. The Act specifies provisions that ensure a deterrent punishment and fine in case there is a breach of safety standards. It also ensures prevention and control of pollution, thereby protecting marine environment.
 4. **Offshore Areas Mineral Concession Rules, 2006:** It lays down the process for obtaining renewal of the permits, license or lease. Section 35 of the act provides rules that prescribe the safety measures that need to be followed in leased offshore areas and also includes guidelines on protection of marine environment.
 5. **Mines Act, 1952:** This act was introduced with the aim of consolidating the laws and regulations of labour and safety in mines. It is a welfare legislation that regulates the safety of labours while carrying out mining operations, regular inspection of mines and systematic management of mines. It also regulates the working conditions by laying out the basic provisions for health and safety of people employed in mines.
 6. **Mine Rules, 1955:** The rules include the provision for engaging a medical officer for examination of the labours employed at mines. It ensures basic health and sanitation provisions and welfare amenities for the labours and their families. It also specifies the clearance requirements, approvals and permits necessary for exploring or mining an area such as Environment and Forest Clearance, Wildlife Clearance, Landowner's Consent and so on.
 7. **Indian Bureau of Mines (IBM):** The Indian Bureau of Mines (IBM) was established in 1948, acting as a multi-disciplinary government organisation under the Ministry of Mines. IBM promotes conservation, scientific development of mineral resources and aims to protect the environment in mines other than coal, petroleum & natural gas, atomic minerals and minor minerals. The organisation aims for optimum utilisation of both on-shore and off-shore mineral resources of the country, while also maintaining a central database for exploration, prospecting, mines and minerals of the country in the form of National Mineral Information Repository.
 8. **National Mineral Exploration Trust (NMET):** The NMET was formed by GoI in August 2015, with the objective to expedite mineral exploration in the country. NMET operates on a two-tier structure, where the apex body is the Governing Body, chaired by the Minister of Mines, holding the overall control of the Trust. The holder of mining lease or a prospecting licence-cum-mining lease transfer money (an amount equivalent to 2% of royalty paid) to the NMET Fund. The Trust's main objective is to support regional and detailed mineral exploration.
 9. **The Forest (Conservation) Act, 1980:** The Forest Conservation Act 1980 was established with the objective of helping conserve India's forests. It severely restricts and regulates the de-reservation of forests or use of forest land for non-forest purposes without the prior approval of Central Government. The Act also lays down the circumstances and pre-requisites for the de-reservation of forest land for non-forest purposes. Since mining has great environmental impact in and around its sites, the act helps minimize the potential negative impacts from this sector for the Indian ecosystem.
 10. **Pradhan Mantri Khanij Kshetra Kalyan Yojana (PMKKKY):**
 - a. It is an initiative taken by the Indian government that ensures welfare of the community affected by the mining related operations. It uses the funds generated by District Mineral Foundations (DMFs).
 - b. It aims at implementing various developmental and welfare projects/programmes in the areas affected by mining.

- c. It also ensures minimisation of the adverse effects of mining with regards to the environment, health and socio-economic aspects.
- d. It guarantees long-term sustainable livelihoods for the affected people in mining areas.

11. **Mining Surveillance System (MSS):** The MSS has been developed by Ministry of Mines & Indian Bureau of Mines (IBM) with assistance from Bhaskaracharya Institute for Space Applications and Geoinformatics (BISAG), Gandhinagar and Ministry of Electronics and Information Technology (MeitY). It is a satellite-based monitoring aimed to check illegal mining activities around mining leases and establish responsive mineral administration through automatic remote sensing detection technology. The system follows the basic idea of mineral continuity around the leased mines and checks a region of 500 meters around the existing mining lease boundary in search of unusual activity which is likely to be illegal mining. These discrepancies are then flagged as a trigger and forwarded to respective State Governments for verification through field visit, thus helping to curb illegal mining activities.

MSS being an innovative digital system, incorporates latest satellite images and superimposes digitized mining leases (boundary), thereby combining advanced digital techniques to effectively combat illegal mining practices. Since this data is also available to the public at large, it builds a holistic, transparent and participatory system, which enables general citizens to report unusual mining activities too.

The Ministry of Mines developed a credible system of evaluation of mining footprints and instituted the Sustainable Development Framework (SDF) for taking up mining activity under its umbrella, encompassing inclusive growth, without adversely affecting the social, economic and environmental well-being, at present and also in future generation. Further, to implement the Sustainable Development Framework (SDF), Ministry has evolved a system of Star Rating of Mines. The Star Rating is being implemented as per the provisions of Rule 35 of Mineral Conservation and Development Rules'2017 through the Indian Bureau of Mines (IBM), a subordinate office of the Ministry of Mines.

10. Pre-casting - Overview:

Pre-casting is an advanced and highly efficient construction methodology in which structural and non-structural elements are cast, cured, and finished in a controlled environment, such as a dedicated casting yard or precast factory, before being transported and installed at the construction site. This technique allows for greater precision, uniformity, and quality assurance, as the components are produced under strict supervision with consistent mix design, curing conditions, and dimensional accuracy. By shifting major casting activities away from the site, pre-casting helps to reduce on-site congestion, minimize labor requirements, and accelerate project timelines, ultimately leading to faster, cleaner, and safer construction processes.

Pre-casting finds extensive application across infrastructure, industrial, and building projects. In large-scale civil works such as metro systems and highway networks, pre-cast bridge girders, deck slabs, and pier caps are commonly used to facilitate rapid erection and minimize traffic disruption. Similarly, in normal flyovers and overpasses, pre-cast segments provide uniform load distribution and long-term durability while enabling modular installation. In the building sector, pre-cast beams, columns, wall panels, and floor slabs are utilized to achieve consistent quality, reduced construction time, and enhanced structural performance.

Beyond primary structural applications, pre-casting is also used for utility and architectural components, including utility ducts, cable trenches, box culverts, and specialized elements like fox clovet (utility crossings) that support underground services. Additionally, pre-cast parapet walls, boundary walls, drain covers, and retaining elements are employed to ensure durability, aesthetic appeal, and ease of replacement.

Overall, pre-casting represents a modern, sustainable, and high-performance approach to construction that combines engineering precision with mass production efficiency. It not only optimizes the use of materials and resources but also reduces dependence on site conditions and weather, leading to enhanced quality control, reduced project risk, and improved lifecycle performance of built infrastructure.

10.Competitive landscaping

10.1 Brief Profile of LCC Projects and its peer companies

1. LCC Projects Limited

LCC (Laxmi Construction Company) was established as partnership firm in 2004 and was incorporated as LCC Projects Private Limited in 2017. Company focuses on irrigation and water management business. Headquartered at Ahmedabad, Gujarat, company has a presence with a wide network of offices situated in 12 states, as of March 31, 2026 Company is into construction of dams, barrages, weirs, hydraulic structures, canals, pipe distribution networks, lift irrigation works, water treatment and supply, and other infrastructure development projects.

The company is currently exploring new avenues,

1. Renewable Energy (Solar)
2. Sewerage Network & Treatment (STP)
3. Waste Water Treatment
4. Railways i.e. metro
5. River Linking
6. Desalination

Currently company has unexecuted Order Book of INR 7953.18 crores as on March 31, 2026 which is 2.21 times of FY26 turnover of INR 3600.25 Crores. The company is a multidisciplinary large corporate EPC company from Gujarat, poised to undertake infrastructure projects across 12 states in India. The company is a multidisciplinary EPC company in India in the irrigation and water supply projects segment.

The company has its in-house design and engineering team specializing in developing solutions for projects with geographical and technical complexities. Government authorities provide project scopes and specifications, and the team prepares detailed structural and architectural designs for approval.

Below are few such projects

- i. Canal and PDN Work, SSNNL, Gujarat**
LCC Constructed Distributary Canals including its Minors (UGPL), Sub Minors (UGPL) off taking from subbranch canal including O & M for Five years. (Package-I-II-III-IV-V)(KBC).
- ii. Canal Work, SSNNL, Gujarat**
LCC Constructed Dudhai Sub-Branch canal reach from 11.430 to 23.025 km [Earth work, C.C. Lining, Structures, service Road Gate work, Control Cabins and its operation & Maintenance work for 5 years] (Package-DIR-II).
- iii. Dam Construction, Sitanagar, WRD , MP**
LCC was involved in construction work of composite gravity dam and pressurised Micro irrigation system of SitaNagar irrigation Project.
- iv. Irrigation Work, SSNNL, Gujarat**
LCC has constructed underground pipeline network of more than 20000 km and developed more than 2,00,000 CCA in state of Gujrat.
- v. Metro Rail work, GMRC**
Ahmedabad Metro Rail Project Phase-I The company was involved in construction of metro rail station and other ancillary work at Metro Station Paldi and Old high court station, and Metro Station at Shreyas Nagar & Rajiv Nagar in Ahmedabad, Gujarat.
Construction of paldi station includes RCC works, Arch. Works, PHE works Entry - Exit Structures, Viaduct (Portal & I - Girder)
Construction of 11.6 km viaduct and various stations under Surat metro rail project.
- vi. Dam Construction, WRD, Narsinghgarh**
LCC was involved in Construction Of Composite Gravity Dam On River Parbati, Madhya Pradesh Of Least Gross Capacity Of 172.54 Mcm.
- vii. Long Syphon Canal, SSNNL , Gujarat**

LCC Constructed long Canal Syphon between Ch. 215.272 Km to 217.217 Km. and C.R. At Ch. 215.235 Km. of Kachchh branch canal (Earth work, C.C. Lining, Structures, gates & Stop logs, services road control cabin and O & M work for 5 Year. It is one of the longest of its type.

viii. Dam Construction, WRD, Sagar

LCC Constructed composite gravity dam on River Bina of Gross Capacity of 270.10 MCM for sagar district of Madhya Pradesh (Madia Dam).

ix. Irrigation Work, SSNNL, Gujarat

LCC was involved in Supplying, Installing & testing of UGPL system of sub minor for Irrigation through kundiesin Chakarea for SSP Command of various Sub Minors under jurisdiction of Executive Engineer, N P Canal Dn. No. 4A, Dabhoi with five years maintenance (Package-10)

x. Irrigation, VIRDC, Maharashtra

LCC was involved in construction of Pipe Line Distribution Network for command area of 7109 Ha. including detailed designing with construction as per approved design, formation of WUA (Water user association), handing over the command area to WUA, maintaining the whole system for a period of 60 months after completion, out of which first 3 years irrigation with WUA and next 2 years handing over the area to WUA and irrigation with them for GURUKUNJ LIS Tq. Tiwasa Dist. Amravati.

xi. Canal Work, WRD, Madhya Pradesh,

LCC was involved in construction of cement concrete lining of Tawa Left Bank Main Canal from R.D. 45780M. to 90240M. Of Tawa Project, Hosangabad.

xii. Irrigation, WRD, Odisha,

LCC was involved in extension of Harabhangi Irrigation Project 3763Ha GCA (2800Ha CCA) in Seragada & Aska Block of Ganjam District (Extension through U.G.P.L. (Gravity flow) under Nabakrushan Choudhury Secha Unnayan Yojana, ERM)

xiii. Water Supply Work, GWSSB, Gujarat

LCC was involved in design and construction of WTP @ LakhondHW, RCC U/G Sump, Pump House at various places & Civil Works & Providing, Supplying, Lowering, Laying & Jointing Pipeline & Supply, Installation, Testing & Commissioning of Pumping Machinery with Operation & Maintenance of All type Machineries for 5 Yrs. under Banni Regional Water Supply Scheme Taluka –Bhuj of District Kachchh

Currently Companies Order Book comprises over 103 projects of which

- a. Sondwa Lift Micro Irrigation Project revised contract value rs. 15,349.52 million
- b. Gandhi Sagar 1 Multi-Village Scheme revised contract value rs. 11,539.00 million
- c. Sidhi Bansagar Multi-Village Schemer revised contract value rs. 15,251.44 million

Further, certain of our notable executed projects include the construction of Tawa Left Bank Canal, Parbati Dam Project, Dudhai Sub Branch Canal Project and AKOT Lift Irrigation Scheme which have been covered above.

Company Business

LCC has its presence in below mentioned sectors

i. Irrigation and Water management business

The company over a period have developed relationship with clients I.e. Irrigation department, of various States Government owing to the trust that the company have been able to build over the years on account of successful execution of the projects. The company executes various irrigation and water management projects which includes is construction of dams, barrages, weirs, hydraulic structures, canals, pipe distribution networks, lift irrigation works, water treatment and supply. Significant part of company present revenue is derived from irrigation and water management business.

ii. Waste water management

The company foresees this as one of the big opportunity since water stress has become a recurring worry in India as a result of the rapid and uncontrolled growth in water demand for household, agricultural, and industrial requirements. More than half of the country's population is expected to be urban by 2050. This would challenge water management given the exponential increase. Furthermore, insufficient and restricted wastewater treatment facilities endanger water quality and public health.

iii. Renewable Energy

Given the continued government focus to tap the renewal energy potential, there is focus of the government to tap the solar energy potential of the country. The company has developed significant EPC capabilities over a period of time to execute these projects and is well poised to tap on to the potential of Solar Energy business particularly on (EPC) Execution, Procurement and Commissioning as one of the segment of renewable energy. Presently the company continues to bid for the solar EPC contracts and shall continue to explore such projects in future.

iv. Metro Rail

Metro Rail network in all the urban cities are one of the focus areas of the Government to decongest and ease the urban metro and non-metro city traffic. The government of India through various Metro Rail Corporation is working simultaneously across Indian City to develop metro train network. The company at present is looking forward to tap on to this opportunity. The company has successfully executed few projects for Gujarat Metro Rail Corporation Ltd pertaining to construction of metro stations and would continue to focus on more opportunity in future through various Metro Rail Corporation across various urban cities.

v. Coal Mining

The company at present is handling coal extraction and mining project at Bishrampur Coal Mining site (Under South Eastern Cola Fields) and Public Sector Undertaking in the state of Chhattisgarh. The work involves removal of overburden (top soil and layers of rocks) and extraction of coal and piling of coal a designated collection area. The company is executing this project under long term contract of 7 years.

Technological Capabilities

LCC has projects such as lift irrigation, water supply, underground pipeline network for Irrigation, Micro Irrigation, Canal Network, Dam & Barrage Construction etc.

Company uses technologies like IOT, SCADA, Water Gems, Water Hammer, KY Pipe, E-Survey (used on Hydraulic and Surge Design), Staad-pro (used in structural design) and AutoCAD for design planning and for design data base, Geographic Information System for mapping and analysing topographic data, soil testing equipment for soil investigation and GPS technology for precise location data. Company is using all these advanced resources for preparation of economical and feasible design solution for execution considering budget and financial profit of company.

Company has Electro-Mechanical, Electrical team which work in the field of water sector like Large Pumping station for lifting of water, Automation SCADA system for remotely operation of system, water treatment technology including filtration, chlorination and purification methods, monitoring and control systems for water treatment plants.

Company is involved in project execution like Excavation, Backfilling, Pipeline laying, Pipeline welding – jointing, and Construction of Structures like Intake well Pump House, Elevated Storage Reservoirs, Sumps with using reliable and advanced technologies.

1. Enviro Infra Engineers Ltd.

Enviro Infra Engineers Ltd, was incorporated in 2009. Company is engaged in the design, construction, operation, and maintenance of water and Waste-Water Treatment Plants (WWTPs), development of Sewage Treatment Plants (STP), and Common Effluent Treatment Plants (ETP) and water supply projects (WSSPs) for government agencies/entities.

Company Business

EIEL operations are broadly divided into the following categories:

- i. Sewerage treatment Plants
- ii. Common Effluent Treatment Plant
- iii. Water Treatment Plant
- iv. Sewerage Schemes- Designed to collect, transport, and treat wastewater and sewage to protect public health and the environment
- v. Water Supply Schemes- Methods and infrastructure needed to deliver safe and reliable drinking water to communities.
- vi. Operations and Maintenance (O&M) for ensuring facilities and equipment function efficiently and effectively over their operational lifespan.

2. Vishnu Prakash R Punglia Ltd.

Vishnu Prakash R Punglia Ltd, was incorporated in 1986. Company is an integrated infrastructure development company having vast experience in executing major infrastructure projects for Central and State Governments, Local Bodies, Public Sector Companies, World Bank Projects, and Private Bodies across more than 12 States & Union territories in India. Company's principal business operations are Infrastructure Development Works on EPC mode including their operation and maintenance activities.

Company Business

VPRPL operations are broadly divided into the following categories:

- i. Water Sector which includes works like Water dams, Water Tanks, Reservoirs, Water Treatment Plants, Water supply schemes, Overhead tanks, Pipelines, Irrigation Channels etc.,
- ii. Sewerage Sector which includes activities like Sewerage treatment Plants, Sewer Tank drain,
- iii. Railway Sector, which includes all Railway works like Railway Tracks, Railway Stations and allied buildings, Platforms and Bridges
- iv. Road Sector, which includes Development of roads and highways, bridges and Flyovers
- v. Tunnelling Works
- vi. Buildings and Warehouses Works
- vii. Multi-dimensional Smart City Projects.
- viii. Automation work involving PLC and SCADA.

3. JWIL Infra Ltd

JWIL Infra Ltd, was incorporated in 2006. Company is a distinguished entity within the OP Jindal Group. It stands as a comprehensive water management enterprise. Specializing in turnkey solutions for projects encompassing drinking water, irrigation, wastewater, and industrial effluent treatment. JWIL has its business across diverse geographies, including India, Africa, and South Asia.

Company Business

JWIL Infra operations are broadly divided into the following categories:

- i. Irrigation Projects
- ii. Water Supply and Distribution Management
- iii. Waste Water Solution
- iv. Operations and Maintenance

10.2 Financial benchmarking of key peers in the sector- This section covers some of the operational and financial key performance indicators of LCC Projects and its competitors.

Particulars	LCC Projects			Enviro Infra Engineers Ltd			Vishnu Prakash R Punglia Ltd.			JWIL Infra		
Consolidated financials	FY2024	FY2025	FY2026	FY2024	FY2025	FY2026	FY2024	FY2025	FY2026	FY2024	FY2025	FY2026
Presence in segments	Irrigation, water supply, metro rail and industrial projects, mining			Sewerage treatment, Common Effluent Treatment, Water Treatment Plant			Water supply, Sewerage Sector, Railway, Road Sector- highways and bridges, Tunnelling Works, Buildings and Ware Houses, Smart City Projects, Automation work involving PLC and SCADA			Drinking water, Irrigation, Wastewater and Industrial Effluent Treatment		
Order book as on March 31st (in Rs Millions)	62,689.68	78,821.71	79,531.81	21,225.86	19,922.00	68,136.00	47,169.57	53,634.00	NA	~ 40,000	~ 39,000	NA
Revenue from operations (Rs millions)	24,389.12	29,182.94	36,002.52	7,289.15	10,660.56	11,456.00	14,738.65	12,374.18	8,511.95	21,687.98	18,427.73	
Growth in Revenue from Operations (%)	99.05%	19.66%	23.37%	115.59%	46.25%	7.46%	26.14%	-16.04%	-31.21%	129.55%	-15.03%	
EBITDA (in Million)	2,413.65	4,010.35	5,198.97	1,755.77	2,871.77	3,104.32	2,186.71	1,642.35	-818.48	2,257.31	2,783.81	
EBITDA Margin	9.90%	13.74%	14.44%	24.09%	26.94%	27.10%	14.84%	13.27%	-9.62%	10.41%	15.11%	
PAT (in Million)	1,219.97	2,236.25	2,864.41	1,064.56	1,771.48	1,883.85	1,221.85	585.96	-1,501.16	1,223.31	1,525.51	
PAT Margin (%)	5.00%	7.66%	7.96%	14.60%	16.62%	16.44%	8.29%	4.74%	-17.64%	5.64%	8.28%	
Total Debt (in Million)	4,216.43	7,467.66	8,606.54	2,343.58	2,341.15	4,222.97	3,955.17	7,072.25	6,495.45	3,426.42	3,443.05	
Total Debt to Equity	1.10	1.23	0.97	0.80	0.24	0.34	0.55	0.91	1.03	0.95	0.62	
Return on Equity (%)	31.87%	36.96%	32.24%	36.43%	17.81%	15.28%	16.95%	7.52%	-23.83%	33.93%	27.58%	
Return on Capital Employed (%)	27.63%	27.64%	27.13%	32.19%	22.61%	17.26%	18.58%	9.98%	-8.08%	31.62%	30.51%	
Net Worth (Rs Mn)	3,828.25	6,049.89	8,884.11	2,921.84	9,945.11	12,327.07	7,210.64	7,793.10	6,299.50	3,605.68	5,531.63	

Source: Company annual reports, ICRA Analytics

NA: Not available

Formulae used:

1. Growth in Revenue from Operations is calculated as a percentage of Revenue from operations of the relevant period/year less Revenue from operations of the preceding period/year, divided by Revenue from operations of the preceding period/year
2. EBITDA is calculated as Profit/(loss) before tax for the period/year add finance cost, depreciation and amortisation expenses
3. EBITDA Margin is calculated as EBITDA divided by Revenue from operations
4. Profit after tax is Profit after tax reported in the Restated Consolidated Financial Information
5. PAT Margin is calculated as Profit after tax reported in the Restated Consolidated Financial Information divided by Revenue from Operations
6. Total Debt is calculated as sum of Long-Term borrowings and Short-Term borrowings.
7. Total Debt to equity is calculated as Total Debt divided by Total Equity (excluding non-controlling interest).
8. Return on Equity is calculated as Profit after tax after share of profit/(Loss) of Associate divided by Net Worth.
9. Return on Capital Employed is calculated as EBIT divided by Capital employed. EBIT is calculated as Profit/(loss) before tax for the period/year as increased by finance cost. Capital employed is defined as total debt (Long Term borrowings + Short Term borrowings) plus Net Worth as on the last date of the reporting period.
10. Net worth is calculated as Total Equity less non-controlling interest.

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