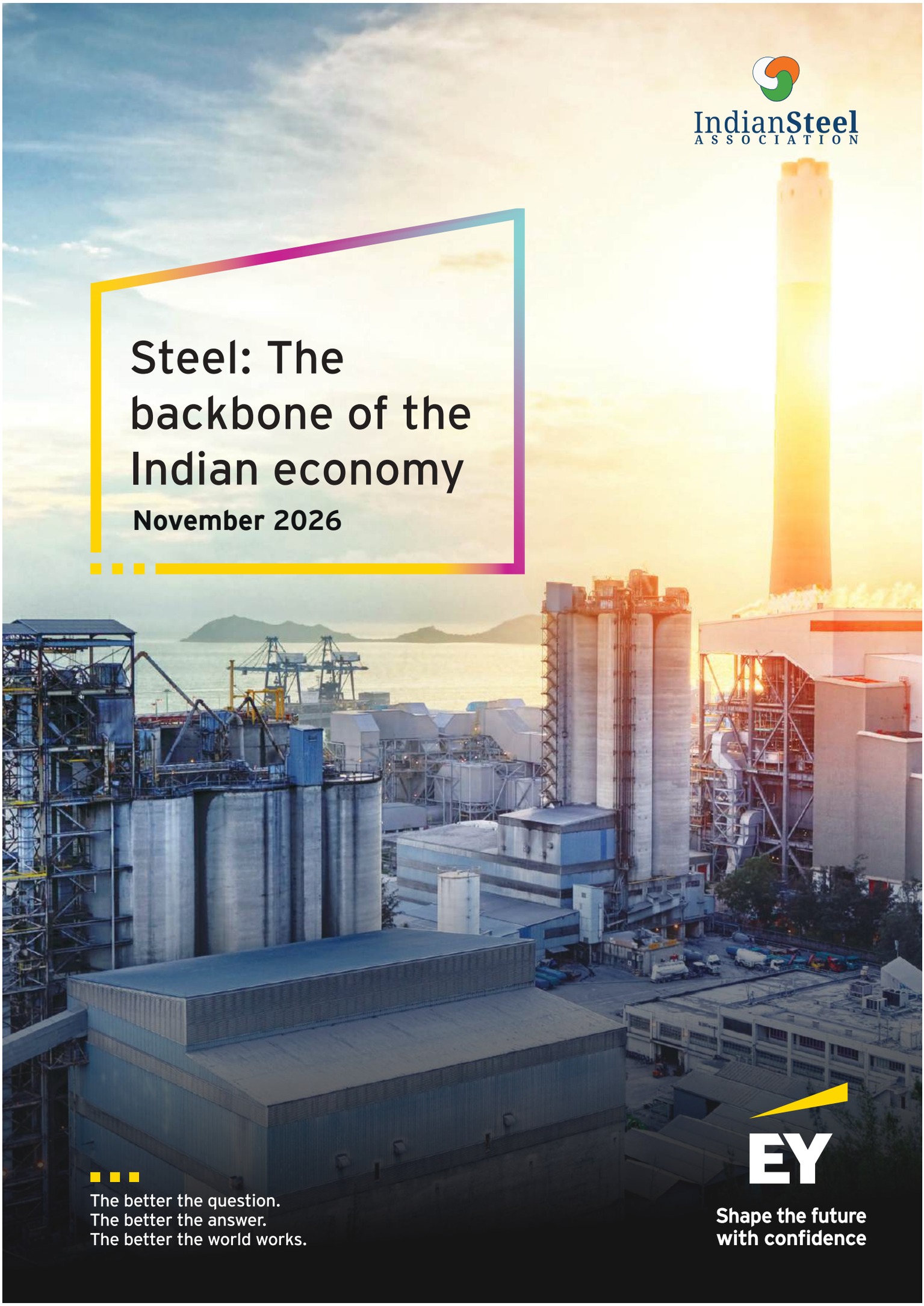


IndianSteel ASSOCIATION

Steel: The backbone of the Indian economy

November 2026

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Naveen Jindal
President
India Steel Association

FOREWORD

India's steel industry is entering a defining phase. The country is expanding infrastructure, strengthening domestic manufacturing, modernising mobility and investing in new energy systems at the same time. Steel lies at the foundation of each of these transitions, creating an opportunity whose scale and diversity are difficult to replicate elsewhere.

The significance of this opportunity extends beyond capacity growth. It will be strengthened with the industry's ability to produce value added steels, improve resource and energy efficiency, and it works closely with steel-consuming sectors. Automotive manufacturers increasingly need advanced high-strength and coated steels. The growth of renewable power and electrification is expanding the market for electrical steel, specialized plates, and corrosion-resistant products. Defense, capital goods, and engineering applications are also creating demand for grades with more demanding metallurgical and performance characteristics.

This evolution can allow India to capture a larger share of the value generated by its own industrial development. Indian steelmakers have already demonstrated their ability to build and operate assets at global scale. The next competitive frontier will be the ability to combine this scale with product development, consistent quality, application engineering, and responsive customer service.

The transition towards lower-carbon steel will further influence competitiveness. India's pathway will reflect its own resource base and production structure, combining greater energy efficiency, renewable power, improved scrap utilisation, beneficiation of domestic iron ore and progressively cleaner metallic inputs. Emerging technologies, including hydrogen-based production and carbon capture, can become more relevant as their technical and commercial viability improves.

India possesses a large iron ore reserve Fe content ranging from 55- 62%, engineering capability, entrepreneurial energy and one of the world's most promising domestic markets. These strengths provide the foundation for building an industry recognised not only for its scale, but also for its quality, innovation, sustainability, and reliability.

The coming decades offer the opportunity to shape the future of an aspirational India to be (a developed) Viksit Bharat by 2047 with Steel playing an incredibly significant and strategic role.



Alok Sahay
Secretary General
India Steel Association

The future competitiveness of Indian steel will be determined not only within steel plants, but across the industrial system that supports them, mining, beneficiation, logistics, metallic inputs, equipment manufacturing, technology, skills, testing, certification and downstream processing will increasingly influence the sector's cost, quality and responsiveness to the market.

India's steel industry has an important structural advantage in the diversity of its production base. Large integrated producers bring scale, technology and the ability to develop advanced grades. Secondary steelmakers provide regional reach and operating flexibility, while downstream processors and MSMEs connect production with a wide range of end-use markets. The industry-s next phase of development will be strengthened by closer integration of these participants and wider adoption of uniform quality, process and environmental standards.

The composition of demand is also changing. Infrastructure and construction will remain the principal volume drivers, but an increasing share of value will come from automotive, electrical equipment, renewable energy, defense, capital goods and precision engineering. Participation in these markets depends on more than installed capacity. It requires metallurgical capability, product consistency, reliable testing and certification, and sustained engagement with end users during product development.

Raw material efficiency will remain central to competitiveness. Greater beneficiation of domestic iron ore, improved recovery and scientific grading of scrap, efficient use of by-products and better multimodal logistics can reduce structural cost, while improving supply security. These are areas where coordinated industry development can create more value than fragmented interventions.

The transition to a lower-carbon steel Introduces an additional capability imperative. A common measurement, reporting and verification framework, supported by credible plant-level emissions data and traceable supply chains, will increasingly influence procurement, financing and access to international markets. Such systems must extend beyond leading producers and become accessible across the industry.

India has built a steel sector of considerable scale and diversity. Its next advantage will come from converting that diversity into a more connected, technologically capable and trusted industrial ecosystem.



Vinayak Vipul

Partner,
Business Consulting
EY Parthenon

India has spent the better part of the last decade building an impressive architecture of steel policy. The Na tional Steel Policy targets 300 million tonnes of capacity by 2031. Three rounds of PLI for specialty steel have committed nearly 30,000 crore rupees in investment and brought 85 companies to the table. A Green Steel Mission, a Scrap Recycling Policy, a hydrogen pilot programme with seven active projects, and a safeguard duty framework to protect domestic producers from the Chinese surplus, it is a serious policy stack by any measure. And yet PLI's production realisation rate remains around 25 percent. India's R&D intensity in the sector sits at roughly 0.5 percent of revenue, against South Korea's 5 percent and Japan's 3.4 percent.

Nearly 70 to 90 percent of domestic scrap handling remains informal, which is why India's scrap use in steelmaking is still below 35 percent of output, compared to 70 percent in the United States. These are not arguments against ambition. They are arguments against mistaking the roadmap for the road. India has the demand, with finished steel consumption projected to reach 315 million tonnes by 2035. It has the resource base, with iron ore production at a record 289 million tonnes last year. It has the policy intent. What the next decade will actually test is whether we have the institutional discipline to convert commitments into commissioned capacity, and pilots into operating plants, at the pace that the opportunity genuinely demands.

Executive

India has cemented its position as the world's second-largest steel producer, with crude steel production reaching ~168.4 MT in FY26, up ~10.7% YoY, supported by robust domestic demand and continued infrastructure activity.

Operating as the definitive multiplier for the broader economy, steel underpins India's projected 6.4% GDP growth, driving expansion across construction (+9.4%), automotive (+7.3%), and infrastructure (+4.4%). As the closest proxy for India's physical economy, steel also commands a 17.92% weight in the Index of Eight Core Industries. Backed by a massive INR11.21 lakh crore in public capital expenditure and rapid urbanization, the Indian steel sector is scaling rapidly.

Steel plays a key role in the construction of 17,000 km of expressways and the addition of 220 airports by 2030. At the same time, it speeds up city modernization with 5,000 km of planned metro lines.

Beyond its GDP contribution, steel is a foundational pillar for national security and domestic employment. The sector employs ~2.5 million people in total (including ~0.6 million direct workers), with the secondary and MSME ecosystems controlling roughly 47% of national capacity and driving regional employment. Strategically, it provides a resilient backbone for all core industries, supplying advanced alloys for defense, API-grade pipelines, CRGO electrical steel and heavy galvanized structural steel for India's 500 GW renewable energy target.

Charting the demand path: Infrastructure and advanced manufacturing as twin demand engines

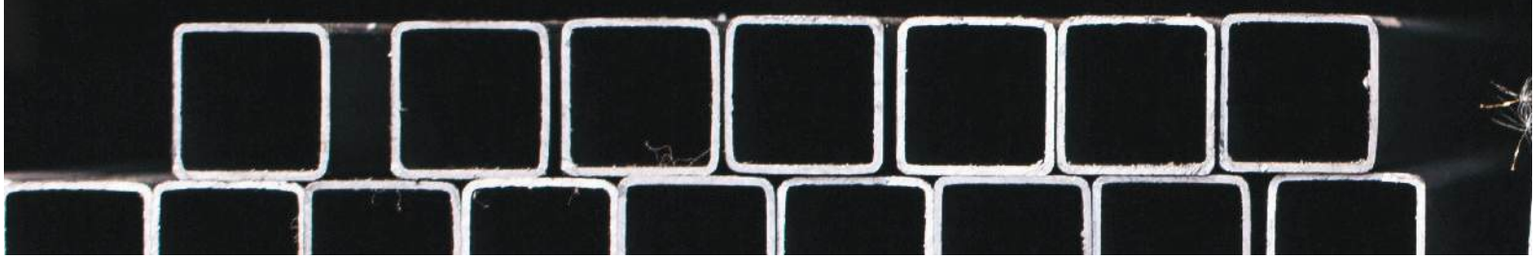
Driven by an anticipated 8% to 10% compound annual growth rate (CAGR), India's total finished steel consumption is projected to reach 200 MT-220 MT by FY30, ultimately exceeding ~250 MT by FY35. This multi-decade expansion is supported by India's per capita consumption (2025-26) of just 115.7 kg, leaving massive headroom for growth compared to the US (~261 kg), Japan (~419 kg), and China (~601 kg). Demand additions will be decisively driven by two primary sectoral engines:

- **Engine 1: Infrastructure and construction (volume growth):** Steel consumption is projected to grow from ~90 MT to ~210 MT by FY35, driven by the PM Gati Shakti Masterplan and urban transit projects.
- **Engine 2: Automotive, capital goods, and energy (value growth):** Steel consumption in the automotive sector is expected to scale from ~12 MT to ~21 MT (FY35), heavily driven by EV demand, while India's 500 GW renewable energy target will mandate millions of tons of new specialty grades.

To meet this surging demand, the sector is successfully progressing towards its National Steel Policy target of 300 MTPA capacity by 2030. India's installed crude steel capacity stood at approximately 220 MTPA in FY 2025-26, leaving roughly 80 MTPA still to be added, and major players including SAIL, Tata Steel, JSW Steel, JSPL and AM/NS continue to invest in expansion. While India is already on a strong path to achieving this volume, securing advantages beyond mere capacity requires immediate strategic intervention. The journey to a self-reliant and premium ecosystem faces deeply embedded raw material constraints, innovation gaps, and mounting global environmental mandates.

Structural bottlenecks: Raw material security and decarbonization pressures

- **Raw material vulnerability:** India relies on imports for 85% to 90% of its coking coal, making its mills susceptible to fluctuating global prices, unlike China, which imports less than 20%.
- **CBAM and carbon risk:** India's emission intensity of ~2,500 Kg CO_2/t faces active exposure to the EU CBAM as of 1 January 2026, risking €125 to €200/t penalties.
- **Specialty steel deficit:** India imports nearly 100% of CRGO electrical steel and ~45% of auto-grade AHSS.
- **Innovation lag:** India's R&D intensity is just ~0.64% of GDP, falling significantly behind innovators like South Korea (~5.0%) and Japan (~3.4%).



summary

Strategic interventions: Procurement reform, green financing and capability leapfrogging

- **Consortium sourcing and indexation:** To shift from a price-taker to a price-influencer, India must form a sovereign-backed "One Nation, One Buying" procurement strategy (aggregating 40-60 MT of demand) and launch an India CFR Coking Coal Index. This mirrors how Japan secures margins via coordinated trading houses and China utilizes state-supported consolidated buying.
- **Accelerating the green steel transition:** Brownfield blast furnaces require immediate retrofits, digital optimization, and the integration of CCUS, while greenfield expansions must pivot toward renewable-powered Electric Arc Furnaces (EAF) and Hydrogen-DRI pathways.
- **Scrap circularity:** Build a National Scrap Registry to formalize recycling and scale low-carbon Electric Arc Furnaces (EAF). Taking cues from global scrap-EAF leaders (see 5.3 for benchmark shares), this intervention will drastically lower the baseline carbon footprint.
- **Agile PLI execution:** Broaden the PLI scheme by lowering capital thresholds for MSMEs (to INR1,500-INR2,000 crore) and offering 10% to 15% advance payouts.
- **Accelerating R&D:** Steelmakers should actively access the INR1 lakh crore ANRF corpus and utilize SRTMI co-funding (60% to 75%) to shorten commercialization times. Launching targeted 'Innovation Sprints' and requiring steelmakers to partner with universities will drastically shorten the time taken to move green steel and advanced alloys from the laboratory to the factory floor.

Transforming the paradigm: Securing a self-reliant steel ecosystem

Procurement and logistics reforms will unlock a structurally embedded US$25 to US40 per tonne cost advantage. Concurrently, deeper domestic capabilities and agile PLI execution will substitute 15% to 25% of current specialty steel imports, thereby generating approximately US$3 billion to US$5 billion in new, high-value export revenue.

With the 300 MT capacity expansion and the above interventions from government and industry, India's steel sector shall contribute effectively to the Viksit Bharat Roadmap. Ultimately, these interventions will anchor a globally competitive, self-reliant ecosystem that provides the resilient backbone to power India's long-term economic destiny.



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Chapter 1

The role of steel in India's economic development

Steel is no longer just an industrial commodity; it is a strategic enabler of India's nation building and industrial transformation agenda. As India enters a capital intensive development phase, steel demand is becoming both structural and multiplicative, tightly linked to infrastructure expansion, manufacturing deepening, and the energy transition.

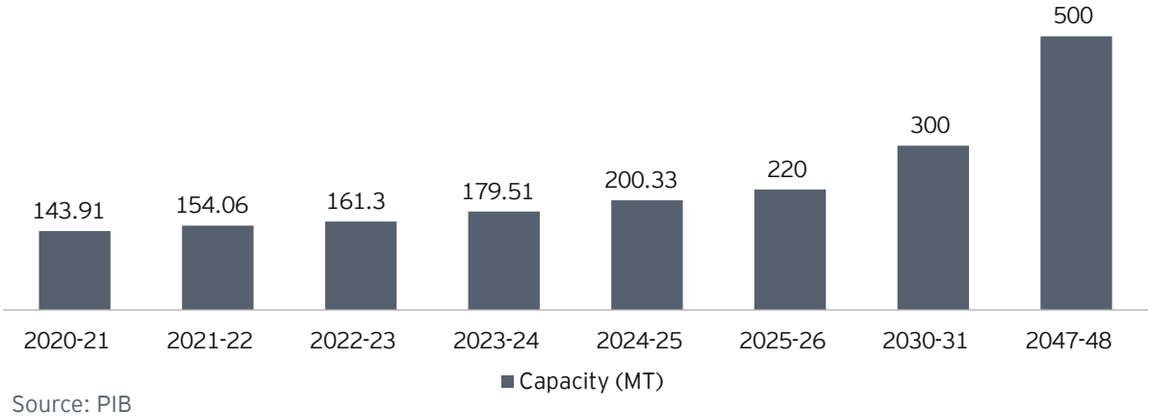
Contributing approximately 2% of national GDP and generating a meaningful multiplier effect across employment, logistics, and downstream manufacturing, the steel sector sits at the intersection of economic growth and global competitiveness.

Over the next decade, the sector must execute two transitions in parallel:

Scale: expanding capacity from ~220 MT today to 300 MT by 2030-31, and toward 500 MT by 2047.

Structure: Shifting from volume led growth to value and carbon efficient production, in line with global decarbonization regimes such as the EU's Carbon Border Adjustment Mechanism (CBAM).

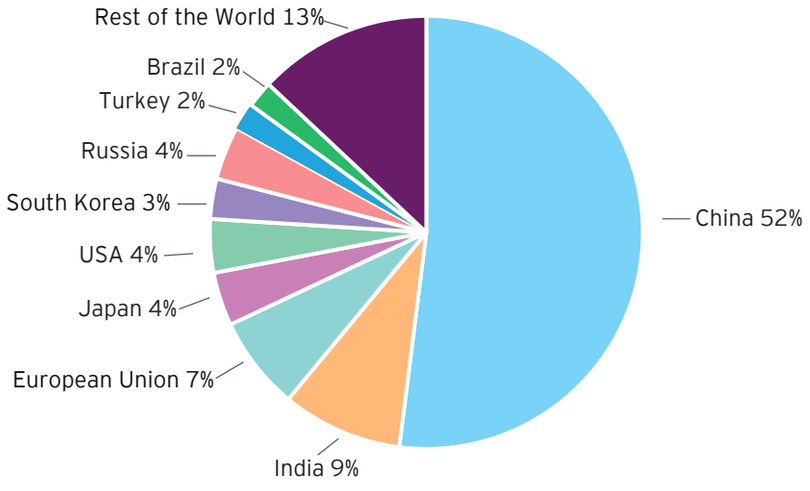
India's crude steel Capacity Growth (2010-Present) with Projections to 2030



Source: PIB

The strategic question is no longer whether India can grow steel volumes, but how it grows, where it invests, and which capabilities it prioritizes. While China remains the dominant producer at ~961 MT (~52% share of global production) in CY2025, its transition away from a real estate-heavy model is leading to a persistent decline in domestic demand, contrasting sharply with India's expansionary phase.

Global crude steel production



Source: World Steel Association

1.1 The steel-GDP elasticity: Rising steel intensity driving incremental economic growth

India's recent growth cycle reflects a classic nation-building pattern: rapid urbanization, sustained public capital expenditure, and rising penetration of steel-intensive assets across housing, transport, energy and manufacturing.

Over the past four years, steel consumption growth has outpaced GDP growth, indicating higher steel-intensity per unit of economic output compared with the pre-pandemic decade. This suggests a structural shift in the economy, where incremental growth is increasingly supported by physical asset creation rather than services alone.

Despite long term consumption growth of ~7% CAGR over the past 16 years, India's per capita steel usage remains materially below global benchmarks. With urbanization at ~36%[1] (versus ~67% in China[2]), India's development trajectory remains materials intensive for at least the next decade, supporting sustained demand across both flat and long products.

Importantly, India now stands out as the only major economy delivering double digit steel consumption growth amid a global slowdown-underscoring the resilience and domestic anchoring of its demand fundamentals.

Strategic recommendation

Forward-looking capital allocation must account for two distinct paths:

- **The resilience case:** Sustained infrastructure-led growth maintaining current intensity.
- **The innovation leapfrog:** A structural shift in value rather than volume, where India captures emerging green steel and advanced grade premiums. While aggregate steel demand may continue to track GDP, selective segments such as electrical steel, AHSS and low carbon certified products could grow at materially higher rates, enabling industry value growth to outpace economic growth.

[1]Forum IAS: Urbanization in India- Significance & Challenges Explained Pointwise
[2][China's population has declined for three consecutive years, with a decrease of 1.39 million people last year]. Lianhe Zaobao. 17 January 2025

Scaling towards the 300 MT vision

India's National Steel Policy articulates a target of 300 MT of crude steel capacity by 2030-31, positioning steel as a cornerstone of national self-reliance. Elevated public capital expenditure over the past five years has emerged as a primary demand catalyst-crowding in private investment while reducing logistics and connectivity constraints.

The demand outlook for 2030 is underpinned by:

- Infrastructure and construction revival
- Urban housing and real estate normalization
- Manufacturing localization and supply chain re shoring

The target is not aspirational but anchored in observable demand and policy commitment. Having anchored the 300 MT ambition in domestic demand and policy commitment, the strategic question shifts from how much capacity India builds to how that capacity reshapes its global role.

Building strategic reach through global acquisitions without overextension

India's steel expansion strategy over the next decade is defined less by overseas asset accumulation and more by carefully sequenced capacity creation at home combined with selective international positioning. As global steel markets enter a phase of constrained investment, carbon discipline, and surplus rationalization, India's approach to global acquisition is expected to be opportunistic, capability-focused, and strategically limited, rather than volume-driven.

Domestic capacity as the principal lever of global influence

The acceleration from ~220 MT installed capacity in FY26 to 300 MT by 2030-31 places India among the few jurisdictions where new capacity continues to be absorbed domestically rather than exported under distress. This fundamentally alters the strategic logic of global acquisitions:

- India does not face an imperative to "export surplus capacity risk" through overseas mills.
- Global relevance is increasingly derived from scale reliability, policy stability, and cost competitive production, not ownership of offshore assets.
- The ability to commission large integrated plants on schedule, rather than acquiring legacy facilities abroad, becomes the primary source of competitive advantage.

In this context, domestic capacity build out itself functions as a form of implicit global acquisition, capturing market share vacated by under investing or high carbon producers elsewhere.

Re defining the role of overseas assets

Future global acquisitions, where undertaken, are expected to be highly selective and strategic, aligned to specific national objectives rather than headline tonnage expansion. These include:

- **Upstream security:** Equity participation in high grade iron ore or metallurgical coal assets to address emerging quality constraints.
- **Carbon and market access:** Minority stakes or joint ventures in low carbon processing facilities within carbon regulated markets to preserve export optionality under CBAM type regimes.
- **Technology and product depth:** Acquisition of niche downstream capabilities (electrical steel processing, advanced coatings, specialty alloys) rather than primary steelmaking capacity.

This approach reflects a conscious policy shift away from acquiring carbon intensive, capital locked assets that risk accelerated obsolescence.

Timing the global cycle

The global steel industry is entering a period defined by:

- Flat to declining capacity additions outside India
- Rising cost of capital for heavy industry
- Increasing regulatory scrutiny on embodied carbon

Within this window, India's best strategic response is not aggressive offshore expansion but capital discipline and execution superiority at home, while keeping dry powder for targeted acquisitions once global asset valuations normalize further and regulatory clarity improves.

This sequencing ensures that India's balance-sheet strength and policy focus remain aligned with the domestic infrastructure cycle through 2030, without importing external financial or environmental liabilities.

Strategic outcomes

By the early 2030s, India's steel sector is expected to transition from being a capacity expanding producer to a system defining participant in global steel markets. Global acquisition, in this framework, becomes a tool for:

- Enhanci ng resilience
- Closing capability gaps
- And reinforcing India's position in global value chains, not a substitute for domestic scale

The strategic emphasis, therefore, is on acquiring influence rather than assets, enabling India to emerge as a steel power that is both structurally sustainable and strategically autonomous.

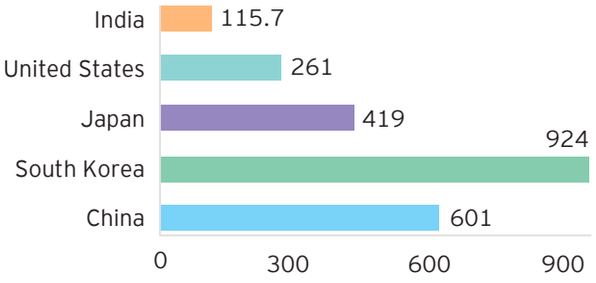
This posture defines how capacity expansion translates into ecosystem level outcomes.



Per capita transformation

With per capita consumption targeted to rise to 160 kg by 2030-31, the challenge is shifting from demand creation to efficient, timely capacity deployment. India's consumption of 115.7 kg is significantly lower than mature economies, which serves as a barometer for the country's potential industrial sophistication

Per capita finished steel consumption (kg)



Source: World Steel Annual Report

Strategic recommendation

The execution velocity challenge: Mitigating carbon and capital lock-in

- Reaching 300 MT is not a demand risk, but an execution and technology risk. Aggressive capacity expansion without parallel investment in scrap-sorting infrastructure and Green Hydrogen-ready DRI plants risks creating "stranded assets", high-carbon facilities that will face severe margin erosion as global carbon pricing (CBAM) has taken effect.

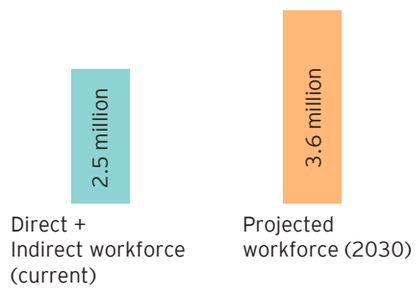
1.2 Social impact: Employment and skill development

The steel industry is a massive engine for socio-economic mobility, characterized by a high employment multiplier effect.

- **Workforce scale:** India's steel sector supports approximately 2.5-2.6 million jobs, comprising about 0.6 million direct jobs in steel manufacturing and nearly 2.0 million indirect jobs across mining, logistics, downstream manufacturing, construction, capital goods and allied services.[3]
- **Employment multiplier:** The sector exhibits high employment intensity, with each direct job in steel production supporting an additional four to seven jobs across the broader value chain, reflecting strong backward and forward linkages with raw materials, transport, fabrication, infrastructure and services.
- Competitive advantage: India benefits from a vast pool of skilled and semi-skilled labor at competitive costs, though senior leadership should address the historical weakness of low labor productivity through increased automation and digitalization.

With India on course to reach 300 MT of steel capacity by 2030, the sector's total workforce is projected to expand to 3.6 million, underscoring steel's enduring role in sustaining employment and socio-economic stability.

Workforce growth (million people)



Source: IBEF: How Government Policies Shape the Steel Industry in India

1.2.1 Driving formalization and upskilling: Modernizing the workforce through digital and ecological training

A shift from informal to formal labor is underway, boosted by the Employment-Linked Incentive (ELI) scheme, which subsidizes EPFO contributions for first-time workers. The PLI scheme for specialty steel is generating up to 70,000 high-skill jobs in advanced manufacturing. NITI Aayog projects 1.1 million jobs requiring digital and ecological reskilling by 2030 under a "Just Transition" towards green steel.

1.2.2 Catalyzing inclusive growth: Narrowing the urban-rural divide through infrastructure expansion

Steel is a catalyst for urbanization, supporting millions of workers in construction, smart cities and mass transit. Government schemes like PMAY-G and rural water projects are driving rural steel demand, aiming to nearly double per capita consumption from ~20 kg to 38 kg by 2030[4]. This fosters modernization of rural infrastructure, localized employment and a narrowing urban-rural divide.

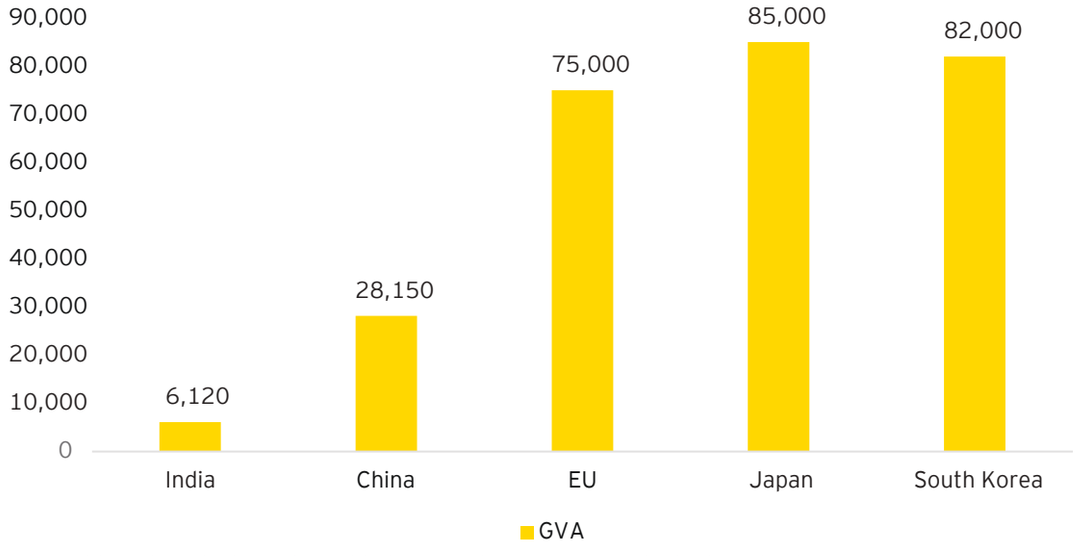
[3]IBEF: How Government Policies Shape the Steel Industry in India
[4]Ministry of Steel Report

Strategic recommendation

The human capital pivot: Solving the productivity-complexity gap

The sector's growth is traditionally viewed through a headcount lens, but the 300 MT vision demands a transition from labor-intensive volume to technology-intensive value. To compete globally, the industry needs to bridge the Gross Value Added (GVA) per employee gap against peers in Japan and South Korea. This requires a shift from vocational training to "Digital Metallurgy" and "Ecological Systems Management."

Gross Value Added (GVA) per worker: Major steel producing economies



Source: World Bank (Industry value added per worker), OECD Productivity Indicators, EUROFER / Oxford Economics, World Steel Association

NOTE: Industry value added per worker is used as a proxy for steel productivity due to the absence of harmonized, steel only GVA per employee data across countries.

This proxy is standard practice in OECD cross country productivity analysis and EU steel economic impact assessments.

India's steel sector operates at significantly lower Gross Value Added (GVA) per worker compared to other major steel producing economies, reflecting differences in automation, digital integration, and process complexity rather than scale. Closing this productivity gap as capacity expands toward 300 MT, and subsequently toward 500 MT, is likely to require a structural human-capital shift toward digital metallurgy, advanced process control, and ecological systems

1.3 The multiplier effect: Macroeconomic foundation, steel production and trade dynamics

India's steel sector has entered a structurally distinct phase of development, characterized by macroeconomic resilience, shifting trade flows, and rising geopolitical relevance. Unlike prior cycles driven by speculative export arbitrage, the current expansion is firmly anchored in domestic demand, a multi-year public capital expenditure cycle, and strategic trade protection. This transition positions steel as a macro-critical industry rather than a purely cyclical one.

1.3.1 Trade Rebalancing

India's steel trade profile underwent a sharp inflection over the past 18 months as the government moved to protect domestic capacity utilization from elevated low-priced imports originating from surplus steel-producing economies.

Trade barriers and free trade agreements shaping India's steel trade dynamics

India's steel trade dynamics are increasingly influenced by an evolving landscape of tariff defenses, non tariff barriers, and selective trade agreements, reflecting the strategic imperative to shield domestic capacity expansion while maintaining export competitiveness in a fragmented global market.



Tariff based import protection (trade remedies)

Safeguard Duty: India imposed a 12% provisional safeguard duty in April 2025 on selected non alloy and alloy flat steel products for 200 days, following a sharp import surge.[5]

- This action targeted hot rolled, cold rolled, coated, and color coated steel.
- Imports of finished steel had reached a nine year high of ~9.5 MT in FY25, triggering the intervention.

Impact: Post imposition, steel imports declined sharply in FY26 (April-January), helping restore domestic pricing power and supporting a return to net exporter status.

Anti Dumping Duties (ADD): India continues to apply product specific ADD on:

- Seamless tubes and pipes (China),
- Welded stainless steel pipes (Vietnam, Thailand),
- Electro galvanized and electrical steel (Korea, Japan, China).

These measures address unfair pricing rather than volume surges.

Rationalization: In December 2025, ADD collections were adjusted where safeguard duties apply, preventing double duty and ensuring WTO-compliant enforcement.



External tariff barriers affecting Indian exports

United States:

- US Section 232 steel tariffs were increased from 25% to 50% in June 2025.
- Direct exposure for India remains limited, but the higher tariff restricts US market access and increases global trade-diversion risk toward India.



Non tariff barriers

EU Carbon Border Adjustment Mechanism (CBAM):

- Entered its pricing impact phase from 1 January 2026.
- Indian steel faces implicit price pressure of ~15% to 22% in the EU market due to higher embedded carbon intensity[6].

Carbon gap:

- Indian steel emissions: ~2.4-2.5 tCO_2 per ton,
- EU average: ~1.4-1.7 tCO_2 per ton.
- This implies a carbon cost of €55 to €80 per ton at current EU ETS prices.

Compliance burden: CBAM requires plant-level emissions reporting and third-party verification, disproportionately affecting MSME exporters and tightening non-tariff market access conditions



Free Trade Agreements (FTAs): Structural impacts

ASEAN-India FTA (AIFTA):

- Tariffs on most steel products were reduced from ~28% to below 3%.
- Empirical evidence shows imports rose significantly, while India's steel exports saw limited gains, worsening the trade balance.
- Trade circumvention risk: Chinese steel entering India via ASEAN countries using preferential tariffs has become a major concern.
- India is now prioritizing Rules of Origin tightening and safeguard flexibility under the ongoing AIFTA review.

[5]Press Release – Ministry of Steel
[6]ANI Report: Indian steel exporters to Europe may have to cut prices by 15-22% as carbon cost kicks in from Jan 1st

RCEP (India not a member):

- By staying out, India avoided near-total tariff elimination across a bloc covering ~30% of global GDP.
- Most analyses conclude that this decision protected the domestic steel sector from intensified import pressure during its capacity expansion phase.
- India's decision to stay out of RCEP reduced near-term competitive pressure on domestic steel during a critical expansion phase, but it also postponed deeper integration into Asia-Pacific value chains, implying a trade-off between protection-led consolidation today and export-led efficiency gains over the longer term

Overall trade policy implication

India's steel trade regime has shifted toward managed openness, characterized by:

- Active use of trade remedies against unfair imports,
- Cautious engagement with FTAs where asymmetries exist,
- Early adaptation to carbon linked non tariff barriers.

This calibrated approach supports the sector's macroeconomic multiplier effect while protecting long term domestic capacity creation during the 300 MT scale up cycle

Strategic recommendation

Forward-looking trade defense strategy for India's steel ecosystem

- Institutionalize a Trade Defence Cell within Ministry of Steel with real-time import monitoring (price, volume, origin) integrated with DGTR and Customs data.
- Expand Quality Control Orders (QCOs) proactively across HRC, CRC, coated, TMT and structural categories – eliminating sub-standard import arbitrage.
- Calibrate safeguard and anti-dumping measures proactively rather than reactively – filing investigations at first evidence of price undercutting rather than post-injury.
- Review FTA schedules in sensitive steel categories – particularly with South Korea (CEPA) and ASEAN – to enable effective rate protection in vulnerable segments.



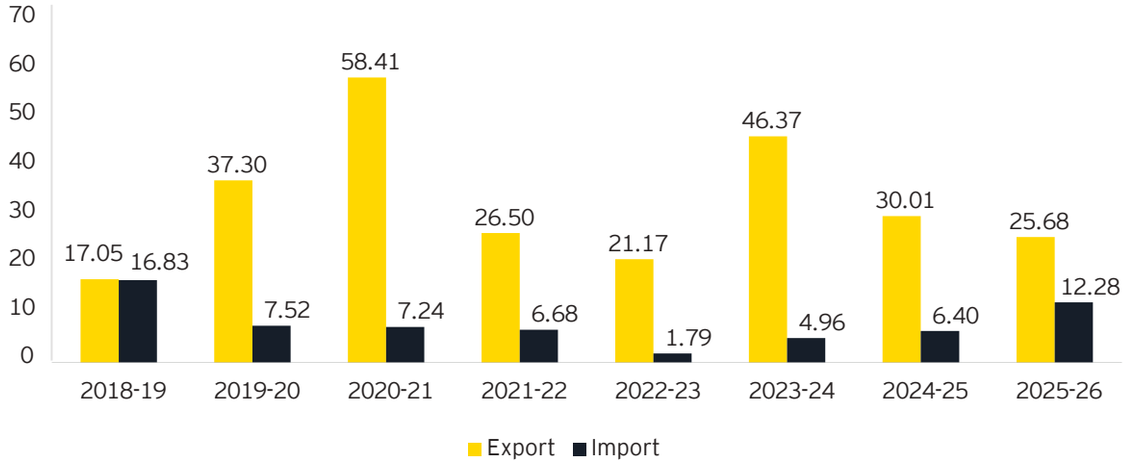
1.3.1 Raw material trade: The quality security challenge

India's steel expansion path is no longer constrained by absolute availability of raw materials, but by quality alignment, reliability of supply, and cost stability as steelmaking migrates toward high efficiency BF optimization, coal based DRI, and future low carbon pathways.

Iron ore: Grade mismatch, not volume scarcity

- **Import surge for quality:** Despite being the world's second largest iron ore producer, India imported 12.28 million tons of iron ore in FY26. This is driven by rising demand for high grade ore required for productivity improvement and emissions reduction, grades that domestic mining and beneficiation capacity currently struggle to supply at scale.
- **Export imbalance:** India's iron ore exports for FY26 were around 25.7 MTPA, while India exported roughly about 30 MT of iron ore in FY25, equiva lent to 8% to 10% of total production (~290 MT), down from prior peaks due to greater domestic absorption, weaker Chinese demand, and regulatory signaling rather than a formal export ban. Policymakers have periodically considered export duties on low grade ores to prioritize domestic steelmaking, reflecting a shift from export monetization to value added steel maximization.

Historical trend of India's iron ore imports and exports (FY19-FY26) in million tonnes



Source: Ministry of Mines

- **Merchant miner economics and risk:** For merchant miners, particularly in Goa and Odisha, exports often yield higher realizations for low grade fines that have limited domestic offtake without beneficiation. This creates structural tension: unless beneficiation and domestic offtake mechanisms expand, miners may favor exports during external price upswings. The absence of a binding domestic supply obligation explains the recurring debate on export duties rather than an outright ban.
- **Strategic implication:** Volume sufficiency is no longer the primary goal; quality security is likely to increasingly determine cost competitiveness as the industry shifts toward coal-based DRI and future green steel pathways.

[7]Economic Times Analysis
[8]Angelone Reports

Coking coal: The most acute trade vulnerability

- **High import dependence:** India remains ~85% -90% import-dependent for coking coal, primarily sourcing from Australia, despite overall coal import reductions. Domestic coal reserves are non coking, and high-quality coking coal availability remains constrained.[9]
- **Trade exposure and cost risk:** Volatility in global coking coal prices directly impacts Indian steel margins, making this the single largest raw material externality in steel cost structures. Government programs such as Mission Coking Coal aim to raise domestic production by 2030, but import dependence is likely to persist through the current capacity expansion cycle.

Steel scrap: Strategic hedge with trade constraints

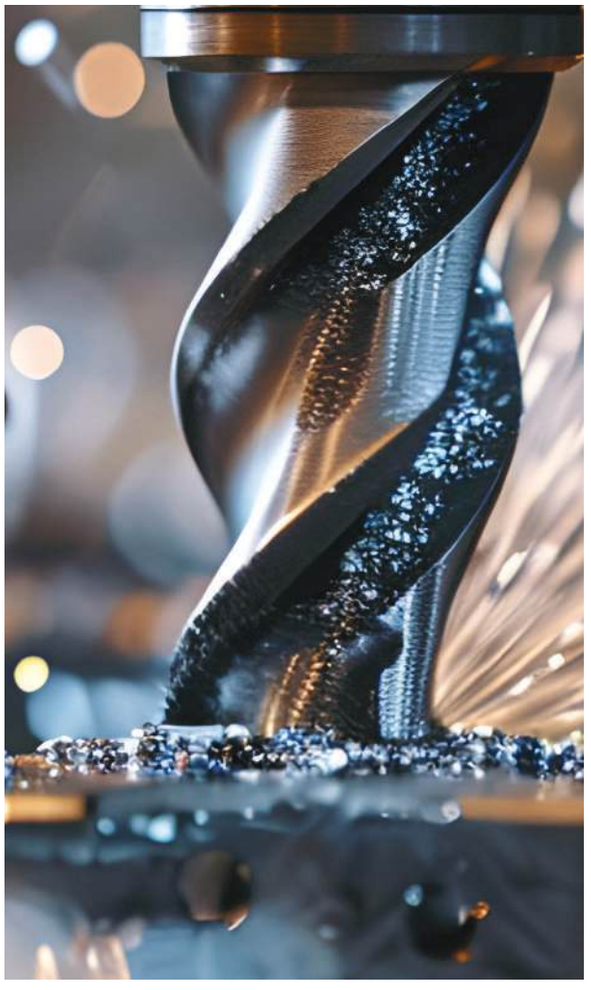
- **Rising role, limited domestic supply:** Scrap consumption in Indian steelmaking reached 36 MT in FY26, of which approximately 28 MT was generated domestically and 8 MT was imported. Thus, imports accounted for about 22% of total ferrous scrap consumption, indicating continued import dependence despite policy efforts to strengthen domestic scrap collection, vehicle scrapping and recycling infrastructure.[10]
- **Import dynamics:** Scrap imports recovered to approximately 8 MT in FY26, after declining in FY25 as competitively priced domestic DRI and sponge iron substituted imported scrap. Despite higher domestic scrap availability, imports still supplied around 22% of the 36 MT of ferrous scrap recycled during FY26. Over the longer term, increased EAF adoption and the transition towards lower-carbon steelmaking are expected to raise demand for high-quality scrap, leaving India exposed to global scrap availability and price volatility.

Cross raw material strategic implication

Across iron ore, coking coal, and scrap, India's steel sector faces a quality and control challenge rather than a supply shortage. As capacity scales toward 300 MT, competitivenesss will depends on:

- **Securing grade appropriate ores domestically,**
- **Managing coking coal exposure through diversification and efficiency, and**
- **Building scrap security through recycling and selective imports.**

In this context, raw-material trade policy is evolving from neutrality to strategic calibration, balancing miner incentives, steel competitiveness, and long term industrial resilience.



1.3.2 Trade Rebalancing

India's steel trade profile underwent a sharp inflection over the past 18 months as the government moved to protect domestic capacity utilization from elevated low-priced imports originating from surplus steel-producing economies.

Trade barriers and free trade agreements shaping India's steel trade dynamics

India's steel trade dynamics are increasingly influenced by an evolving landscape of tariff defenses, non tariff barriers, and selective trade agreements, reflecting the strategic imperative to shield domestic capacity expansion while maintaining export competitiveness will depend in a fragmented global market.

[9]EY analysis: ISA Coaking Coal report
[10]BigMint Report

1.3.3 India's role in the global steel macro economy

India moved counter-cyclically to the global steel market in FY26. While global crude steel production declined by 2.0% in calendar year 2025, India's output increased by 10.4% to 164.9 MT. This momentum continued through FY26, with domestic crude steel production rising by 10.7% year-on-year to approximately 168.4 MT. The divergence highlights India's position as the principal volume-growth engine among major steel-producing economies, supported by capacity additions and sustained domestic demand from infrastructure, construction and manufacturing.

- **Global alignment:** The OECD Steel Outlook 2025 highlights India as one of the few regions where capacity expansion, targeted to hit 300 MTPA by 2030-31, remains structurally aligned with demand.
- **Regional anchor:** With Chinese production likely having peaked and exports coming under increasing global regulatory pressure, India has transitioned from being a price taker to a regional anchor of demand stability.

The metrics confirm that India's steel dynamics are no longer a peripheral indicator-they are core to the nation's industrial resilience. The move back to a net exporter position in FY26, supported by the three-year safeguard duty, provides the domestic industry with a stable window to execute its massive capital expenditure programs. However, for this macro advantage to translate into durable global leadership, we must solve the emerging raw material quality constraints and accelerate our logistics efficiency.



1.4 Roadmap: Navigating the three horizons of Indian steel

Near-term (through 2030): The capacity and consumption sprint

This phase focuses on fulfilling the core objectives of the National Steel Policy (NSP) 2017 and aligning with the current multi-trillion-dollar infrastructure cycle.

- **Capacity goal:** Target of 300 million tons per annum (MTPA) of crude steel capacity by 2030-31.
- **Consumption benchmark:** Raising per capita steel consumption to 160 kg by 2030-31.
- **Infrastructure synergy:** Steel demand is expected towill be anchored by the National Infrastructure Pipeline (NIP) and PM Gati Shakti, which involve a combined investment outlay of approximately US$1.3 trillion.
- **Segment focus:** Fulfilling 100% of domestic demand for high-grade automotive steel, electrical steel, and specialty alloys by 2030-31 through initiatives like the PLI Scheme for Specialty Steel.
- **Decarbonization milestone:** Reducing sectoral carbon emission intensity by 20% (target of ~2.4 t/tcs) by 2030.
- **CCUS-ready capacity without carbon lock-in:** Embed CCUS-readiness (not deployment) into all new large BF-BOF capacities to avoid carbon and capital lock-in while prioritizing efficiency, scrap usage, and energy optimization for immediate emission reductions
- **Resource security:** Executing Mission Coking Coal to increase domestic raw coking coal production to 140 MT by FY30, reducing import reliance from 85% to 65%.

Mid-term (through 2035): Technological maturity and deep decarbonization

As the initial capacity expansions stabilize, the industry is positioned to will shift toward high-value manufacturing and the adoption of cleaner production technologies.

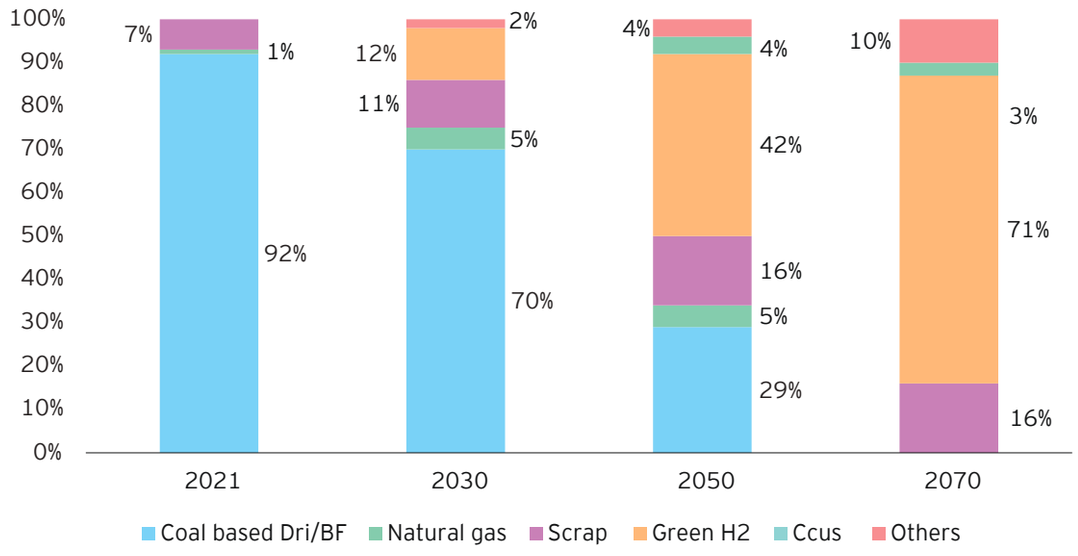
- **Technology pivot:** A structural transition from coal-based rotary kilns to gas-based shaft furnaces as a bridge toward full green hydrogen adoption.
- **Hydrogen integration:** Scaling green hydrogen-based steelmaking beyond early pilot projects (currently funded with INR455 crore under the National Green Hydrogen Mission) toward commercial-scale operations.
- **CCUS as a transitional bridge for legacy assets:** Deploy CCUS selectively as a transitional bridge on young, export-exposed BF-BOF assets, clustered with other industries, to protect capital, jobs, and competitiveness while hydrogen and circular steel scale up.
- **Circular economy:** Full operationalization of the Scrap Recycling Policy to reduce primary raw material dependence and support the growth of low-emission Electric Arc Furnace (EAF) production routes.
- **Urbanization drivers:** Demand is expected towill be increasingly driven by the projection that over 400 million people will reside in Indian cities by 2030, contributing to 60% of GDP and requiring massive urban infrastructure renewal.

Long-term (through 2047): The Viksit Bharat Vision

The ultimate horizon aligns the steel industry with India's goal of becoming a developed economy (Viksit Bharat) by the centenary of its independence.

- **Vision 2047 capacity:** The long-term blueprint targets a total steelmaking capacity of 500 MTPA.
- **Global positioning:** Transitioning from a regional demand anchor to a dominant net exporter, aiming for zero steel imports and global leadership in high-end steel application sectors.
- **Sustainability goal:** Progressing toward the national commitment of net zero by 2070, with the steel industry acting as a primary driver of industrial decarbonization through CCUS (Carbon Capture, Utilization, and Storage) and fossil-free manufacturing.
- **Macroeconomic scale:** Supporting a projected $30 trillion economy by 2047, where manufacturing reaches a 25% share of GDP

India's projected steel decarbonisation roadmap till 2070



Source: : Source: IEEFA

Strategic execution risk

Addressing land acquisition and project timelines

While the roadmap to 300 MTPA by 2030-31 is structurally aligned with India's infrastructure cycle, achieving this capacity requires mitigating historical execution hurdles. Specifically, the acceleration of land acquisition processes and environmental clearances remains a critical path for the timely commissioning of greenfield projects. Close public-private coordination among industry leaders is essential so that the projected US$1.3 trillion infrastructure outlay translates into steel-intensive asset creation without capital lock-in.

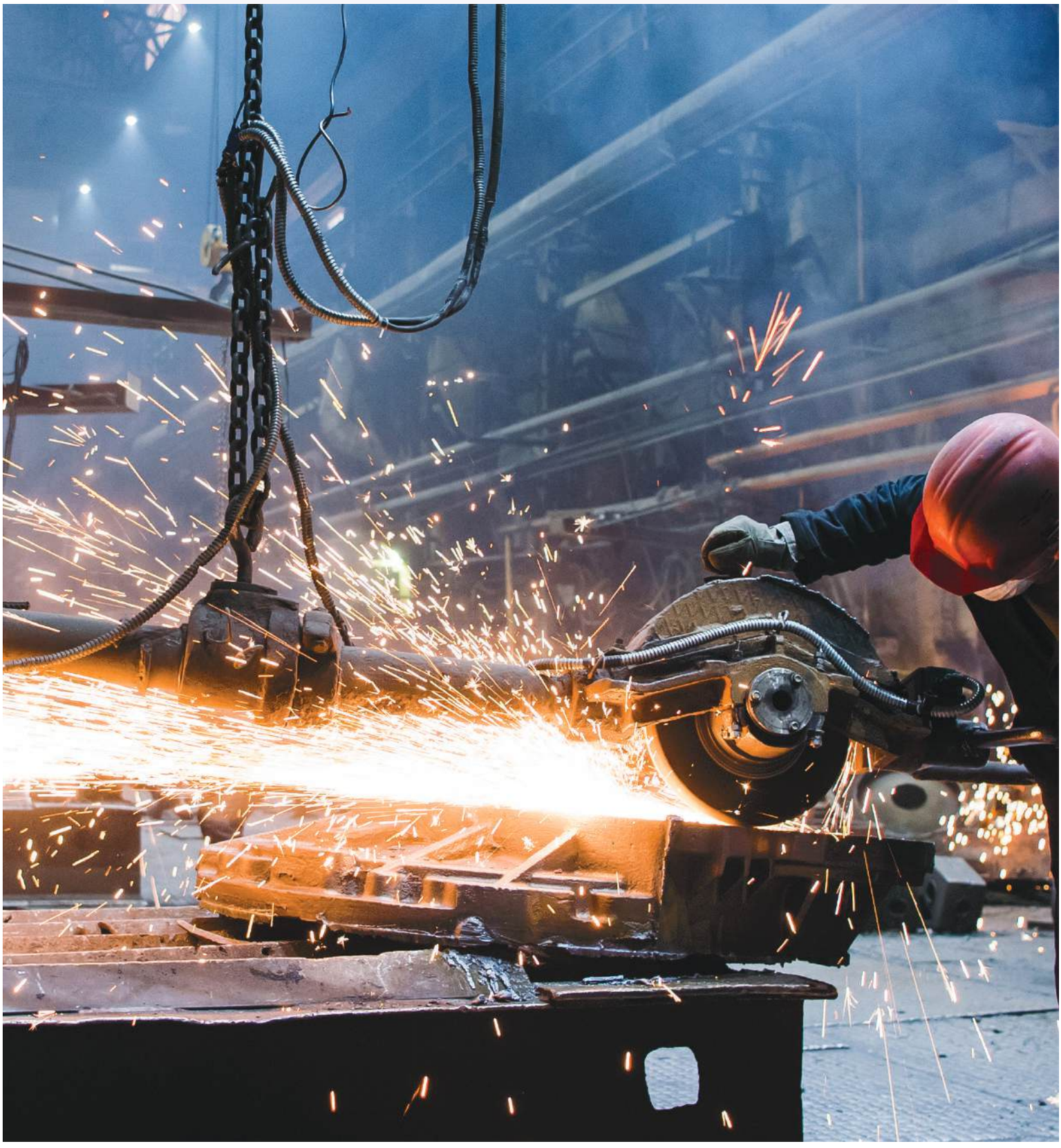
Bridging the high-grade raw material gap

A secondary risk to the 2030-31 production target of 255 MT is the emerging grade mismatch in domestic iron ore. While India is a major producer, the industry faces a "Quality Security Challenge" where high-grade ore imports are projected to reach 12 MT to 14 MT in FY26 due to domestic supply constraints. Reaching the 300 MT target would necessitate significant investments in domestic beneficiation capacity to utilize low-grade ores, which are currently

While Viksit Bharat articulates the aspiration for high value, sustainable manufacturing , the industry's success iswill ultimately be determined by near term execution: closing current capacity gaps, aligning production with rapidly shifting demand profiles, and delivering timely additions during India's most steel intensive phase of development. Translating this ambition into outcomes requires a clear understanding of the sector's underlying demand-supply mechanics.

The following section therefore examines the demand and supply dynamics of India's steel industry, assessing production trajectories, consumption drivers, and capacity expansion pathways that are expected to will ultimately shape India's journey toward global steel leadership.

While the 300 MTPA capacity target for 2030 is within sight given current brownfield and greenfield momentum (such as AM/NS India has laid the foundation for its Anakapalli plant in Andhra Pradesh, with an 8.2 MTPA first phase and steelmaking targeted to begin by Q1 2029. JSW Steel plans around 1.3 trillion of investment to add 16 MTPA by FY30, including a 5 MTPA Dolvi expansion due in FY2027-28. Tata Steel completed the 5 MTPA Kalinganagar Phase II in 2025 and has approved further projects at NINL, Meramandali and in Maharashtra. SAIL plans to reach 35 MTPA by FY2030-31 with an indicative investment of about 1.1 lakh crore) the 500 MTPA target for 2047 requires a complete reimagining of our logistics and energy backbones. We cannot reach 500 MTPA using current methods; it will requires a massive shift toward maritime logistics (Amrit Kaal Vision 2047) and a decarbonization investment of approximately $283 billion to make our existing and future production green. The roadmap is set, but the victory is dependent on thewill be in the execution of these structural shifts





Chapter 2

Supply-side analysis

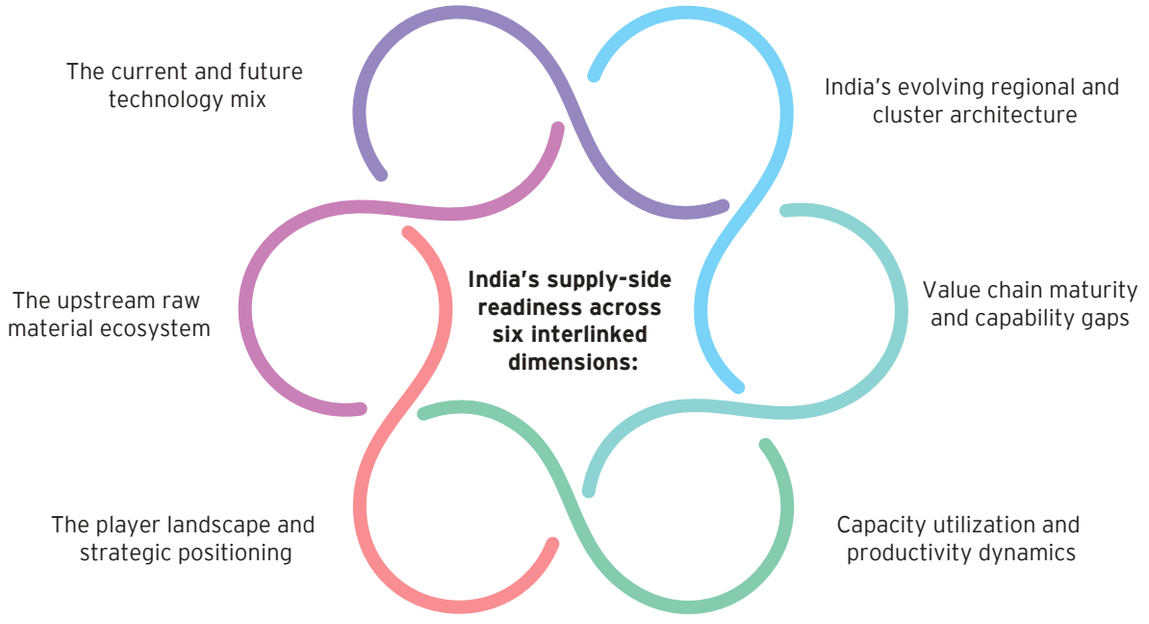
2.1 Supply platform driving India's growth ambition

India enters the second half of the 2020s as a structurally significant global steel producer, having completed a decade of rapid capacity expansion and scale-led growth. This transformation – already detailed in the preceding chapter – establishes a critical baseline: India's steel sector is no longer emerging but systemically embedded in global supply, trade flows and emissions accounting.

The 300 MTPA capacity target for 2030 has increasingly become a working planning assumption, reflected in announced investment pipelines and balance-sheet allocations across major producers. The more consequential issue, however, lies beyond this milestone: what might India's steel supply base look like by 2035 and 2047?

As capacity expands, a key strategic choice emerges – whether growth primarily extends the existing coal-intensive and technologically fragmented model, or whether this phase is used to deploy a next generation steel supply infrastructure that is cleaner, more efficient and globally competitive. With national steelmaking capacity articulated around a 500 MTPA ambition under Viksit Bharat 2047, and with instruments such as the EU's Carbon Border Adjustment Mechanism (CBAM) beginning to impose tangible costs on carbon-intensive exports, these choices are likely to carry trillion-rupee implications for competitiveness, capital efficiency and long-term industrial viability.

To understand and answer these questions, this chapter examines:



2.2 India's technology mix and the green steel imperative

2.2.1 The current technology mix: BF-BOF, EAF and Induction furnace

India's steel industry's structural resilience and cost competitiveness are fundamentally shaped by a bifurcated, yet internally differentiated, technology landscape. Steelmaking in India broadly spans three technological routes: Blast Furnace-Basic Oxygen Furnace (BF-BOF), Electric Arc Furnaces (EAF) and Induction Furnaces (IF).

At present, the BF-BOF route, representing the dominant integrated pathway, accounts for approximately 40% to 45%[11] of total installed capacity. This segment is largely concentrated among large, integrated producers, whose competitiveness is underpinned by captive iron ore access, scale economies, and stable high-volume output. However, the BF-BOF route remains heavily dependent on imported coking coal, exposing producers to global price volatility while embedding structurally higher carbon emissions within the production process.

The remaining 55% to 60% of capacity is routed through the electric steelmaking pathway, comprising both Electric Arc Furnaces (EAFs) and Induction Furnaces (IFs). The EAF route, accounting for roughly 21% of installed capacity, is gradually expanding but faces structural constraints. Despite offering greater process flexibility and lower theoretical energy intensity, EAF viability in India is limited by insufficient availability of high-quality scrap, high open-access power tariffs, and continued reliance on alternative metallic inputs.

Induction Furnaces (IF), forming the backbone of India's secondary steel sector and MSME ecosystem, constitute approximately 36% of installed capacity. IF units are typically clustered in demand-proximate regions and operate at smaller, modular scales. Given quality limitations and inconsistencies in domestic scrap supply, the sector predominantly follows a DRI-IF feedstock model, relying extensively on domestically produced Direct Reduced Iron (DRI).

As a result, despite a majority share of capacity being installed under "electric" steelmaking technologies, India's steel sector remains inherently carbon-intensive. This outcome reflects not a limitation of the core technologies themselves, but structural deficiencies in supporting infrastructure and input ecosystems. In particular, the absence of a well-developed scrap collection, processing and aggregation system, coupled with the limited availability of gas-based DRI, prevents a meaningful transition toward low-carbon steelmaking-forcing both EAF and IF operators to depend heavily on coal-based DRI.

Exhibit 1: India's steelmaking technology mix: Capacity, production and carbon profile (FY25)

Steelmaking route	Installed capacity share (FY25)	Key characteristics and outlook
BF-BOF (Blast Furnace - Basic Oxygen Furnace)	80 – 90 MTPA	Dominant primary route; high capex/carbon intensity; captive ore advantage
EAF (Electric Arc Furnace)	~40 – 45 MTPA	Growing; scrap + DRI feed; key to green transition; open-access RE barriers
IF (Induction Furnace)	~70 – 75 MTPA	MSME-dominated; DRI-IF route prevalent; quality constraints; demand-proximate

Source: GMK Center / BigMint (April 2025); World Steel Association (2025); Ministry of Steel; IBEF (2025).

[11]Press Release – Ministry of Steel

2.2.2 The technology transition roadmap for India's Green Steel Mission

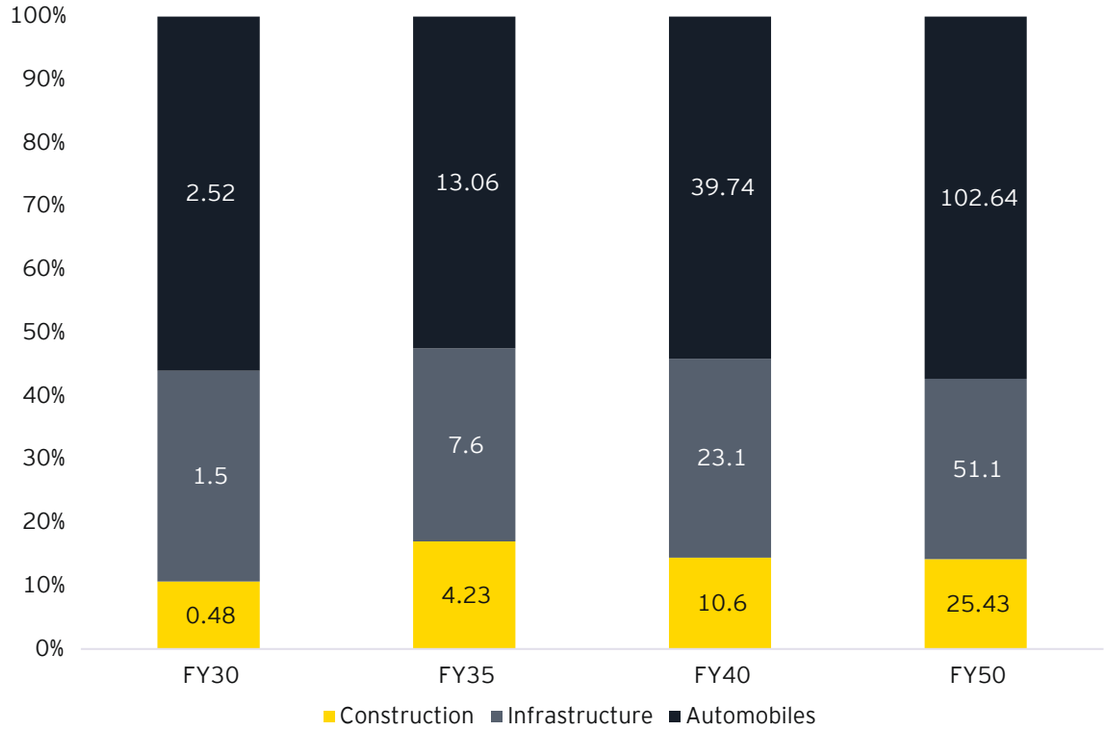
India's Green Steel Mission – – with an estimated outlay of INR15,000 crore – is the structural policy vehicle for technology transformation. Anchored in the National Green Hydrogen Mission (INR455 crore allocated for steel sector pilot projects)[12], it defines a phased shift from coal-based routes to three decarbonization pathways:

- Energy efficiency retrofits and renewable electricity integration with existing BF-BOF brownfield assets
- Gas-DRI as a bridge technology where pipeline access allows
- H-DRI/EAF as the definitive green primary steelmaking route from the 2030s onward

The Ministry of Steel has awarded three pilot projects under the National Green Hydrogen Mission: two targeting 100% H DRI in vertical shaft furnaces and one for hydrogen injection in blast furnaces to reduce coke consumption. These projects mark the industry's entry into demonstration-scale green steelmaking. The Green Steel Public Procurement Policy – – mandating that government agencies purchase green steel from FY28 – – creates an early demand signal that couldwill de-risk these private investments.

Green steel demand is projected to grow from negligible levels today to ~4.5 MT by FY30, expanding sharply to 20 MT+ by 2035 as H-DRI becomes commercially viable.[13] The cost trajectory is decisive: green hydrogen costs need to fall from today's US$4- US$6/kg toward a US$1- US$2/kg viability threshold, with projections showcasing hydrogen production to be clean soon and that commercial parity shall be achievable by 2030 in the most competitive markets.

Demand for green steel in construction, infrastructure and automobile sectors in India (MMT)



Source: EY Parthenon analysis based on primary interaction/interviews

[12]Press Release: Ministry of Steel
[13]EY Analysis: Unlocking Green Steel Demand

Exhibit 2: India's green steel decarbonization trajectory from 2025 to 2047

Milestone	Emission intensity target	Technology pathway
2025 (Baseline)	~2,550 kg CO_2/t	BF-BOF dominant; coal DRI prevalent
2028	~1,950 kg CO_2/t	Energy efficiency retrofits; RE integration begins
2030	~1,650 kg CO_2/t	Coal-based route share falls to ~70%; gas DRI grows
2035	~900-1,000 kg CO_2/t	H-DRI/EAF commercial scale; scrap ecosystem matures
2047 (Viksit Bharat)	Net Zero trajectory; <500 kg CO_2/target	Full H-DRI Transition; 80%+ scrap/EAF share

Source: Ministry of Steel Green Steel Roadmap (September 2024)

2.2.3 Technology transition constraints requiring targeted interventions

- Scrap infrastructure gaps remain the most immediate and binding constraint on EAF growth. India generates ~32-35 MT of scrap annually, fragmented across informal channels, with copper and other tramp element contamination undermining melt quality. The Parliamentary Standing Committee explicitly flagged the absence of a centralized scrap database. IF units have responded by shifting towards 80% DRI / 20% scrap charge mixes in 2025-26, insulating quality but deepening dependence on coal-DRI. More than 180 vehicle scrapping centers are operational and represent the first institutional response; scaling to more than 500 could unlock approximately 11 MT/yr ELV scrap reservoir projected for 2036-2041.

- Renewable energy access for steelmaking is structurally uneven. Karnataka's 50% open-access cross-subsidy waiver was struck down in early 2025 following regulatory disputes. Odisha and Chhattisgarh offer comparable incentives under specific conditions. Without a national open-access policy, EAF/IF operators in key states face grid power costs that make round-the-clock renewable energy procurement uneconomic, which is a prerequisite for green steel competitiveness.

- MSME modernization barriers are structural. Over 1,000 IF units lack access to affordable long-tenure financing for furnace upgrades, AI-driven process optimization, or quality monitoring systems. The proposed Technology Upgradation Fund and SRTMI co-funding (up to 60% to 75% of project cost) are the appropriate instruments; deployment at scale requires simplified access, lower thresholds and transparent disbursement.
- India's R&D intensity at ~0.64% to 0.65% of GDP compares poorly to South Korea (5.0%), Japan (3.4%) and China (2.6%). Steel-sector R&D spending is similarly low. INR1 lakh crore RDI corpus over six years (ANRF/RDI scheme, FY25-26 budget) and SRTMI's challenge-method co-funding provide the architecture for closing this gap – – if steel firms leverage the stacking of PLI + SRTMI + RDI incentives for innovation projects.

Addressing these technology-transition constraints is not an end in itself; it is the enabling condition for a credible, time-bound decarbonization pathway. Once the bottlenecks around scrap availability, renewable power access, MSME modernization, and innovation capacity are resolved, the sector can shift from episodic pilots to scalable implementation. Below is the quantification of the resulting CO reduction trajectory and the competitiveness gains that follow.

CO_2 reduction trajectory and macroeconomic dividends

This capital deployment is projected to trigger a steep decline in India's carbon intensity. By aggressively adopting Hydrogen-DRI/EAF routes-which can cut emissions by 40% to 60% per ton-maximizing EAF scrap integration and leveraging digital process optimization (yielding 5% to10% energy efficiency gains), the sector targets a radical transformation. From a baseline of approximately 2,550 kg CO/ton in 2025 , the industry targets a steady decline to ~1,950 kg by 2028 (a 20% reduction), ~1,650 kg by 2030 (a further 15% reduction), and ultimately reaching a global benchmark of 900-1,200 kg CO/ton by 2035-a 50% to 60% reduction in emission intensity. India's total absolute steel CO emissions are correspondingly projected to fall from ~270 million tons per year in 2025 to 160-180 million tons by 2035.

India's competitive positioning in the global green steel race

As the global green premium erodes, fierce competition for market share is underway. By 2035, China is projected to command the highest absolute volume with 15 MT to 18 MT of installed green steel capacity, targeting US$12 billion to US$15 billion in green steel exports . Advanced economies such as Japan (5 MT to7 MT) and South Korea (5 MT to 6 MT) are positioned to leverage deep R&D ecosystems to dominate high-value export markets. However, India is strategically positioning itself to lead in the relative transition scale. By 2035, India targets 20 MT+ of installed green steel capacity, with green steel constituting 30% to35% of total output-heavily outpacing Japan (15% to 25%) and South Korea (15% to 20%) in proportional decarbonization, and exceeding China's projected 10% to18% share.

With the decarbonization pathway and export positioning defined, the next question is execution: Where should India locate the capacity and infrastructure?



2.3 India's steel geography and its 2035 evolution

2.3.1 Cluster formation logic and the emerging northern demand belt

India's steel geography is shaped by the interplay of mineral endowment, coastal logistics and demand-pull. The Eastern ore belt dominates primary steelmaking; coastal western clusters leverage port efficiency for raw material imports and product exports; the southern cluster combines ore access with automotive demand; and Bengal/West India clusters serve as secondary and export-linked hubs. The most significant structural shift underway for 2035 is the migration of secondary steel capacity toward India's northern demand belt, i.e., Rajasthan, Gujarat hinterland, Haryana and UP, where urbanization, PM Awas Yojana, and Smart City programs are generating fast-growing, demand-proximate consumption that the Eastern primary cluster cannot serve cost-efficiently through long-rail freight.

Exhibit 3: India steel regional clusters: Installed capacity, drivers and 2035 outlook

Cluster	Installed capacity (Approx.)	Cluster formation driver
Eastern Ore Belt (Odisha, Jharkhand, Chhattisgarh)	~80-100 MTPA	Iron ore and coking coal proximity; Paradeep/Dhamra ports
Western Coastal Cluster (Gujarat, Maharashtra)	~30-50 MTPA	Deep-draft ports (Hazira, Mundra, Pipavav); coastal logistics
Southern Cluster (Karnataka, Andhra Pradesh)	~25-30 MTPA	Vijayanagar ore belt; Vizag/Krishnapatnam ports
Eastern Bengal and Coastal WB (West Bengal)	~10-20 MTPA	Port access (Haldia); demand proximity (East India)
Northern Demand Belt (Rajasthan, Gujarat Hinterland, Haryana, UP)	~10-15 MTPA (secondary/IF dominant)	Rapid urbanization; PM Awas Yojana; smart city demand
Emerging Central Corridor (MP, Chhattisgarh non-ore, Telangana)	~6-10 MTPA	Mineral linkages; rail infrastructure; Central India demand
Emerging Gadchiroli Steel Cluster (Eastern Maharashtra)	~50 MTPA under development / proposed	High-grade iron ore availability; development of integrated mine-to-steel ecosystem; improving rail/freight connectivity; planned linkages toward JNPA/Vadhavan and western markets

Source: Ministry of Steel; ISA; IBEF (2025); GMK Center (April 2025)

2.3.2 Future cluster evolution: Coastal, green, and export-oriented

The three structural cluster shifts that are shaping India's 2035 supply map are already in motion. Coastal steel hubs — anchored in Maharashtra, Andhra Pradesh and Odisha — are expected to add an estimated 40-50 MTPA of greenfield integrated capacity on port-proximate sites, lowering coking coal freight costs significantly. Green steel hub concepts—envisaging the co-location of renewable energy corridors and hydrogen electrolyzer near eastern mineral clusters in Odisha and Jharkhand — are currently at an early design stage, with shared electrolyzer infrastructure emerging as a potential lever to spread green-hydrogen capex across producers. Export-oriented specialty clusters linked to Gujarat and Maharashtra automotive and defense zones could leverage PLI scheme-driven capacity in CRGO, superalloys and high-strength steel, targeting India's CBAM-preparedness window.

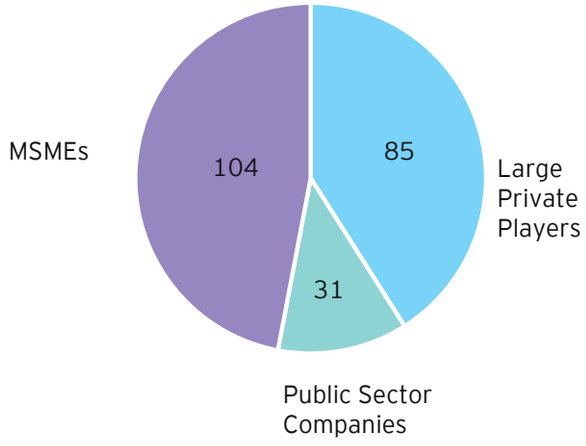
2.4 Mapping India's 220 MTPA producer base

India's 220 MT capacity base is not monolithic; it is a layered ecosystem of three tiers, each with its own cost structure, technology profile and competitive logic. The large private integrated producers dominate at 40% to 42% of total capacity, operating at the commercial frontier with port-adjacent or ore-adjacent advantages.

The public sector accounts for 10% to 15% of total capacity and carries the strategic weight of regional employment and commodity security, but it operates under cost and governance constraints that private players do not face.

The MSME and secondary sector accounts for 45% to 50% of capacity and produce significant volume of TMT, wire rod, and structural sections that reach India's construction sites, yet remains chronically under-invested and maximally exposed to input volatility.

Exhibit 4: India's steel: Installed capacity by player segment (~220 MTPA Total, FY26)



Source: Individual annual reports for FY26

2.4.1 Tier-specific vulnerabilities that constrain the supply base

The PSU challenge is one of structural stagnation. SAIL's five plants – most commissioned in the 1960s to1980s – carry BF-BOF assets that are 15 to 30-year-old, incur higher employee costs per ton than the private-sector benchmarks and carry massive gross debt. The resulting financial constraint prevents the modernization capex that the next decade demands, while RINL's unresolved divestment status creates an investment overhang that deters both internal spending and interest from potential partners.

Strategic recommendation

- PSU modernization has been resolved elsewhere not through privatization, but through performance-mandated, ring-fenced capital.
- South Korea's POSCO – a state-owned enterprise until 2000 – was turned into the world's most cost-efficient steelmaker through a performance compact (including EBITDA targets, utilization floors and carbon intensity trajectories) backed by Korea Development Bank concessional debt.
- Germany's Saarstahl accessed blended state-private financing for its EAF transition without full divestiture.
- A SAIL asset renewal mandate funded through NaBFID long-tenure bonds, with disbursement conditional on performance metrics – and technology Joint Ventures with private players in product lines such as electrical steel and specialty rails, where private producers hold grade advantages.

The large private producers face a distinct tension: their balance sheets still carry expansion-era leverage just as the green transition demands a new wave of capital. Shifting or augmenting legacy BF-BOF assets with EAFs or hydrogen-based DRI requires multi-billion-dollar commitments that layer on on top of, rather than replacing, ongoing capacity expansion plans, intensifying capital allocation and return pressures. When Chinese import surges compress HRC realizations, as they did in H1 FY25, EBITDA narrows at the moment green-transition investment decisions require long-term cash flow confidence.

Strategic recommendation

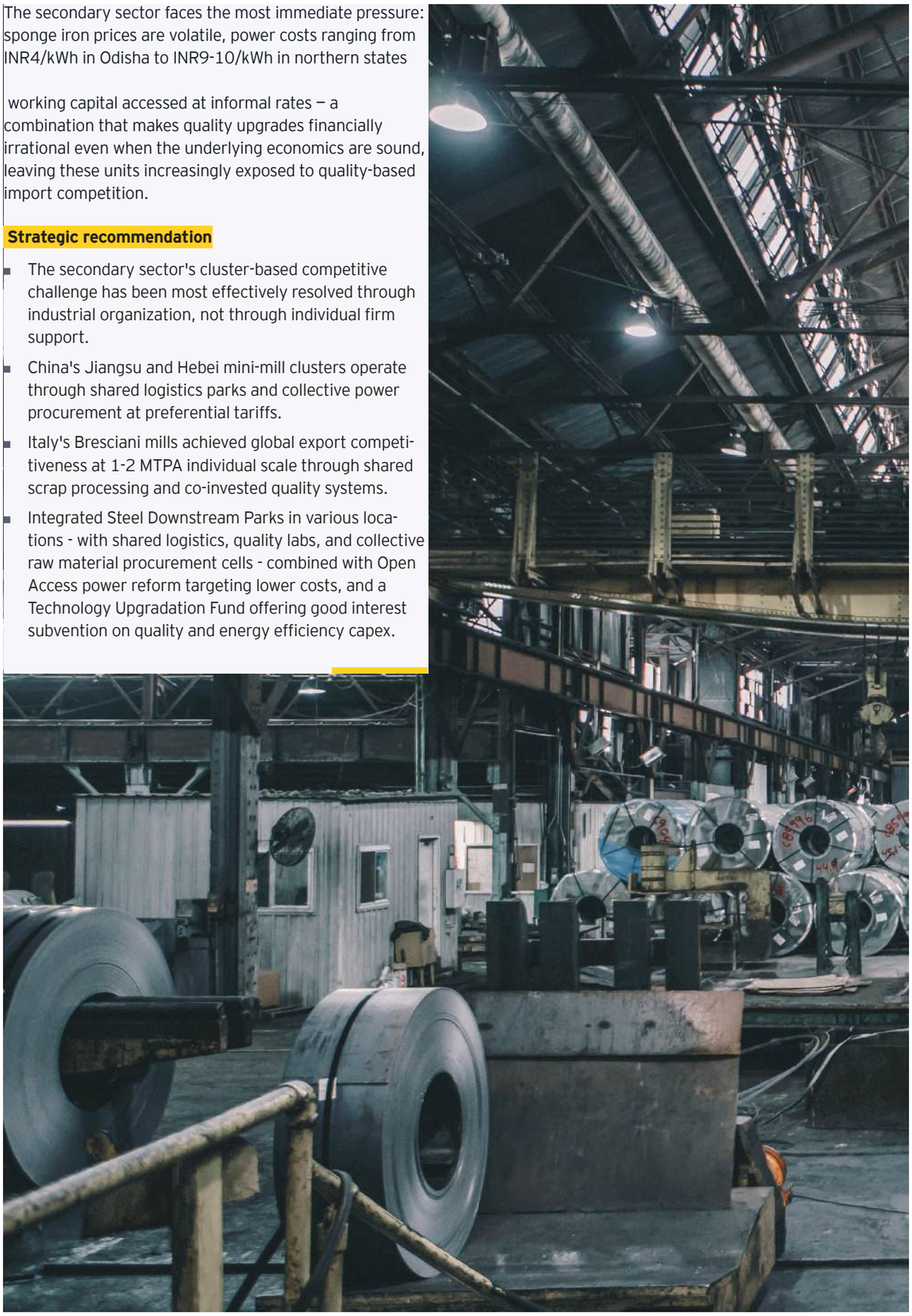
- The private sector's green-transition capex burden has clear international precedents. Germany's H2Global mechanism absorbs the cost gap between green hydrogen production and market pricing for a committed initial offtake, drawing private capital into technologies that would otherwise remain uneconomic for years. Similarly, the UK's co-investment in Port Talbot facility made the shift to EAF viable where the company's balance sheet alone could not.
- India's response needs to blend two distinct approaches: a voluntary raw-material procurement consortium to structurally lift operating margins and competitiveness, coupled with an Indian green steel contract-for-difference to underwrite the green steel cost premium and catalyze private investment at scale.

The secondary sector faces the most immediate pressure: sponge iron prices are volatile, power costs ranging from INR4/kWh in Odisha to INR9-10/kWh in northern states

working capital accessed at informal rates — a combination that makes quality upgrades financially irrational even when the underlying economics are sound, leaving these units increasingly exposed to quality-based import competition.

Strategic recommendation

- The secondary sector's cluster-based competitive challenge has been most effectively resolved through industrial organization, not through individual firm support.
- China's Jiangsu and Hebei mini-mill clusters operate through shared logistics parks and collective power procurement at preferential tariffs.
- Italy's Bresciani mills achieved global export competitiveness at 1-2 MTPA individual scale through shared scrap processing and co-invested quality systems.
- Integrated Steel Downstream Parks in various locations - with shared logistics, quality labs, and collective raw material procurement cells - combined with Open Access power reform targeting lower costs, and a Technology Upgradation Fund offering good interest subvention on quality and energy efficiency capex.



2.5 Bridging the utilization gap

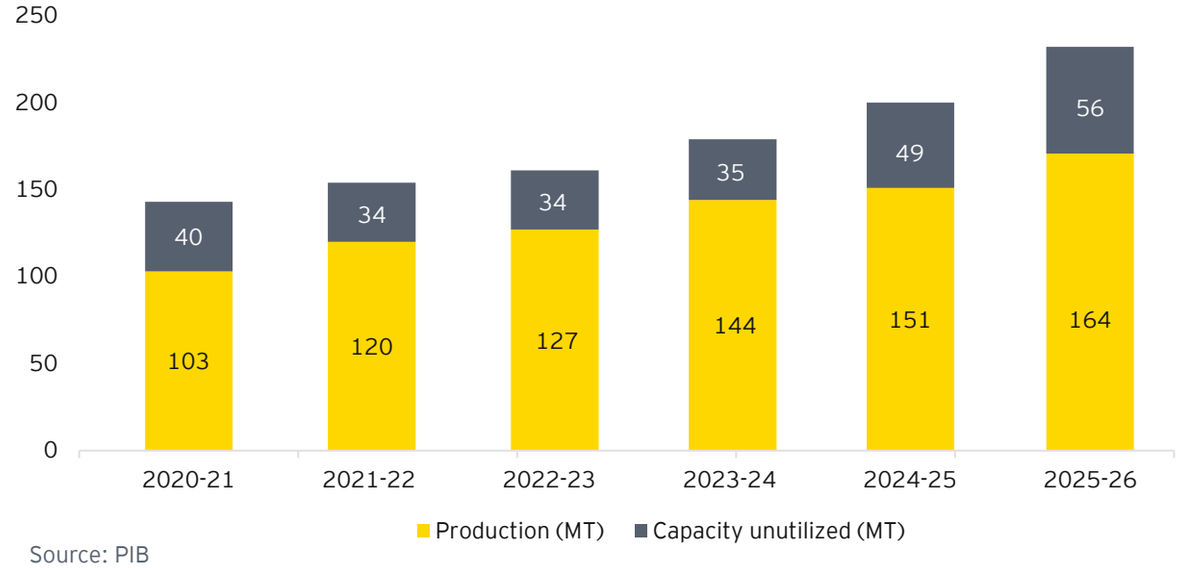
While installed capacity offers a measure of the steel sector's long-term production potential, actual output and capacity utilization provide a more accurate picture of prevailing supply dynamics. The relationship between the two reflects not only available headroom in the system but also emerging structural pressures related to efficiency, market alignment and resource constraints.

India's crude steel production increased from 144.3 MT in FY24 to 152.2 MT in FY25, representing year-on-year growth of approximately 5.5%. This momentum strengthened in FY26, with production reaching ~169 MT, an increase of approximately 11.8% year-on-year. Crude steelmaking capacity stood at 220.41 MTPA in FY26, implying an aggregate capacity utilisation of around 77%. Growth was supported by capacity additions and strong domestic demand from infrastructure, construction and manufacturing, reinforcing India's position as the world's second-largest crude steel producer.

Despite this upward trajectory, a persistent gap between installed capacity and realized output continues to characterize India's steel ecosystem. This divergence does not merely indicate weak production fundamentals; rather, it reflects a complex interplay of structural constraints operating across both the supply and demand sides of the market. Key factors limiting the sector's ability to fully absorb available capacity include:

- Uneven growth across end-use sectors,
- Misalignments in product mix relative to market requirements,
- Regional imbalances in steel consumption and
- Demand for specific quality grades that existing capacity is not optimally equipped to serve.

Steel capacity vs production



Source: PIB

Understanding this underutilization, therefore, requires a two-pronged analytical approach. While a detailed examination of demand-side dynamics is undertaken in the subsequent chapter, a comprehensive assessment must begin with the upstream structure of the steel industry itself.

2.6 The upstream equation: Raw material security, energy and mining

2.6.1 Integrated raw material risk matrix

Exhibit 6: Raw material risk matrix: India's steel sector

Material	Domestic availability	Import risk	Price volatility
Iron ore	High (4th largest producer; 700 MT/yr potential)	Low	Moderate
Coking coal	Very low (domestic met coal negligible)	Very high (85% import dependence)	Very high (US$120- US$ 600/ton range for the last five years)
Scrap	Moderate (32-35 MT domestic; rising)	Moderate	Moderate
Green hydrogen	Nascent (Pilot project awarded)	Tech risk (technology/ infra risk)	High (US$4-6/kg vs. US$1-2/kg viability thresh-old)

Source: Indian Bureau of Mines; IBEF; IEEFA; IEA Green Hydrogen Report (2025)



2.6.2 Coking coal: India's single largest external vulnerability

Coking coal accounts for 35% to 45% of BF-BOF steelmaking costs , and India's 85% to 90% import dependence makes it structurally exposed to a market it cannot influence. Every US$100/ton increase in coal prices translates to US$60- US$70/ton increase in steel production cost-directly compressing margins, eroding export competitiveness, and undermining investment confidence in specialty steel. Global prices fluctuated between US$120 and US$600/ton over the past five years. Freight adds US$15- US$30/ton to the landed cost, priced separately and subject to its own volatility .

India's mills price on Platts Premium Low Vol (PLV) FOB Australia — a benchmark designed for Australian export conditions and dominated by China's demand dynamics. With no India CFR index, no pooled procurement and minimal hedging participation (<5% of exposure hedged), India is a passive price taker in its most critical input market. At 300+ MTPA steel scale, annual coking coal imports could exceed significantly, making the current absence of a pricing mechanism a national industrial security gap.

Exhibit 7: Coking coal procurement structure: India vs. comparators

Factor	India	China	Japan	South Korea
Import dependence	Very high (85%)	Medium	Very high	Very high
Procurement model	Fragmented; mill-by-mill	State-consolidated	Coordinated (trading houses)	Long-term strategic contracts
Domestic pricing index	No (price taker)	Yes (futures trading)	Negotiated	Structured
Strategic reserve	No	Implicit (state-backed)	Limited	Limited
Overseas coal assets	Limited (EXIM/NIIF nascent)	Strong (state-backed)	Strong (trading cos.)	Moderate
Hedging ecosystem	Weak (<5% hedged)	Strong	Moderate	Moderate
Price influence	None	High	Moderate	Moderate

Source: World Steel Association; Platts; Ministry of Coal



Addressing this vulnerability requires coordinated interventions, each tackling a different dimension of India's structural exposure:

Exhibit 7A: Coking coal: Full intervention stack

Intervention	Mechanism and design	Rationale and impact
Launch India's CFR Pricing Index	India CFR East/West Coast PLV Index —transaction-based, quality-adjusted, weekly-published, independent oversight	Enables futures trading on MCX, hedging 20% to 30% of exposure Budget certainty for three to six months makes India a price influencer rather than a passive price taker
Aggregated procurement pool	Voluntary Procurement Pool by major players enabling better negotiation and multi-year volume-linked contracts on a sovereign scale	Mirrors Japan's (coordinated trading houses), China's (state-backed consolidated buying), and Korea's (long-term strategic contracts) strategy
Strategic coking coal reserves	Like strategic oil reserves: maintaining national coal stock, used during price spikes to prevent panic buying and stabilize domestic steel pricing	Reduces on spot buying Stabilizes domestic steel pricing during supply disruptions and provides a buffer against geopolitical supply shocks
Overseas coal asset acquisition	Enable private players to acquire stakes in Australian, Mozambican, and Canadian coking coal assets by providing sovereign backing for acquisitions	Mirrors China's state-backed overseas asset model reducing price taker status and providing supply security during market stress
Logistics and port rationalization	Improved rail evacuation from major coal ports, reduced port congestion and handling charges while promoting coastal shipping	Freight savings translate into steel cost reductions. Combined with the coal price reduction, it improves export competitiveness of Indian steel significantly
Coal blending and technology investment	Incentivize higher PCI rates in blast furnaces and promote coke rate reduction using alternative reducing agents Investments in R&D in non-coking coal blends	Japan and Korea operate at lower coke rates due to technology efficiency. India can reduce coal intensity by 5% to 10%, with focused R&D funding through SRTMI

Source: Ministry of Coal; MCX/NSE; EXIM Bank of India

The combined impact of these interventions, if implemented cohesively, is estimated at US$25- US$ 40/tonne in sustained steel cost competitiveness improvement.

At 300 MTPA production scale, this translates to significant cost savings across the industry, with compounding benefits for export competitiveness, specialty steel viability and investment attractiveness.

2.6.3 Iron ore: Domestic strength undercut by structural distortions

India is broadly self-sufficient in iron ore — the world's fourth-largest producer with reserves capable of supporting 700 MTPA output. Yet domestic ore costs are structurally distorted by auction premiums sometimes exceeding 100% to150% of Indian Bureau of Mines base price (particularly in Odisha), opaque transaction structures, and first- and last-mile logistics gaps adding INR500-800/ton above global benchmarks. At 300 MTPA of steel requiring ~450 MTPA of iron ore, even an INR500/ton distortion creates an INR22,500 crore annual cost drag — equivalent to the entire PLI specialty steel scheme outlay, recurring every year.

Unlike coking coal, this is a self-inflicted constraint on a domestically abundant resource, making it the most tractable raw material reform available to the sector.

Exhibit 7B: Iron ore: Full intervention stack

Intervention	Mechanism and design	Rationale and impact
Establish India Iron Ore Index	A transaction-weighted, grade-specific domestic iron ore index, compiled and published weekly by an independent agency using transparent, verifiable transaction data	A credible domestic price index would separate market-based price discovery from fiscal and administrative distortions, better reflect grade-linked price differentials, and create clearer incentives for beneficiation and quality improvement
Premium smoothing and auction reform	Cap excessive auction premiums in key iron ore producing states and convert a portion of any premium above the threshold into production linked royalties payable over the life of the mine Introduce a tenure based smoothing mechanism to spread levy payments across the mine life, reducing short term speculative bidding and preventing artificial inflation of domestic ore costs.	Smoothing auction premia over the mine life would reduce cost volatility for steel producers, improve the financeability of long-gestation capacity additions, and lower incentives for incumbents to strategically distort auction outcomes
Dedicated Iron ore corridors	Develop dedicated iron ore evacuation corridors connecting major mining clusters with steel plants and export ports, including targeted investments in slurry pipeline networks, rail connectivity, and port infrastructure upgrades	Addressing first- and last-mile logistics bottlenecks could eliminate INR500-INR800 per ton in avoidable cost premiums currently embedded in domestic ore prices relative to global benchmarks
Beneficiation and palletization push	Mandate and incentivize large-scale beneficiation of low-grade iron ore, alongside a stronger push for palletization to raise Fe content ahead of use in blast furnace and DRI operations. Support mechanisms could include co-funding, capital subsidies, and integration with cluster-based infrastructure planning	Higher Fe feedstock directly reduces coke rates in blast furnaces and improves DRI throughout, strengthening the link between ore quality improvement and coking coal import reduction. Beneficiation also lowers energy losses from gangue material and reduces emissions intensity on a per-ton basis

2.6.4 Scrap: India's circular economy lever for 2035 and beyond

Domestic scrap generation stands at ~32-35 MT today – fragmented, quality-inconsistent and structurally under-organized. The National Steel Policy projects more than 30% scrap-based steelmaking by 2030; current levels remain well below that threshold, with the sector dependent on scrap imports (US$350- US$ 450/ton volatility) and coal-based DRI as the default IF feedstock. Yet the structural potential is substantial: ~410 MT of steel consumed domestically over the past five years builds a growing future scrap reservoir. Vehicle Scrappage Acceleration could unlock ~11 MT/year of additional ELV scrap by 2036-41. West India leads domestic scrap generation (~35%) via Alang ship-breaking and Maharashtra/Gujarat auto clusters; North India contributes ~25% from Haryana/Punjab ELV recycling .
The Parliamentary Standing Committee has explicitly flagged the absence of a centralized scrap database as a systemic governance gap.
The constraints are structural across four dimensions:
1. Supply chain opacity and GST leakage (informal sector dominance)
2. Quality inconsistency from copper and tramp element contamination
3. Fragmented collection with no digital traceability
4. High import dependence with dollar benchmark volatility.
Addressing them requires a coordinated scrap ecosystem policy:

Exhibit 9A: Scrap ecosystem: Full recommendation stack

Pillar	Mechanism and design	Rationale and impact
Recognize scrap as a strategic resource	Formally designate steel scrap as a strategic raw material within the national steel policy framework, supported by a cross-ministerial coordination committee to steer scrap ecosystem development	Such recognition would shift policy from reactive handling of shortages to a proactive, system-wide approach, enabling alignment across ministries and unlocking coordinated public investment and regulatory support
National scrap registry and digital traceability	Establish a national scrap registry, supported by harmonized scrap grading standards and mandatory testing and certification protocols. Implement end-to-end digital traceability from scrap generation to furnace intake	This would reduce supply-chain opacity and GST leakage, enable quality-linked pricing, and provide EAF operators with reliable data to plan feedstock procurement and operations more effectively
Urban mining policy	Institutionalize construction and demolition scrap recovery by mandating deconstruction norms and material audits for all government infrastructure projects. Complement this with collaboration between academia and industry to develop smart demolition standards and require the circularity of industrial scrap across manufacturing sectors	Construction and demolition waste represents the largest untapped source of future scrap. The introduction of mandatory deconstruction and material recovery norms in government projects—across railways, highways, and public buildings—alone has the potential to more than double recoverable construction scrap volumes by 2030.
EAF expansion support via Renewable Power access	Enable wider access to green power for EAF and induction furnace units through open-access reform, time-of-day tariffs that encourage off-peak smelting, and targeted exemptions from cross-subsidy surcharges for hard to abate producer, paired with grid-stability investment	Improved access to renewable power lowers EAF carbon intensity while reducing power costs, directly strengthening the underlying economics of EAF-based steelmaking

Source: Parliamentary Standing Committee on Steel; Ministry of Road Transport (RVSF data); CPCB; ISA

Critically, The Committee on Steel and Iron Industries has recommended for scrap to be formally recognized as a strategic resource — on par with iron ore and coking coal — with cross-ministerial coordination (Steel, Road Transport, Urban Affairs, Finance) to secure long-term scrap imports, rationalize customs duties, address GST leakage and reduce logistics costs. Recognition of scrap as strategic changes the policy architecture from reactive to proactive, enabling the kind of sustained ecosystem investment that Japan and Germany made a decade before their scrap-to-EAF transitions became economically self-reinforcing.

2.6.5 Hydrogen and energy: The long-term decarbonization lever that determines India's green steel competitiveness

Hydrogen-based DRI is not a distant option; it is the definitive decarbonization pathway for primary steelmaking, and India's timeline for commercial-scale deployment is likely to determine its CBAM exposure, export competitiveness, and alignment with Viksit Bharat 2047 net zero commitments. Green steel production via H-DRI/EAF emits 82% to 97% less carbon than conventional BF-BOF. The challenge is economic: green steel currently costs 30% to 54% more than conventional steel, and green hydrogen at US$4- US$6/kg remains two to three times above the US$1- US$2/kg viability threshold. Today's estimates show green steel cost premium at ~US$210 per tonne , with a target of US$7 per tonneton by 2035 — a 97% cost reduction that hinges on green hydrogen scale, RE cost trajectory, and technology learning curves.

Infrastructure gaps compound the cost challenges. India has no hydrogen pipelines, no large-scale storage infrastructure, no electrolyzer manufacturing at commercial scale, and limited operational expertise in H-DRI processes — from logistics to furnace integration. The MNRE's INR455 crore steel sector pilot allocation and three awarded H-DRI pilot projects represent the beginning of a capability-building journey, not a deployment program.

The recommended intervention architecture for these challenges, validated against Germany's H2Global mechanism and South Korea's POSCO roadmap:

Exhibit 9A: Hydrogen ecosystem: Full recommendation stack and renumber

Intervention	Mechanism and design	Rationale and impact
Financial bridging via Contracts for Difference (CfD)	Modeled on Germany's H2Global mechanism: government's CfD bridges the gap between green hydrogen production cost and the steel sector's willingness-to-pay. Early adopters receive differential payments until market parity, de-risking first-mover investment	Without CfD, no rational private actor would want to commit to H-DRI at current hydrogen prices. CfD converts an uneconomic technology choice into a bankable project, attracting investors
Develop green hydrogen hubs co-located with steel clusters	Co-locate hydrogen hubs with major steel clusters in Odisha, Jharkhand, and Chhattisgarh, sharing electrolyzer, storage, and pipeline infrastructure to amortize green H CAPEX across multiple producers	Shared electrolyzer infrastructure reduces the unit cost of green hydrogen by 20-30% versus captive standalone models. Co-location with steel clusters eliminates pipeline distribution costs.
Scale for domestic electrolyzer manufacturing	Provide targeted R&D grants for electrolyzer manufacturing; temporary import duty rationalization on electrolyzer components until domestic scale is achieved	Domestic manufacturing capability is a prerequisite for cost-competitive green hydrogen at scale, with multiplier effects across the green economy.

Source: Ministry of Steel Green Steel Roadmap (Sept 2024); MNRE; IEA Green Hydrogen Report (2025);

On renewable energy, the position is unambiguous. To achieve viable green steelmaking at scale, the sector needs to reach up to 90% renewable electricity penetration. This requires accelerated development of solar, wind, and storage capacity in steel-producing regions; assured land access for captive RE plants; banking of renewable power; open-access charge exemptions for hard-to-abate sectors; and clear regulatory support for round-the-clock (RTC) RE procurement. Grid instability and state-level regulatory fragmentation on banking and open-access charges currently represent the most immediate operational constraints for EAF operators seeking to decarbonize. CBAM preparedness is the external forcing function that makes the hydrogen and energy agenda urgent beyond 2030. India needs a uniform national GHG measurement, reporting, and verification (MRV) system aligned with EU CBAM protocols, enabling emission intensity reduction from 2.5 tCO/t today toward 9 to 1.2 tCO/t by the mid-2030s and preserving EU market access for Indian steel exports.

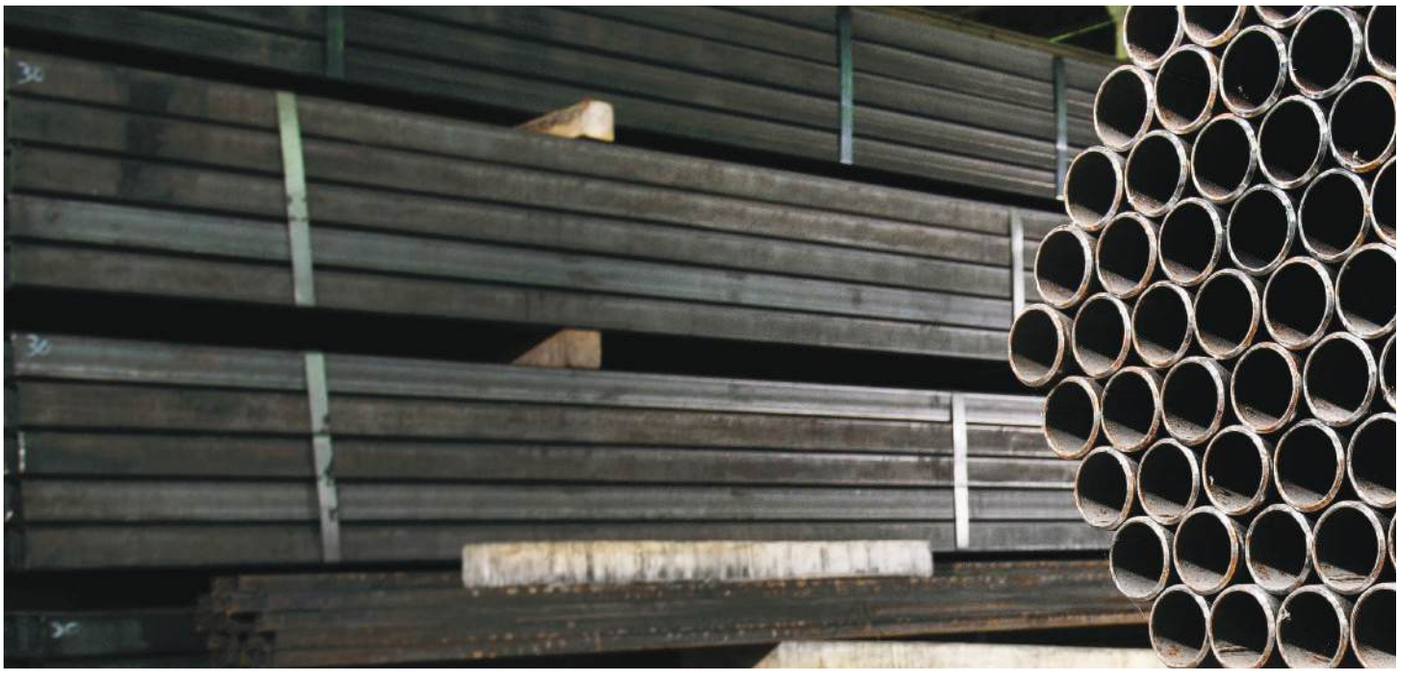
2.6.6 Mining ecosystem, DMF and the infrastructure enablement agenda

India's mining ecosystem continues to face structural bottlenecks: coking coal and iron ore block operationalization delays, first- and last-mile ore evacuation constraints, and state-level policy unpredictability on mineral levies and auction premiums. The mine auction regime has improved competitive access, but execution lags persist — particularly for coking coal blocks where infrastructure investment requirements and regulatory hurdles slow operationalization.

Exhibit: Mine development gap

Minerals	Auctioned	Operational	% Operational
Iron ore	130	36	~28%
Coal (all incl. coking)	209	55	~26%
Total minerals	**385**	**~50**	**~13%**

Source: Indian Express



The District Mineral Foundation (DMF), established under MMDR 2015, is structurally one of India's largest untapped infrastructure financing pools, which is also dramatically under-deployed.

Exhibit 8: DMF collection vs. utilization: Key steel-belt states

State	DMF collected	DMF utilized	Key observations
Odisha	~INR31,324 cr	~INR12,403 cr	Largest collector; Keonjhar and Sundergarh major unspent; NHRC concerns raised
Chhattisgarh	~INR15,200 cr	~INR9,000 cr+	Relatively stronger; priority sector spending better tracked
Jharkhand	~INR13,791 cr	~INR2,983 cr	Infrastructure + welfare mix; moderate utilization
Rajasthan	~INR10,833 cr	~INR1,324 cr+	Infrastructure focus; low high-priority sector share
Madhya Pradesh	~INR8,605 cr	~INR1,594 cr+	Moderate; infrastructure spending dominates
Karnataka	~INR2,336 cr	~INR798 cr	Lower utilization; mixed project outcomes
All India (Pan-India)	~INR25,000 cr/yr (FY24)	~INR12,000-14,000 cr	

Source: Ministry of Mines / National DMF Portal; State DMF Committee reports.

Nationally, about 40% to 45% remains unspent. The root causes are well-documented: weak district-level project planning with no scientific needs assessment; absence of impact metrics and cost benchmarks; policy ambiguity on priority sectors; governance gaps in DMF committees; state government inertia and departmental silos; and low private sector engagement — mining companies treating DMF as a compliance cost rather than a partnership opportunity. Physical infrastructure achieves only 57.8% deployment against sanctioned amounts — the single most relevant category for ore evacuation, mining logistics and steel cluster connectivity.



The recommended three-phase reform roadmap addresses root causes through a structured escalation from institutional foundations to execution accountability to private sector partnership:

Exhibit 8A: Suggestive DMF reform roadmap

Phase and timeline	Key interventions
Phase 1: Strengthening foundations	■ A national implementation framework to standardize DMF planning across states, focusing on priority sectors such as drinking water, livelihoods, climate resilience and skills, with common outcome indicators and benchmark cost norms to improve accountability and comparability of spending ■ A district-level needs assessment approach combining baseline surveys, GIS-based mapping, and community consultations, culminating in a three-year rolling DMF District Investment Plan that prioritizes projects aligned with local development needs and execution capacity ■ Dedicated technical support at the divisional or district level through multidisciplinary Technical Support Cells, jointly funded by the DMF corpus and state budgets, to support project appraisal, design, implementation, and monitoring
Phase 2: Execution, visibility and accountability	■ DMF project approvals should be performance-linked, with clear conditionality on alignment with the DMF District Investment Plan, defined KPIs, and time-bound procurement milestones. Approval turnaround and administrative prioritization should be tied to measurable accountability indicators, reducing delays driven by ad hoc or politically motivated project selection ■ A GIS-enabled digital execution platform should track every DMF project through geo tagging and real-time status dashboards covering planning, tendering, execution, completion, and impact. Mandatory photo documentation and budget disclosures at each stage, combined with publicly accessible dashboards, would strengthen transparency and community-level accountability ■ Quarterly public scorecards should disclose DMF utilization levels by district and state, projects completed, and key outcome metrics through state portals and a National DMF Portal. Meeting minutes of DMF Committees should be published routinely to institutionalize oversight and informed public scrutiny
Phase 3: Scale and partnership expansion	■ A private sector co-funding framework should enable matching grants, whereby for every INR1 spent by DMF on priority interventions, mining companies contribute INR0.25-INR1. Companies fulfilling the performance benchmarks could receive preference or recognition across CSR-DMF partnerships, encouraging co-design, shared accountability, and outcome-linked contracting ■ Structured community co-design workshops should be institutionalized to involve local residents in project selection, target-setting, and monitoring. This participatory approach would improve project relevance, strengthen local ownership, and enhance long-term sustainability beyond project completion ■ DMF investments should be systematically converged with major state and central schemes such as MGNREGS (labor provisioning), Jal Jeevan Mission (water supply), PMAY (housing), and Skill India/PMKVY (skilling). Such convergence would allow scheme stacking, reduce duplication, and significantly amplify developmental impact ■ Continuous capacity building should be undertaken through annual training programs for DMF committee members, focused on project appraisal, procurement best practices, digital monitoring systems, and effective community engagement to improve institutional decision-making and execution quality

2.7 Value chain maturity and capability gaps

2.7.1 The absence of a rolling steel demand forecast undermines investment confidence

India's steel producers currently make capacity expansion decisions — multi-year, high-capital commitments — without access to a government-published rolling steel demand forecast aligned with the infrastructure pipeline. The National Infrastructure Pipeline (NIP), Pradhan Mantri Awas Yojana (PMAY), renewable energy (RE) programs, and defense capital procurement plan each contain implicit multi-year steel demand signals; no mechanism currently aggregates and publishes these as a coherent demand outlook.

This information asymmetry has two consequences: private sector investment decisions are made with higher uncertainty than necessary, raising the required return threshold and slowing capacity deployment; and product mix investments in specialty grades — which require three to five years from investment decision to commercial output — are underinformed about the trajectory of high-growth segments like AHSS, wind tower plate, and defense grades.

- Publish a five-year rolling steel demand forecast disaggregated by product category and consuming sector, updated annually
- Align forecast publication with Union Budget cycle so that industry investment decisions are informed by the same pipeline numbers that determine government capex allocation
- Establish a Steel Demand Intelligence Cell, jointly funded by industry and government, to maintain real-time product-level demand tracking and publish quarterly updates
- Modelled on Japan's METI steel demand outlook and Germany's Steel Institute VDEh annual demand report — both of which provide the forward product-mix visibility that Indian steelmakers currently lack

2.7.2 Elevated capital costs are slowing the supply response to demand signals

India's steel industry faces a structural competitiveness gap that constrains its ability to serve domestic demand at globally competitive prices. Two dimensions are most significant for the demand side. First, elevated financing costs: Indian steel companies access project finance at ~8% to10% versus ~2% to 4% for Japanese and Korean peers — a 300-600 basis point disadvantage that raises the all-in cost of delivered steel and reduces the investment return for capacity expansion projects, slowing supply-side response to demand growth. Second, long gestation periods for greenfield projects, compounded by multi-ministry clearance requirements, mean that demand signals identified today may not result in supply additions for five to seven years, creating windows of import dependence that are difficult to close once established .

- Extend infrastructure status benefits to integrated steel projects — immediately unlocking lower project finance rates through IIFCL, NaBFID and DFI channels; reduces financing cost by 150–200 basis points
- Expand long-tenure project finance access: NaBFID to establish dedicated steel sector financing window; minimum 20-year tenor for integrated steel projects aligned with asset depreciation life
- Enable blended finance for green transition: Contracts for Difference (CfD) for H-DRI; Viability Gap Funding (VGF) for first-of-kind green steel plants; concessional NaBFID lending for EAF/RE integration
- Single-window clearance acceleration: designate steel projects as National Important Projects with 120-day clearance commitment across Environment, Forests, Land, Power and Water ministries

2.7.3 Demand is outpacing production capability

The most strategically consequential demand-side challenge is the mismatch between where India's demand is growing faster and where India's steel industry has built production capability. Infrastructure and housing – commodity TMT bars, structural sections, HR coils – are well-served by India's existing supply base and growing MSME secondary sector. But the segments with the highest growth rates and most consequential import dependence – AHSS for EVs, CRGO for renewable energy infrastructure, armor and aerospace grades for defense, wind tower plates for the RE build-out – require a fundamentally different level of metallurgical sophistication, capital investment, and R&D intensity than the commodity supply base delivers.

Moving up the value chain is not optional; it is the mechanism by which India captures the full economic value of its own demand growth rather than transferring it to import suppliers. Three interventions are required in combination: PLI execution reform (addressed in the supply chapter) to enable committed investments actually reach commercial production; targeted R&D collaboration between steel producers and consuming sectors (automotive OEMs, renewable developers, defense PSUs) to co-develop India-specific grade specifications; and export-oriented specialty clusters that combine PLI-backed production scale with the quality systems and certification infrastructure that premium global customers require. The Growth Enablers framework proposed by the Ministry – demand visibility, cluster-based development, export competitiveness – is the policy architecture for this transition.

- Set R&D intensity targets: incentivize leading steel companies to increase R&D from 0.5% to 1.5% of revenue over five years via weighted deduction enhancement; potential unlock of INR3,000–5,000 crore annual incremental R&D
- Export competitiveness: improve port evacuation efficiency (Paradeep, Dhamra, Vizag, Mundra); facilitate trade finance for steel exports; build 'Green Steel from India' brand identity aligned with CBAM preparedness
- Establish joint R&D centers (government + industry + academia) for pre-competitive research in AHSS, wind tower grades, CRGO and decarbonization processes – eliminating duplication of individual company investment
- Demand visibility publication enables targeted R&D investment by giving producers a credible signal of which specialty segments will hit scale demand – making the R&D investment case commercially viable



2.8 300 MTPA is the floor: The supply-side interventions that determine India's global steel standing in 2035 and 2047

India's supply-side trajectory to 300 MTPA is structurally confirmed. Investment pipelines are live, private sector ambition is demonstrated, and crude steel production growth of 11.2% in FY26 (169.2 Mt), alongside 8.3% growth in finished steel consumption in Q1 FY27, confirms demand-side pull. Crude steelmaking capacity stood at ~222 MTPA as of June 2026. The 300 MTPA mark, now largely a capital deployment and logistics execution question, is attainable. With steel production targeted at 500 MTPA under Viksit Bharat 2047, and India's per capita consumption still less than half of the world average, the structural demand case is equally settled. The supply question shifts decisively from 'if' to 'at what technology level, what carbon intensity, and what cost competitiveness.'

Three integrated agendas are likely to determine whether India's expanding supply base is globally competitive in 2035 and 2047 or merely large.

First, raw material sovereignty: An India Coking Coal CFR Index, a Strategic Coal Reserve, a National Scrap Registry, and a domestic Iron Ore Index together could deliver US$25 to US$40/ton in sustained steel cost competitiveness, turning a structural vulnerability into a managed input strategy.

Second, the green steel transition: The National Green Steel Mission (INR15,000 crore), Green Public Procurement from FY28, and H-DRI pilot scale-up provide the institutional and demand-side scaffolding; industry needs to match it with capital allocation, RE procurement, and technology partnerships.

Third, mining ecosystem reform: Accelerating mining output and reliability require reforming ore evacuation, shared cluster logistics, and mine-region infrastructure that currently constrain supply responsiveness. Strategically deploying the funds collected annually under DMF toward evacuation corridors, rail-road interfaces, and common logistics assets can materially lower delivered ore costs and improve the steel sector's competitiveness. Crucially, by simultaneously funding local infrastructure, livelihoods, and social services in mineral-bearing regions, DMF becomes a driver in resolving land acquisition frictions and community resistance, lowering execution risk for new and expanding mining projects.

With these three agendas advancing in parallel — coordinated through the proposed National Raw Material Security Council — India's steel supply base would not merely scale to 300 MTPA and beyond; it would do so as a globally cost-competitive, technologically advanced, and low-carbon industrial platform worthy of the Viksit Bharat 2047 ambition.

The following chapter analyzes the demand-side architecture — spanning infrastructure, construction, automotive, defense and exports — that this expanding supply base is expected to serve and shape through 2035.





Chapter 3

Demand-side analysis

3.1 India's steel demand today is large, fast, and still far below its potential

India consumed approximately ~152 million tons of finished steel in FY25 and 164.19 million tons in FY26 (April 2025 to March 2026), up 8.0% year-on-year, the highest in the country's history. This follows a compound annual growth rate of 8.7% over the five years to FY25. In Q1 FY27 (April to June 2026), finished steel consumption reached 41.6 MT, up 8.3% over the corresponding period last year. India has firmly established itself as the world's second-largest steel consumer, after China, with consumption continuing to grow at a high single-digit pace.

The aggregate demand number, however, tells only part of the story. To understand the durability of India's demand growth, its product composition, geographic concentration and resilience to economic cycles, it must be examined through three lenses:

01 The government scheme and policy pipeline that is directly underwriting multi-year demand

02 The sectoral breakdown of where demand comes from and what steel products each sector requires

03 The structural market shifts driven by technology and economic evolution are creating entirely new categories of steel demand.

Each of these is examined in the sections that follow.

3.2 Infrastructure dominates today, but energy, defense and EVs define the growth frontier

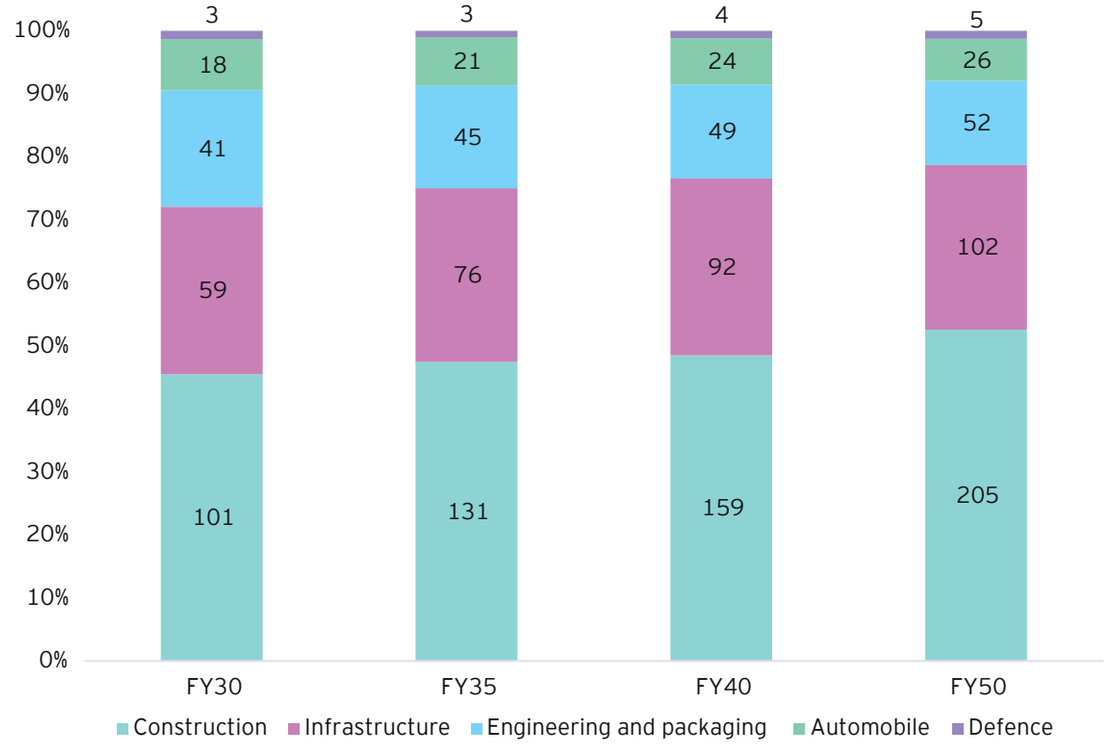
India's steel demand is not monolithic. The ~164 MT consumed in FY26 is spread across multiple end use sectors, each with distinct product specifications, growth trajectories, and degrees of sensitivity to government spending cycles. Infrastructure and construction — broadly defined to include roads, railways, bridges, ports and urban civil works — accounts for over half of all finished steel consumption, making it the dominant and most cycle-sensitive demand category. Real estate and housing, automotive, capital goods and engineering, energy, and the combined defense and consumer segments make up the remainder.

The product mix implications are equally significant. Infrastructure drives demand for TMT bars, structural sections, and HR coils — the bulk-volume, commodity end of the steel product spectrum. Automotive drives HR/CR coils and, increasingly, Advanced High-Strength Steel (AHSS) as lightweighting mandates intensify. Energy and defense create demand for specialty grades — wind tower plates, transmission steel, armor grades, aerospace alloys — that command premium margins and currently depend heavily on imports. Understanding this sectoral architecture is a prerequisite to understanding where India's supply base needs to upgrade in quality, not just scale in volume.

Exhibit 2: India's finished steel demand by sector: FY26 consumption, product mix and outlook for 2030-35

Sector	FY26 Demand	Share	Primary demand drivers (2025-30)
Infrastructure and construction (roads, railways, bridges, ports, urban infra)	104 - 115 MT	~67%	Bharatmala Phase II, DFC, NIP INR111 lakh crore pipeline, PM Awas Yojana (three crore homes), urban housing demand, SWAMIH Fund 2
Automotive (PV, CV, 2W, EVs)	16 - 17 MT	~10%	EV transition (FAME III), PLI for auto components; production to 35 million+ units; AHSS growth
Capital goods and engineering	34 - 38 MT	~22%	Make in India, PLI for capital goods; export orderbook growth, consumer income growth
Defence and aerospace	1 - 2 MT	~1%	Defense capital procurement: INR6.81 lakh crore over five yrs; 75% domestic procurement target; PLI 1.2 superalloys

Forecasted steel consumptionn in end-use sectors (MMT)



Source: EY Parthenon analysis

Two clear structural shifts emerge from the projected sectoral consumption profile. Construction and infrastructure together continue to anchor steel demand through 2050, accounting for over two-thirds of incremental volumes, with combined consumption rising from ~160 MT in FY30 to over 300 MT by FY50. This reflects the persistence of asset-heavy growth-urban housing, transport networks and public infrastructure as the dominant demand engine even in later stages of development.
At the same time, smaller, higher-value end-use segments grow faster from a low base, altering the quality and grade mix of steel demand. Automobiles see steady expansion despite efficiency-led material optimization.

Defense, though remaining a small share of total tonnage, almost doubles in absolute demand, underscoring its disproportionate strategic importance. This is the segment where import substitution, metallurgical sophistication, and specialty steel capability are most critical-with policies such as PLI 1.2 explicitly targeting the transition toward domestic production of advanced alloys with 2047 in view.
Each sector will be examined in depth in subsequent sub-chapters, with detailed analysis of demand drivers, product specifications and growth projections.

3.2.1 Infrastructure and construction: The anchor pillar

Infrastructure and construction collectively absorb over 68% of India's annual finished steel consumption, and this dominance is structurally locked in through 2030-31 . The National Infrastructure Pipeline (NIP) now covers 13,000+ projects worth INR185 lakh crore as of March 2025, up from the original 6,800 projects at INR111 lakh crore when launched in FY20.

Roads are the largest aggregate consumer of steel in infrastructure: Bharatmala alone has awarded 26,425 km of corridors, with steel demand concentrated in flyovers, bridges, crash barriers and elevated interchanges. Roads collectively account for an estimated 15 MT to 20 MT of annual steel demand.
Railways represent the single largest institutional buyer. Railway capex is budgeted at 2.93 lakh crore in FY27 (Union Budget 2026-27), a record high and ~10.5% above the FY26 revised estimate, with 2.78 lakh crore of that coming as central budgetary support.

Metro rail is the fastest growing urban sub segment. Each kilometer of elevated metro requires roughly 6,000–10,000 tons of steel, including stations and support structures. Of this, viaducts account for ~4,000–5,000 tons, while stations add another 1,500–5,000 tons, averaged over route length.

With Cabinet approval of Pune Metro Phase II (INR9,857 crore, 31.64 km) in November 2025, and active networks in Delhi, Bengaluru, Chennai, Hyderabad and Ahmedabad, the metro grid could double past 1,000 km by 2030, implying 8-10 MT of incremental structural steel.
The most stable demand for housing is supported by PMAY-Urban 2.0, which has approved 10 million urban units. To build a million affordable homes, roughly 2 to 2.5 metric tons of long products are needed. This means PMAY alone could account for 20 to 25 metric tons between fiscal years 2026 and 2029.

Challenge	Strategic recommendations
Execution delays Large infra projects run 18-36 months behind committed timelines on average, creating lumpy, unpredictable demand	■ Fast-track land acquisition reform for linear infrastructure to convert the steel pipeline into actual construction volumes ■ A centralized digital control tower for infrastructure execution should be implemented, building on PM GatiShakti, integrating EPC (Engineering, Procurement and Construction) progress, approvals, and material flows to improve real-time visibility
Sub-standard rebar in market Significant volumes of non-compliant TMT bars enter through informal channels, suppressing price premiums for quality producers and compromising structural integrity	■ Strengthen quality control orders with mandatory third-party BIS certification for all government-funded housing and infrastructure projects stage, combined with publicly accessible dashboards, would strengthen transparency and community-level accountability

3.2.2 Automotive: Volume growth meets grade upgrade

India is the world's third-largest vehicle market by volume and the primary consumer of flat steel products. The sector accounts for ~15% to 20% of domestic steel demand, with annual flat steel requirements of approximately 27 MT . The automotive steel market is valued at US$5.56 billion as of FY26 and is projected to reach US$7.58 billion by 2030 at a 7.7% CAGR, driven by both volume (30+ million vehicles produced in 2024) and a structural shift toward higher-value grades.
India's steel story is developing in two ways. First, production volume is increasing. More vehicles are made each year. Second, steel quality is improving. This is a result of changing needs. Car companies are using stronger steel. They are moving from mild steel to Advanced High-Strength Steel (AHSS) and Ultra-High-Strength Steel (UHSS). This makes vehicles lighter. It also helps meet new safety standards. The Bharat NCAP crash safety norms will be mandatory from 2025. Stronger steel also aids in meeting stricter fuel economy rules. A current passenger car uses 60-70 kg of AHSS. India still imports a lot of this type of steel. Major suppliers are Japan, South Korea and Germany.
The EV dimension adds further complexity. Electric vehicles require higher volumes of both Cold-Rolled Non-Oriented (CRNO) and Cold-Rolled Grain-Oriented (CRGO) electrical steel for motors, structural AHSS for battery enclosures, and corrosion-resistant coated steels.

Challenge	Strategic recommendations
AHSS import dependence Domestic producers concentrate in commodity flat steel; the premium AHSS segment remains structurally underdeveloped	■ Link PLI disbursements to grade certification milestones, not tonnage targets. A producer qualifying Bharat NCAP-grade AHSS should receive a higher incentive multiplier than one scaling commodity coated steel ■ Deploy safeguard duties and QCOs proactively for AHSS and coated automotive steel to protect the domestic market as Chinese flat steel overcapacity seeks export outlets
PLI execution gap PLI 1.0 (specialty steel) achieved only ~25% of targeted production - limiting domestic AHSS and CRGO/CRNO supply for automotive OEMs	■ Restructure PLI triggers to grade certification milestones; introduce quarterly grade-level production reporting linked to third-party BIS quality audits

Aluminum is emerging as a credible challenger in the automotive sector.

With ~one-third the density of steel, it enables ~20% to 30% vehicle-level weight reduction, making it structurally attractive for EVs where every kilogram of weight reduction improves range.

The Indian aluminum market is projected to grow steadily (~6% to 7% CAGR), with EV adoption emerging as a key demand driver (industry estimates).

Steel's counter lies in Advanced High Strength Steel (AHSS), which can deliver comparable lightweighting through gauge reduction, while maintaining a cost advantage on a strength-adjusted basis.

3.2.3 Energy: The growing steel frontier

Energy is the demand category that is expected to alter India's steel profile over the next decade and the one most likely to surprise on the upside. Unlike infrastructure or automotive, where demand tracks GDP cycles, the energy sector has hard, legislated targets that translate into near-certain steel volumes. India's total installed power capacity is projected to double from 520 GW to 1,121 GW by 2035-36 (CEA, March 2026), and renewable energy is the primary engine of this expansion.

Renewable energy

India added 40+ GW of combined solar and wind capacity in 2025, more than 37 GW solar and 5.82 GW wind, which is the highest annual renewable addition in the country's history. Solar installed capacity stood at 164.59 GW as of 31 July 2026; wind reached 58.14 GW; total non-fossil capacity hit 300.50 GW (over 54% of the ~552 GW total installed base). Crucially, while global renewable investment declined ~9% to 10% in 2025, India recorded double-digit growth in capacity installation, making it the primary driver of incremental energy-transition steel demand globally.

The steel intensity of renewables is substantial. Every GW of utility-scale solar requires 25 to 40 tons of steel per MW in mounting structures, which is primarily galvanized and Alu-Zinc/Magnesium-coated steel designed for 25-year outdoor lifespans. Wind is far more intensive: a single onshore tower requires 100 to 120 tons of structural steel per GW.

At India's 500 GW renewable target by 2030, cumulative energy-sector steel demand is conservatively estimated at 40 to 50 MT over FY26-FY31.

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Thermal and conventional

Thermal energy is not disappearing from India's demand equation — it is evolving. Coal is expected to remain the dominant source of electricity in India, supplying ~60% to 70% of generation through the next decade, even as its share gradually declines.

New thermal capacity, boiler replacements, flue gas desulfurization retrofits, and plant upgrades are expected to continue consuming alloy steels, high-temperature creep-resistant grades and pressure vessel steel through the decade.

Challenge	Strategic recommendations
Coated steel supply gap While India has rapidly scaled domestic Magnelis/ Alu-Zinc coated steel production to over 1 MnTPA solar projects continue to specify stringent 25-year corrosion warranties that require qualification of domestic suppliers against imported benchmarks	▪ Develop a Solar and Wind Steel Quality Framework under BIS, defining domestic equivalents for Magnelis/Alu-Zinc coatings and standardizing wind tower specifications (aligned to EN 10025-2). This enables the qualification and scaling of domestic coated steel for renewable projects, targeting capacity aligned with MNRE's 280-300 GW solar goal by 2030.
No clear transmission network plan 37 GW offshore wind target has pilot funding (INR7,453 crore VGF), but lacks scaled port, fabrication, and transmission infrastructure	▪ Fast-track offshore wind policy with a published tender pipeline and port infrastructure timelines; even 5 GW by FY27-29 would generate 2.5-4 MT of incremental structural steel demand

3.2.4 Engineering goods: The multiplier in the middle

Engineering goods sit at the intersection of every other sector — capital equipment, industrial machinery, heavy fabrications, pressure vessels and structural steel for industrial plants. India's engineering goods exports crossed US$116 billion in FY25 , making it one of the country's largest export categories. Yet the sector's strategic importance for steel lies less in its headline volume (20 to 25 MT in FY26) than in the quality of demand it generates: alloy steels, tool steels, stainless long products and bearing steels - categories where India remains import-dependent from Germany, Japan, South Korea and Sweden.

As India accelerates its manufacturing ambition through 14-sector PLI programs worth INR2 lakh crore, and through the 12 National Industrial Corridors under NICDC, the engineering goods sector is positioned to emerge as the anchor customer for high-value domestic steel, only if domestic supply can match the grade specificity of OEM demand. The PLI Specialty Steel scheme (INR6,322 crore, targeting 18 MT to 42 MT of specialty steel by FY2027) is the intended supply-side response; 42 MoUs had been signed by February 2025 .

Challenge	Strategic recommendations
Specialty steel import dependence Domestic producers lack the alloy addition infrastructure, vacuum degassing capacity, and quality consistency to fully serve engineering OEM specifications	■ Create an India Alloy Steel Roadmap: co-develop a five-year procurement commitment framework between the Ministry of Steel and Indian engineering OEMs to anchor domestic investment in alloy steel grades ■ Mandate domestic steel sourcing in government engineering procurement (PSU capex) where BIS-specified equivalents exist
MSME fragmentation The engineering goods sector is dominated by MSMEs with no direct sourcing relationships with large steel mills, creating quality inconsistency and export competitiveness risk	■ Establish a Steel Service Centre Network co-located with each of the 12 National Industrial Corridors, modeled on Japan's system where processed, cut-to-length steel is available within 48 hours, reducing the MSME inventory burden

3.2.5 Defense: Small volume, highest strategic value

Defense is the smallest steel consumer by volume (~2% of total) but the fastest growing by trajectory: a ~20% CAGR through 2030, driven by India's defense budget of INR6.81 lakh crore in FY26, of which INR1.80 lakh crore is capital expenditure . The government's 68% indigenization target under Atmanirbhar Bharat – reinforced by the Ministry of Steel's revised DMI&SP policy (Dec 2025) mandating preference for fully Indian-made steel – creates a durable demand signal for domestically manufactured defense-grade steel.

Naval construction requires DMR grades (DMR 249A for hull plating; DMR 1700 series for submarine pressure hulls), combining yield strength above 500 MPa with weldability and fracture toughness.
A single INS-class destroyer requires 3,500 to 4,000 tons of marine-grade structural and armor steel; an aircraft carrier requires 12,000 to 15,000 tons. Armored Fighting Vehicles require rolled homogeneous armor (RHA) and high hardness armor plate. Aerospace pulls maraging steel, titanium alloys and superalloys. The Indian Navy has 47 ships and submarines under construction or on order as of 2025, including six nuclear submarines under the ATV program and six P75I submarines.

Challenge	Strategic recommendations
Import dependence India's defense sector remains dependent on imported specialty steels, including armor-grade, maraging, and bearing-quality steel, because domestic mills lack the certified production scale to supply them	■ Time-bound indigenization targets embedded in procurement policy would give mills the demand certainty to justify the investment ■ A domestic certification ecosystem could enable smoother capacity ramp up by preventing qualification bottlenecks from outlasting the short term gaps they are meant to resolve.
Long qualification timelines Defense steel grades require one to three years of SQAE/DRDO qualification before a new domestic supplier can enter the supply chain, which directly blocks rapid response to indigenization mandates	■ Implement parallel SQAE testing for non-critical structural grades, enabling provisional supply during qualification to cut the one- to three-year lag blocking domestic producers

3.2.6 Important observations: What the data is really saying

India is unlikely to face a shortfall of steel demand. The five sectors analyzed here provide a diversified, policy-anchored demand base with high 10-year visibility.

What India faces instead are three structural choices that are set to determine whether this demand creates domestic value or leaks to imports.

Strategic choice	What it requires	Cost of deferral
Grade migration over volume	Invest in AHSS, CRGO/CRNO, DMR grades alongside commodity capacity	Import dependence persists on Japan/South Korea/Germany; domestic industry cedes the margin-rich specialty segment
Renewables as anchor customer	Galvanized and Alu-Zinc coated steel for solar; wind tower fabrication eco-systems with procurement mandates	40-50 MT steel demand (FY26-31) partially served by Chinese imports of coated and structural products
Defense steel Indigenization	Scale DMR-grade armor plate and maraging steel DRDO plants with time-bound commitments	Forex outflows continue on specialty steel Strategic vulnerability in Atmanirbhar defense posture

These sectors are expected to underpin the next phase of steel demand growth. The critical question is whether India's steel industry — and the policy architecture that shapes it — can position itself to capture this demand at the right grades, the right timeframes, and a globally competitive cost structure. The following section therefore undertakes a detailed review of government policy, which serves as a decisive lever in accelerating and shaping the trajectory of the steel sector's growth

3.3 Government as the steel demand architect

The Government of India is not merely a facilitator of steel demand; it is the largest direct creator of steel demand in the economy. Public capital expenditure has grown from INR2 lakh crore in FY14-15 to INR11.2 lakh crore in Budget FY26, with a further increase to INR12.2 lakh crore proposed in FY2026-27 (Union Budget 2026-27). Every rupee of this capital expenditure flows, in significant part, through steel - in roads, railways, bridges, housing, water infrastructure, ports and urban systems. Understanding the architecture scheme behind this number is the difference between a growth projection and a demand forecast.

3.3.1 Government creating steel demand directly through schemes, missions and infrastructure programs

Nine government programs collectively constitute India's direct steel demand pipeline — each with committed budget allocations, physical targets and quantifiable steel implications.

The table below maps these programs across the steel value chain, from civil infrastructure to housing to defense procurement:

Exhibit 3: Government scheme steel demand pipeline: Allocations, physical targets and steel implications

Scheme / Program	Budget allocation	Physical target	Steel demand implications and product types
National Infrastructure Pipeline (NIP) + PM Gati Shakti	INR111 lakh crore (2020-25) NIP 2.0 pipeline extending to 2030	7,400+ projects; highways, railways, ports, airports, urban infra	~40-50 MT steel demand pipeline over five years across roads, bridges, and rail infrastructure PM Gati Shakti integrates 16 ministries for multimodal logistics coordination
Ministry of Road Transport & Highways (Bharatmala + NH)	INR2.94 lakh crore (Budget FY27, up 8%) Bharatmala Phase II ongoing	60,000+ km of National Highways; four-laning, expressways, ring roads	~1,500-2,000 kg steel per lane-km of 4-lane highway Total pipeline implies ~8-10 MT annual steel demand from roads alone Steel-intensive bridge program under Bharatmala adds incremental demand
Indian Railways (Capex + DFC + high-speed)	INR2,65,200 crore (Budget FY26); 7 high-speed corridors (Budget FY27)	New freight corridors (Dankuni-Surat DFC) 100 Amrit Bharat, 200 Vande Bharat trains Seven HSR growth connectors	Total railway steel demand ~5-7 MT/year at current capex pace; HSR corridors would add structural steel intensive via ducts
PM Awas Yojana Urban 2.0 + Gramin	INR10 lakh crore for PMAY-U 2.0 overall target	Three crore additional homes SWAMIH targeting one lakh stressed units Urban Challenge Fund of INR1 lakh crore	Three crore homes imply ~3-6 MT direct steel demand Urban housing also drives structural steel and coated products for commercial construction
Jal Jeevan Mission (Extended to 2028)	Enhanced outlay (exact FY26 allocation not disclosed) extended beyond initial INR3.6 lakh crore corpus	100% rural tap water coverage	20% residual coverage (over four crore households) implies ~0.8-1.2 MT pipe steel demand through 2028 and urban waterway upgrade additional
Metro Rail Expansion (Phase III/IV)	INR9,857 crore (Pune Metro Ph.II alone, Nov 2025); ongoing multi-city approvals	Active projects in 27+ cities; ~1,000+ km planned/under construction nationally	1,000 km pipeline implies ~20-25 MT structural steel while also driving demand for rail, rolling stock and station steel
Defence Capital Procurement Programme	INR6.81 lakh crore planned over 5 years; 75% indigenization target	Tanks, warships, submarines, artillery, aircraft, drones, armored vehicles	75% indigenization mandate directly forces domestic specialty steel development PLI 1.2 superalloys and titanium sub-categories specifically target defense grades

Scheme / Program	Budget allocation	Physical target	Steel demand implications and product types
Sagarmala + Maritime Development Fund	INR25,000 crore Maritime Development Fund (Budget FY26, 49% Govt)	Port modernization, coastal shipping, shipbuilding, 20 new National Waterways	Port infrastructure steel (cranes, berths, storage), coastal shipping fleet expansion, NW-5 (Odisha mineral corridor) directly supports the steel cluster logistics
Smart Cities Mission + AMRUT 2.0	INR6,450 crore (AMRUT 2.0 FY26 allocation) Smart Cities 94% complete (June 2025)	100 smart cities completed; AMRUT 2.0 covers 500 cities for water and sewerage	Urban infrastructure steel for stormwater, sewage pipes, pedestrian infrastructure, transit stations; AMRUT 2.0 water and sewerage implies pipe steel demand across 500 cities

Source: Union Budget FY25-26 and FY26-27 (PIB, GoI); IBEF Infrastructure Report (2025))

Two budget announcements for FY26-27 deserve particular attention for their steel demand implications. First, the seven high-speed rail corridors designated as inter-city 'growth connectors' is likely to require among the most steel-intensive civil works in India's recent history; elevated viaducts, bridge structures, and station infrastructure at HSR design standards imply materially higher steel intensity per km than conventional rail. Second, the new Dedicated Freight Corridor connecting Dankuni-Surat (East-West corridor), approved alongside the operationalization of 20 new National Waterways, is expected to drive both structural steel demand for civil works and logistics infrastructure steel for port and inland waterway equipment.

3.3.2 PLI led manufacturing expansion and downstream steel offtake

Beyond direct infrastructure spending, India's Production Linked Incentive (PLI) architecture across 14 sectors is generating a second category of government-driven steel demand: derived demand from the manufacturing scale-up that PLI incentivizes. Each PLI linked factory, product line, and export platform generates demand for specific steel grades.

Taken together, PLI implementation across autos, solar, white goods, electronics, and defence has created a new layer of downstream steel demand that did not exist prior to the program. This is a demand that grows with India's manufacturing share of GDP rather than with infrastructure spending cycles — and therefore provides a structural diversification of the demand base.

Exhibit 4: PLI schemes: Production scale-up and derived steel demand implications

PLI Scheme	Scope and Target	Steel Demand Implication
PLI - Specialty steel (Rounds 1.0, 1.1, 1.2)	22 product sub-categories; CRGO, AHSS, wear-resistant, superalloys, titanium; 4-15% incentive rates	Directly creates demand for high-grade input steel (alloy, specialty, electrical grades) and simultaneously builds the specialty steel supply that displaces imports, reducing the ~4 MT specialty steel import bill
PLI - Automobiles and auto components	10 champion OEMs; 15 auto component manufacturers; EV + hydrogen fuel cell vehicles included	The auto sector consumes ~17-19 MT of HR/CR coils, AHSS, coated steel per year; PLI-induced production scale-up directly grows steel offtake; EV-specific sub-segments create demand for high-strength, lightweight steel

PLI Scheme	Scope and Target	Steel Demand Implication
PLI - White goods (ACs and LEDs)	Target: US$4 billion annual production; import substitution for ACs and LED components	Each AC unit requires ~8-12 kg of coated steel (cabinet, heat exchanger components); PLI target of ~40-50 million units implies ~0.4-0.6 MT demand for cold-rolled and coated grades
PLI - Solar PV modules	50 GW domestic module manufacturing capacity; 10 GW per tranche	Solar mounting structures: ~25-40 tons of steel per MW of ground-mounted solar; 500 GW RE target implies ~12-18 MT of structural/galvanized steel for mounting; hot-dip galvanized sections are the primary product type
PLI - Advanced Chemistry Cell (Battery)	50 GWh domestic battery manufacturing capacity	Battery enclosures and EV battery frames: ~15-20 kg steel per EV battery pack; 1 million EVs/year implies ~15,000-20,000 tons specialty steel for battery structural components; stainless and coated grades preferred
PLI - Electronics and IT hardware	Target: US$300 billion of electronics manufacturing by 2026	**Data center construction (steel-intensive: ~100-150 kg/sqm structural); electronics factory fit-outs; server rack steel; indirect demand estimated at 0.5-1 MT/year as the electronics manufacturing ecosystem scales**
PLI - Defense and aerospace	Drones, missiles, helicopters, armored vehicles under the PLI framework	**Direct demand for armor steel, aerospace-grade alloys, and specialty forgings; PLI 1.2 specialty steel superalloys/titanium sub-categories directly serve this sector; estimated 0.3-0.5 MT high-value specialty steel demand annually by 2028**

Source: Ministry of Steel PLI 1.0/1.1/1.2 updates (2025); DPIIT PLI scheme data; MHI; MNRE; Ministry of Defence; Union Budget 2025-26; IBEF (2025)

The PLI for Specialty Steel (Rounds 1.0, 1.1 , and 1.2) is unique in that it simultaneously creates demand (for input specialty steel grades) and supply (the schemes fund the plants that are expected produce those grades). This self-reinforcing dynamic - where PLI investment in CRGO manufacturing, for example, creates both supply of electrical steel and demand for the upstream specialty inputs - is the structural architecture through which India plans to reduce its ~4 MT annual specialty steel import dependency . At the November 2025 launch of PLI 1.2, 22 product sub-categories now attract incentives of 4% -15% on incremental sales, covering the full range from coated products to superalloys and titanium for defense and aerospace.

3.4 India's demand trajectory is structurally locked in across every consumption sector

India's steel demand through 2047 should be viewed less as a point forecast and more as the logical outcome of a structural transformation already underway. The drivers of this expansion are no longer episodic or policy-dependent; they are embedded in the way India's economy, cities, and industrial base are being reshaped. Urbanization, industrial deepening, and asset renewal are converging to create a durable, multi-decade demand platform rather than a single-cycle upturn.

As India's urban footprint expands and densifies, steel demand increasingly reflects not just new construction but the layered build-out of transport systems, utilities, commercial spaces and industrial ecosystems that sustain urban economies. In parallel, the ongoing shift toward a more manufacturing-led growth model implies sustained capital formation in factories, logistics networks and industrial clusters - all of which are structurally steel-intensive. Overlaying both is a less visible but equally powerful force: the renewal and replacement of infrastructure built over the past three decades, which introduces a recurring demand layer alongside greenfield growth.

What differentiates this trajectory from earlier phases of steel demand growth is its breadth and resilience. Demand is no longer concentrated in a narrow set of public infrastructure projects but is distributed across multiple, loosely correlated end-use segments — government infrastructure, private manufacturing, urban real estate, mobility, energy and defense. This diversification fundamentally alters the cyclicality of steel consumption. Slowdowns in one segment are increasingly offset by acceleration in others, reducing the historical sensitivity of aggregate demand to single-sector shocks or fiscal cycles.

Viewed together, these shifts mark a structural reset in India's steel consumption profile. The country is moving from a phase where volume growth was episodic and investment-led, to one where demand is continuously reinforced by urban lifestyles, industrial activity and technological transitions. This multi-vector demand architecture — rather than any single program or projection — underpins the robustness of India's steel demand outlook as the country moves toward 2047.

Exhibit 6: India's steel demand trajectory: FY25 to Viksit Bharat 2047

Milestone	Finished steel demand (MT)	Per capita consumption	Key demand drivers active at milestone
FY25 (Actual)	~150 MT	~102 kg	Infrastructure supercycle, housing, auto growth, capex recovery post-Covid
FY27 (Near-term)	~180-190 MT	~115-118 kg	NIP acceleration, PMAY ramp-up, RE pipeline materializing, EV adoption beginning
FY30 (2030 target)	~200-220 MT	~135-145 kg	Bharatmala Phase II completion, DFC full operations, 500 GW RE milestone, EV fleet scaling
FY35 (Medium-term)	~240-260 MT	~165-180 kg	Viksit Bharat industrial acceleration, defense indigenization, green steel demand reaching 24 MT, logistics/ data center build-out

Source: Ministry of Steel National Steel Policy targets; McKinsey Integrated Steel Demand Model (Dec 2025); World Steel Association Long Range Scenarios (2025); EY-Parthenon (July 2025); ICRA (FY26 projection); Mordor Intelligence (2025)

3.5 Demand meets supply: India's steel sector in the next decade

Taken together, the supply and demand assessments point to a steel sector that is fundamentally well anchored for long term growth and increasingly capable of supporting India's broader economic transformation. The underlying demand momentum is durable and diversified, while investment commitments on the supply side provide a strong foundation. The defining question, therefore, is not one of scale but of alignment — between what the economy increasingly requires and what the steel sector is structurally positioned to deliver.

The principal challenge lies in bridging the gap between volume capability and product sophistication. As steel demand shifts toward higher performance, application specific, and lower carbon grades, competitive outcomes are increasingly dependent on advances in metallurgy, process integration, and quality control rather than capacity addition alone. The continued presence of imports in select specialty segments reflects a transitional phase rather than a structural limitation. It highlights where domestic capability could be deepened — and where opportunities to capture greater value exist.

Encouragingly, this challenge is both recognized and addressable. The policy and investment frameworks now taking shape are explicitly oriented toward upgrading technological capability, supporting specialty production, and enabling cleaner pathways at scale. If executed with consistency and coordination, these measures can progressively realign the supply base with the evolving demand profile—converting current gaps into sources of competitive advantage.

In this context, India's steel sector stands at a constructive inflection point. The combination of strong fundamentals, strategic clarity, and industrial intent creates a credible pathway for transformation. With focused execution, the industry can move beyond being predominantly volume driven to becoming quality led and globally competitive—positioning steel not merely as a source of material supply, but as a strategic enabler of Viksit Bharat 2047.





Chapter 4

Technology, innovation and digitization

Technology has moved from a supporting function to the central engine of competitiveness in India's steel industry. As global trade regimes increasingly condition market access on environmental transparency — most notably through the European Union's Carbon Border Adjustment Mechanism (CBAM), which entered its paid phase on 1 January 2026 — the adoption of advanced process engineering and digital ecosystems is now a strategic imperative.

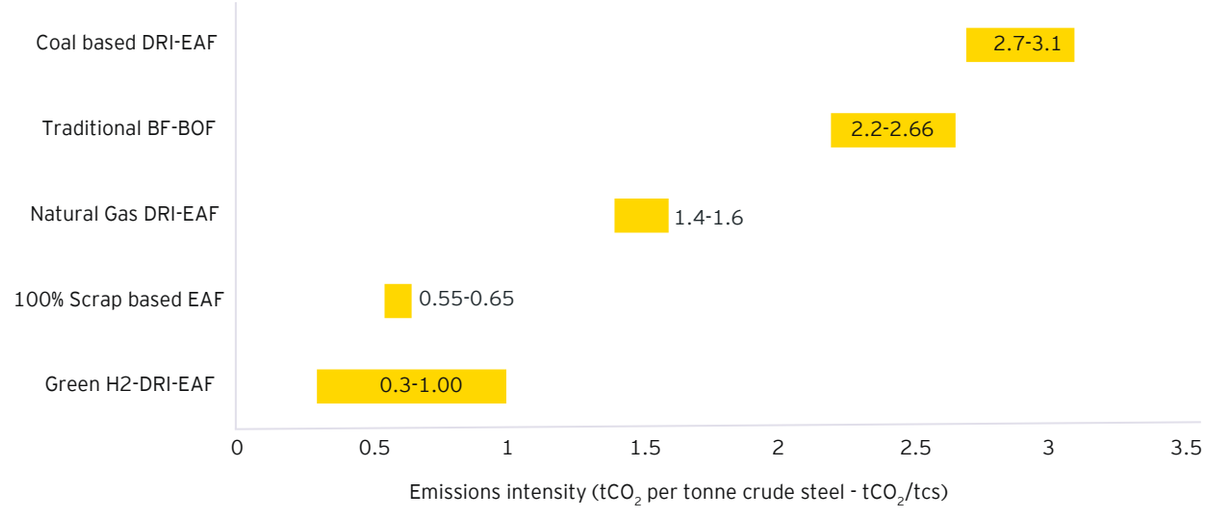
To maintain its position as the world's second-largest crude steel producer, India should converge three critical vectors: process modernization, Industry 4.0 integration and advanced product innovation.
The strategic challenge is not whether to decarbonize, but how to do so in a power-constrained, scrap-scarce, and cost-sensitive environment, where capital misallocation could lock the industry into structurally uncompetitive assets.

As global markets increasingly penalize carbon-intensive production, India's ability to "leapfrog" traditional technological cycles through digitization and innovation will be its most significant strategic advantage.

4.1 Modern steelmaking technologies: The decarbonization frontier

The global steel industry is undergoing a "twin transition" — the simultaneous pursuit of green innovation and digital intelligence — to mitigate its 7% to 9% contribution to global greenhouse gas emissions. While the traditional Blast Furnace-Basic Oxygen Furnace (BF-BOF) route remains the backbone of primary production with an emissions intensity of 2.66 tons CO2e per ton of steel, the industry is pivoting toward Electric Arc Furnaces (EAF) and Direct Reduced Iron (DRI) pathways.

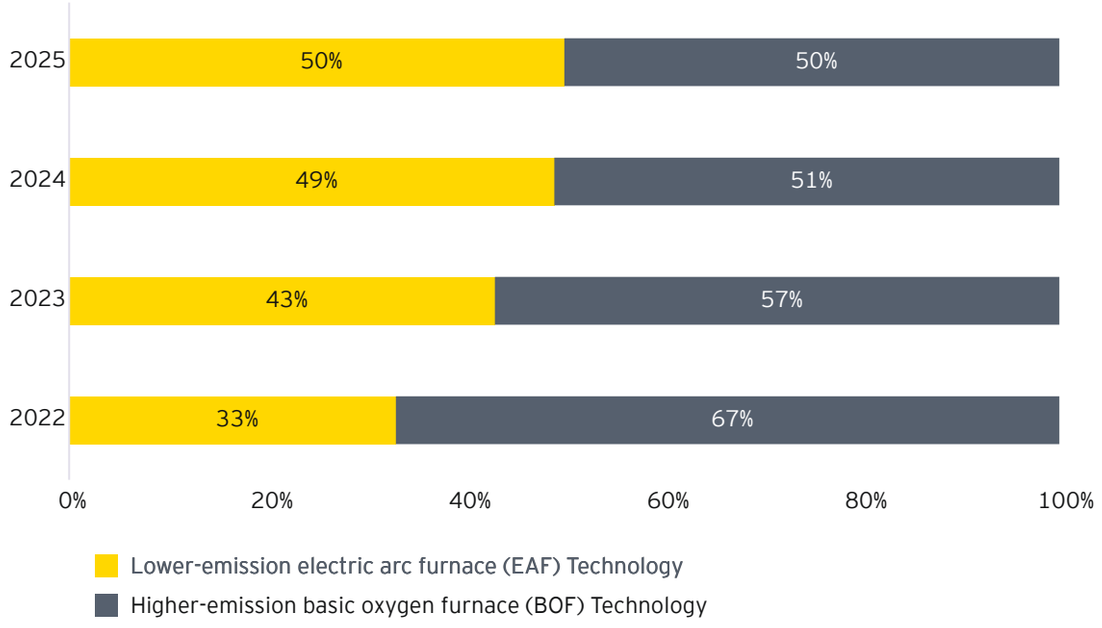
Emissions intensity by steelmaking route



Implication: Without accelerated EAF and scrap scaling, Indian steel could face a structural carbon cost disadvantage versus US and EU producers under CBAM regimes.

Comparative global benchmarks

The adoption of low-emission technologies varies significantly by region, creating a diverse competitive landscape for Indian players.



Source: Global Iron & Steel tracker

United States: Leading the world in secondary steelmaking, the US currently derives approximately 72% of its domestic steel output from EAF technology , leveraging its abundant scrap resources and cost-efficient power.

European Union: A frontrunner in "Green Hydrogen" pilots, the EU expects EAF's share of production to exceed 50% by 2030, supported by the build-out of over 40 million tons of new green steelmaking capacity.

India and China: Despite accounting for 60% of global production, EAF penetration remains low in these markets due to historical reliance on coal and insufficient natural gas availability for DRI. However, China aims for EAF production to exceed 20% by 2030, while India is aggressively exploring hydrogen-based DRI (H2-DRI) and gas-based shaft furnaces to bypass coal-intensive rotary kilns.

4.1.1 Strategic breakthroughs in India: Domestic pilots shaping future readiness

Indian majors are already piloting next-generation technologies to align with the National Green Hydrogen Mission.

These pilots are less about near term scale and more about preserving strategic option value in a post coal steelmaking world

Hydrogen integration

One leading producer is planning to commission a ~12 TPD alkaline electrolyzer for green hydrogen injection in DRI by Q4 FY26, while another has developed hydrogen-compliant API X65 grade steel for hydrogen transportation.

Alternative feedstocks

Innovative partnerships are exploring the use of locally sourced rice husk pellets as a biomass-derived syngas for iron ore reduction, offering a viable regional alternative to coal.

For India, the strategic objective is not to replicate the US scrap led model or the EU hydrogen heavy pathway, but to sequence hybrid routes that preserve cost competitiveness while remaining CBAM compliant.

4.1.2 Hydrogen-ready ironmaking: From pilot to scale

The National Green Hydrogen Mission, supported by an INR19,744 crore outlay, has catalyzed significant industrial commitment.

Pilot initiatives

The Ministry of Steel has allocated INR455 crore through FY30 for pilots including 100% hydrogen-based DRI and hydrogen injection in blast furnaces.

Corporate leadership

Leading players are also exploring biochar and hydrogen as coal alternatives in BFs, while also designing DRI plants to be hydrogen-ready as the fuel becomes commercially viable.

Economic barriers

Green hydrogen production costs are targeted to hit US$1.5/kg by 2030 , yet current DRI-EAF routes using hydrogen face costs 50% to 140% higher than conventional routes, necessitating substantial subsidies or "green premiums" to be viable

While hydrogen defines the long term decarbonization frontier, scrap based EAF production remains the only immediately scalable lever to reduce emissions, energy intensity capital risk over the next decade.

Strategic posture:

Lead: Export-oriented majors with balance-sheet depth and EU exposure

Follow: Domestic players via gas-DRI with hydrogen-retrofit hooks

Avoid: Sub-scale hydrogen pilots without offtake or policy support

4.1.3 Scrap-based circularity: Immediate route to decarbonization

Scrap-based EAF production offers the most immediate route to decarbonization, requiring significantly less energy than primary routes.

Consumption trends

Ferrous scrap consumption reached approximately 36MT in FY26, with the Steel Scrap Recycling Policy (2019) aiming to increase scrap's share in steel production to 50% by 2047.

Infrastructure growth

As of September 2026, 164 Registered Vehicle Scrapping Facilities (RVSFs) are operational, marking a significant formalization of the value chain.

Strategic recommendations: Process modernization

For CXOs: Accelerate natural gas-based DRI investments with "hydrogen-retrofit" hooks to avoid asset stranding as green hydrogen costs decline.

For policymakers: Expand SIGHT incentives beyond electrolyzer manufacturing to include direct subsidies for green steel offtake, bridging the US$50-US$140/ton cost gap.

4.1.4 Carbon Capture, Utilization and Storage (CCUS)

CCUS) offers a critical bridging technology for hard-to-abate segments of steelmaking, particularly for existing BF-BOF assets where full process transitions remain economically unfeasible in the near term.

Consumption trends

Global CCUS capacity in the steel sector remains nascent. India has no operational steel-sector CCUS projects, though pilot initiatives are under evaluation at integrated plants in Odisha and Jharkhand.

Infrastructure growth

Capture costs for steel-sector CO currently range between US$60-US$120/ton, with storage and transportation adding a further US$20-US$40/ton, making full-chain CCUS economically viable only with significant policy support or a robust carbon pricing mechanism above INR3,000/ton CO_2.

Strategic recommendations: Process modernization

For CXOs: Pursue modular, retrofit-ready capture unit pilots at existing blast furnace sites to build operational experience and de-risk future scale-up, prioritizing assets with 15+ year remaining lifespans where full transition to DRI-EAF is not viable.

For policymakers: Enabling Article 6.2/6.4 carbon credits for CCUS projects would improve project IRR without additional budgetary outlay which would be a mechanism we believe is under-utilized and should be formally activated.

As steelmaking shifts towards hydrogen, scrap and hybrid routes, process variability increases materially — making digital control, real time analytics and AI driven stabilization not optional, but foundational.

4.2 Digital acceleration and Industry 4.0: Enabling operational transformation

The "intelligent plant" is the essential glue for the energy transition. Digitization allows for the real-time stabilization of complex furnaces and the precise measurements required for export compliance.

The Ministry of Steel's 2026 Digital Roadmap suggests that the next phase of Indian steelmaking is likely to be shaped as much by algorithms as by metallurgy. Industry 4.0 adoption is delivering measurable gains in operational efficiency, with 72% of Indian manufacturers having implemented IoT-based automation by 2025.

4.2.1 AI-driven performance metrics

Advanced analytics and Machine Learning (ML) are no longer theoretical; they are delivering tangible bottom-line impact in integrated steel operations.

Energy efficiency

The adoption of an AI-enabled decision support system at a large steel plant delivered ~4.39 MW of average export power savings, underscoring the potential of advanced analytics in industrial energy optimization.
Leading international firms have demonstrated that fully integrated AI-driven production monitoring can achieve a 14% reduction in energy use per ton of ferro-alloys, setting a high-efficiency benchmark for the industry to emulate

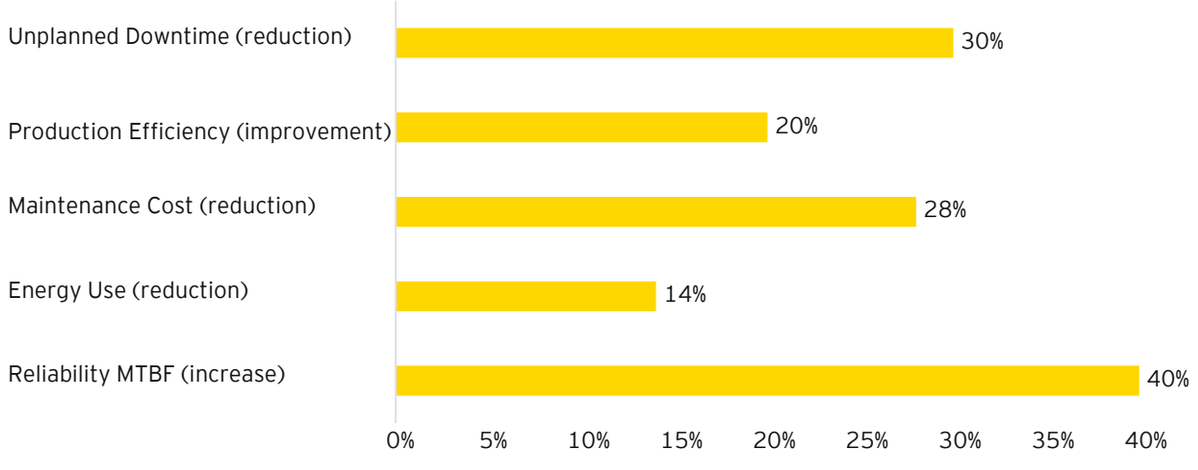
Predictive maintenance

The implementation of AI/ML models for asset health has led to a 25% to 35% reduction in unplanned downtime across major Indian plants.

Digital twins

Leading private players are utilizing digital twins for real-time process optimization and furnace temperature management, enhancing productivity and safety.

Representative operational gains



4.2.2 Scaling smart manufacturing: Advancing towards fully integrated digital plants

The concept of "One Button Steelmaking" is moving from pilot to scale, with some global leaders automating up to 95% of the steelmaking process through Level 2 automation and advanced metallurgical models. In India, a leading steel producer operates three "Global Lighthouse" manufacturing sites recognized by the World Economic Forum for excellence in digital transformation. The binding constraint is no longer technology maturity, but data governance, digital talent depth, and cross plant interoperability.

Strategic recommendations: Process modernization

For CXOs: Prioritize interoperability by moving away from "automation islands" toward a unified data layer to enable plant-wide AI diagnostics.

For policymakers: Establish a national industrial AI sandbox through the Steel Research and Technology Mission of India (SRTMI) to accelerate startup-led innovation.

4.3 R&D and product innovation: Building collaborative innovation ecosystems

In a world of demand cyclicality and trade barriers, proprietary technology and differentiated grades are the only sustainable shock absorbers. Innovation is the ultimate hedge against market volatility.

Global R&D spending reached approximately US$2.9 trillion in 2024, with China and the US leading at over US$780 billion each. India, by contrast, has historically underinvested, with gross R&D intensity at ~0.645 to 0.65% of GDP and private-sector R&D at ~0.2% of GDP, far below peer benchmarks. This gap has constrained India's ability to develop indigenous process technologies, specialty alloys and low carbon steel pathways .

Country	R&D (% of GDP, 2022-2025, depending on country)	Impact
South Korea	~5.0% - one of the highest globally	South Korea and Japan have systemic industry-academic R&D partnerships and long histories of innovation in steel processes and alloys
Japan	~3.4% - strong industrial R&D ecosystem	
China	~2.6% - rapidly growing R&D spend	China, although lower as a percentage, leads in absolute R&D spending (nearly US$780b+ worldwide) and rapidly expanding industrial research coverage
India	~0.64-0.65% - comparatively low	India's low overall R&D intensity contributes to slower technology adoption and reliance on imports/foreign partnerships

4.3.1 Structural shift is underway and moving towards mission-driven collaboration

The Government of India has initiated a decisive structural shift through large-scale, mission-oriented R&D frameworks:

National RDI Scheme (INR1 lakh crore / ~US$12 billion, 6 years):

Approved in FY26, with INR20,000 crore allocated in FY25-26 alone, this is India's largest-ever R&D financing initiative. Managed via the Anusandhan National Research Foundation (ANRF), it deploys patient capital (long-tenor, low-cost loans and equity-like instruments) through AIFs, DFIs, and NBFCs-explicitly correcting the historic bias toward capex-only financing at the expense of technology development.

Steel Research & Technology Mission of India (SRTMI):

Positioned as a sector-specific "live sandbox", SRTMI operationalizes collaborative innovation through:

- Challenge-led R&D (100% funding) for systemic issues such as decarbonization and raw material efficiency
- Industry-Academia Open Innovation (up to 60% co-funding)
- Startup accelerator programs with up to 75% funding for steel-tech startups

These mechanisms directly address long-standing barriers-risk aversion, weak academia-industry linkages, and IP uncertainty-by de-risking early-stage innovation.

4.3.2 Deepening the ecosystem: Academia, startups and Industry 4.0

Academic partnerships

Steel majors are partnering with IIT Bombay, IIT Kharagpur, and international institutions such as Imperial College London to advance R&D in:

- Carbon Capture, Utilization and Storage (CCUS)
- Hydrogen-based iron reduction
- Advanced and specialty alloy design (AHSS, electrical steel, corrosion-resistant grades)

Predictive maintenance

Corporate venture arms have already piloted with 40+ global startups, focusing on:

- AI/ML-driven process optimization
- Energy and yield efficiency
- Scrap quality enhancement and traceability
- Digital MRV systems for CBAM compliance

Industry 4.0 integration

Priority R&D themes now explicitly include AI/ML, digital twins and predictive maintenance, with estimated 5-10% energy-efficiency gains achievable through digital optimization alone.

4.3.3 Priority cascade

- Non negotiables (2025-2030): MRV systems, digital integration, scrap formalization
- Scale bets (2030-2035): Gas DRI, hydrogen ready assets, Pilot CCUS at BF BOF plants
- Option value (Post 2035): Full H2 DRI, Industrial-scale CCUS hubs

Initiative	Indicative budget	Timeline	Expected impact
National RDI Scheme (via ANRF)	INR1,00,000 crore (INR20,000 crore in FY26)	FY26-FY31	Scales private R&D; provides low-cost, long-tenor capital for green steel, advanced materials and deep-tech innovation

These priorities are reinforced by a time-phased national R&D + decarbonization investment roadmap of ~INR1.12 lakh crore (2026-2035), with ~INR31,000 crore public support crowding in ~INR81,000 crore of private capital.

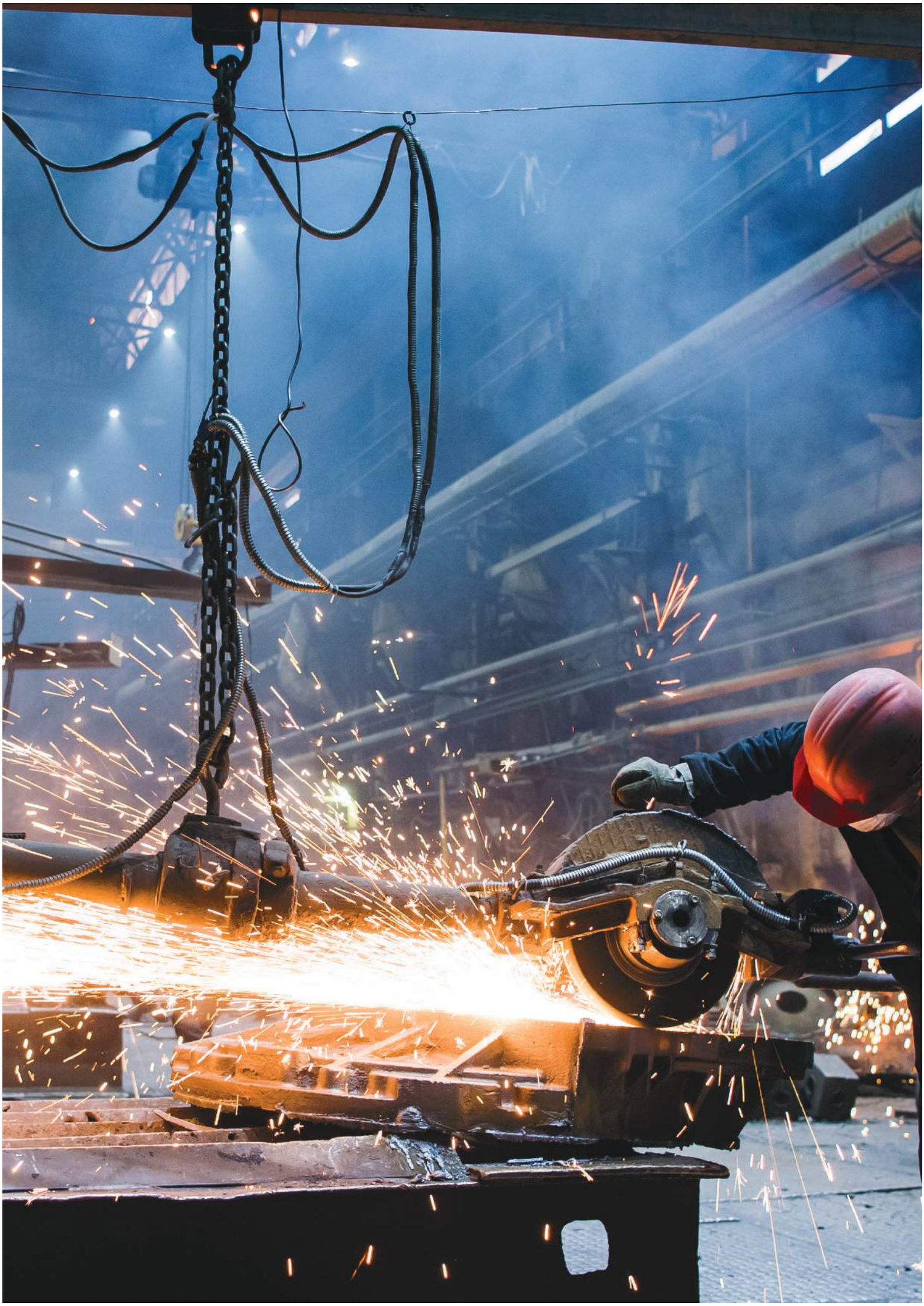
Implications for policymakers

Technology is increasingly central to whether India's steel industry remains primarily a volume-driven player or evolves toward global competitiveness in low-carbon, high-value steel. While much of the necessary policy architecture is now in place, the critical challenges appear to reside in execution and the depth of corporate participation.

Enterprises that align early with the SRTMI- and RDI-supported ecosystems are likely to realize durable advantages in cost efficiency, carbon performance and product differentiation, which may prove difficult for later adopters to replicate through incremental adjustments alone.

Initiative	Indicative budget	Timeline	Expected impact
SRTMI - Challenge-led R&D and open innovation	Project-based; up to 60%-75% public co-funding	Ongoing (2026+)	De-risks industry-wide challenges (decarbonization, H-DRI, CCUS); accelerates lab-to-plant translation
Steel Startup Accelera-tors (SRTMI and Corpo-rate VC arms)	Embedded within RDI/SRTMI pools	2026-2030	Faster adoption of AI/ML, digital MRV, energy efficien-cy and circular economy solutions
Industry-academia joint R&D centers	~INR12,000 crore (2026-28 phase)	2026-2028	Build domestic IP in specialty alloys, low-carbon processes and testing infrastructure
Green steel pilots (H_2 DRI, CCUS, EAF+RE)	~INR40,000 crore	2029-2032	Demonstrates technical and commercial viability; builds operational know-how
Full scale green steel commercialization	~INR60,000 crore	2033-2035	Positions India as a compet-itive exporter of low carbon and specialty steel; 50%+ CO intensity reduction

Having mapped the technology frontier and the regulatory imperatives, the lens shifts from constraint to capability. The role of steel as the structural backbone of India's future economy, and the roadmap that would help achieve it.





Chapter 5

Strategic roadmap: Purpose and structure

Earlier chapters have established the structural drivers of India's steel trajectory - rising steel intensity in GDP, the scale up towards 300 MTPA by 2030 and 500 MTPA by 2047, and the parallel imperatives of raw material security, decarbonization and value added growth. This chapter lays out a forward looking roadmap that sequences priority interventions across three time horizons.

The roadmap is organized into three horizons:

Short-term (0-2 years)	Medium-term (3-5 years)	Long-term (5-10 years)
Stabilize and de risk the system – especially raw materials, logistics, and policy architecture – and unlock quick, high impact reforms.	Scale, differentiate, and decarbonize – align capacity and product mix with demand while embedding technology and low carbon pathways.	Consolidate global leadership – in cost, carbon and capability – and position India as a preferred source of green and specialty steel.

5.1 Short-term roadmap (0-2 years)

The immediate horizon focuses on measures that can be initiated within existing policy envelopes and institutional capacity. The aim is to stabilize key input markets, reduce volatility, and create the enabling architecture for deeper medium term transformation.

Short-term roadmap 0 – 2

Area of impact	Initiative	Responsible	Key Impact
Raw material security	**India CFR coking coal index and voluntary pooled procurement**	Government and industry	Shifts India from price taker to price influencer in coking coal at full maturity, the coking coal reform stack (index, pooled procurement, logistics optimization, blending and hedging) can improve steel cost competitiveness in the range of US$25- US$40 per ton by lowering effective coal prices, freight and coke rate intensity
	Domestic iron ore index and auction premium smoothing	Government	Reduces self inflicted ore price distortion A INR500 per ton correction on around 450 MT of ore at 300 MTPA implies a national level saving of roughly INR22,500 crore per year Transparent indices and premium smoothing also improve planning certainty for new capacity
	National scrap registry, grading standards and scrap price index	Government	Formalizes scrap as a strategic raw material and improves quality, traceability and pricing. Over time, a deeper and more organized domestic scrap ecosystem contributes to US$30- US$50 per ton of steel cost stability by reducing dependence on volatile imported scrap and strengthening EAF route economics

0

Short term roadmap

2

Area of impact	Initiative	Responsible	Key Impact
Upstream and logistics	**DMF framework that prioritizes mine to plant corridors and first mile evacuation**	Government	Redirects underutilized District Mineral Foundation funds into high impact logistics - dedicated ore/coal corridors, slurry pipelines, and last mile evacuation Well designed corridors can reduce delivered ore/coal cost by about INR500-INR800 per ton in key mineral belts, improving competitiveness and utilization
Policy coordination	**National Raw Material Security Council (NRMSC)**	Government	Provides a standing coordination mechanism for iron ore, coking coal, scrap and hydrogen Oversees indices, pooled procurement, and overseas asset strategies Underpins the targeted US$25- US$40 per ton improvement in steel cost competitiveness and US$30- US$50 per ton cost stability envisaged under the raw material roadmap
Carbon risk / CBAM	**Steel MRV and CBAM aligned reporting framework**	Government	Establishes standardized measurement, reporting, and verification (MRV) of emissions aligned with EU CBAM and other emerging carbon border mechanisms. Creates the data foundation to avoid potential €55-€80 per ton CBAM linked carbon cost of exports as actual decarbonization measures are implemented
Demand generation and import substitution	**PLI for specialty steel 2.0 - lower thresholds, advance incentives and export bonus**	Government	Unlocks the stalled PLI pipeline by improving participation (especially from MSMEs and mid tier producers) and accelerating commissioning. Over the medium term, it supports substitution of 15% to 25% of India's specialty steel imports (roughly 4 MT today) and enables US$3- US$5 billion of annual specialty steel exports as domestic capacity in CRGO, AHSS and defense/energy grades ramps up
Technology and MSME upgrades	**Technology Upgradation Fund and cluster design for secondary/MSME steel**	Government and industry	Provides financing instruments and cluster level infrastructure (integrated downstream parks) for energy and yield improvement capex in the MSME/secondary segment, which accounts for 45%-50% of national capacity

5.2 Medium term roadmap (3-5 years)

The three- to five-year horizon is the execution window in which India is likely to reach 300 MTPA capacity and materially improve its product mix and emission profile. The focus is on scaling the short term architecture into full programs and commissioning the first generation of green and export oriented assets.

Mid term roadmap (3 – 5)

Area of impact	Initiative	Responsible	Key Impact
Raw material security	**Full coking coal reform stack (index + pool + strategic reserve + blending + hedging)**	Government and industry	Operationalizes the full set of coking coal interventions designed in the short term At maturity, delivers a structural US$25-US$40 per ton improvement in steel cost competitiveness versus the current baseline and significantly reduces exposure to spot price spikes, directly benefiting margins and investment appetite at 300 MTPA scale
Raw material security / circularity	**National scrap ecosystem at scale - ELV scrappage, urban mining, organized processing**	Government and industry	Scales end of life vehicle scrappages, construction demolition recovery and organized scrap processing, enabling the National Steel Policy's target of around 30+% scrap based steelmaking Reduces reliance on imported scrap priced off volatile global benchmarks and anchors a more stable, low carbon EAF segment
Decarbonization and hydrogen	**Green steel Contracts for Difference and H_2- DRI pilot clusters in two to three major steel regions**	Government and industry	Moves from concept to demonstration scale hydrogen based steelmaking. De risks the initial cost premium of green steel (currently around ~US$210 per ton above conventional routes) and builds capabilities that support a glide path towards single digit US dollar per ton premiums by the mid 2030s
Technology and MSME upgrades	**Technology Upgradation Fund and cluster design for secondary/MSME steel**	Government and industry	Provides financing instruments and cluster level infrastructure (integrated downstream parks) for energy and yield improvement capex in the MSME/secondary segment, which accounts for 45%-50% of national capacity
Decarbonization of legacy assets	**BF BOF modernization and CCUS ready upgrades on young export exposed assets**	Government and industry	Raises energy efficiency, PCI usage, and limited hydrogen injection capability while embedding CCUS readiness into newer BF BOF assets Reduces emission intensity and mitigates future stranded asset and carbon cost risk

Mid term roadmap 3–5

Area of impact	Initiative	Responsible	Key Impact
Export competitiveness and logistics	**Phase I coastal/export oriented steel clusters near major ports**	Government and industry	Commissions the first wave of integrated and downstream capacity co located with ports. Reduces inbound raw material and outbound steel logistics costs (order of ~US$10 per ton on seaborne flows), improves service reliability, and positions India as a source of CBAM compliant flat and specialty products
Technology and productivity	**Industry 4.0 / digital metallurgy scale up across at least 50% of capacity**	Government	Deploys advanced analytics, digital twins, and AI driven optimization across integrated and secondary plants Typical improvements in yield and energy efficiency, alongside higher GVA per employee and more consistent quality - especially important for automotive, renewable and defense grades
Demand architecture	**Five year rolling national steel demand forecast linked to NIP, Gati Shakti, PLI and defense/RE pipelines**	Government	Institutionalizes a planning tool that links scheme pipelines and macro projects to explicit steel demand by segment and grade

5.3 Long-term roadmap (5-10 years)

The 5- to 10-year horizon aligns with India's transition from a demand anchored, 300 MTPA system to a 500 MTPA ecosystem with explicit global leadership ambitions in green and specialty steel. The focus shifts towards full commercialization of low carbon routes, deep export integration, logistics re platforming and sustained innovation.

Long-term roadmap 5–10

Area of impact	Initiative	Responsible	Key Impact
Decarbonization and carbon pricing	**Commercial scale H_2 DRI/EAF and CCUS hubs in major steel clusters**	Government and industry	Scales up from pilots to integrated low carbon clusters combining hydrogen based DRI, scrap rich EAF routes and CCUS for residual BF BOF capacity Supports sectoral emission intensity reduction from around 2,550 kg CO per ton in 2025 towards 900-1,100 kg CO per ton by 2035 Protects export exposure as carbon pricing tightens and avoids CBAM type penalties

5

Long-term roadmap

10

Area of impact	Initiative	Responsible	Key Impact
Export competitiveness	**Global green and specialty steel export platform anchored in coastal clusters**	Government and industry	Leverages coastal clusters, CBAM aligned MRV and specialty grade capacity to position India as a preferred origin for low carbon, high grade steel Over time, underpins US$3- US$5 billion of annual specialty and green steel exports and lifts the overall value added share of the product mix
Logistics and upstream	**"Logistics 2.0" - multimodal, low carbon steel corridors (DFCs, waterways, coastal shipping, ore corridors)**	Government and industry	Re platforms steel logistics around dedicated freight corridors, inland waterways, coastal shipping and integrated logistics parks In combination with earlier DMF funded and Sagarmala/Gati Shakti projects, delivers a structural reduction in delivered cost and emissions at 500 MTPA scale
Workforce and skills	**Steel workforce transformation - "digital and green metallurgy" skilling programs**	Government and industry	Aligns workforce capabilities with hydrogen ready, automated and digitally optimized plants, while enabling MSME and secondary clusters to climb the technology curve
R&D and innovation	**Steel R&D and innovation platforms via RDI/ANRF and SRTMI with higher R&D intensity**	Government and industry	Sustains an innovation pipeline in advanced alloys, process intensification, circular economy solutions and digital process control Raising sectoral R&D intensity can unlock additional private R&D, supporting emission reduction, higher margin products and long term competitiveness in green and specialty steels

5.4 Concluding outlook: From strategic vision to an executable blueprint

The three-horizon roadmap demonstrates that India's steel ambitions do not require new slogans or targets, but disciplined execution of a finite set of high-leverage interventions. Raw material and logistics reforms alone can unlock structural savings on the order of US$25 – US$40 per ton and stabilize a further US$30– US$50 per ton of cost volatility, substantially strengthening the sector's baseline competitiveness. Targeted use of PLI, DMF, RDI/ANRF and SRTMI then closes critical specialty steel and technology gaps, while green steel pilots, MRV/CBAM alignment, and hydrogen/CCUS hubs secure access to carbon-regulated premium markets over the long term.

As the government delivers the enabling architecture – indices, DMF reform, MRV and CBAM frameworks, green-finance instruments, coordinated raw-material governance, and demand visibility – and industry responds through timely capex, technology adoption and workforce transformation, India is positioned to transition from a fast-growing volume player toward a structurally low-cost, low-carbon and high-value steel producer.

Annexure: Glossary of key terms

Terms	Definition
AHSS	Advanced High Strength Steel. A family of high strength steel grades used in automotive manufacturing to reduce vehicle weight without compromising safety.
AluZinc Steel	Steel coated with an aluminum zinc alloy for superior corrosion resistance. Commonly used in solar structures and roofing.
ANRF	Anusandhan National Research Foundation. A government body with a INR1 lakh crore corpus to fund research and innovation across scientific disciplines in India.
APIGrade Steel	Steel manufactured to American Petroleum Institute standards for use in oil and gas pipelines, casing and tubing.
Atmanirbhar Bharat	Hindi for 'Self Reliant India.' A national policy initiative to reduce import dependence and strengthen domestic manufacturing.
BFBOF	Blast Furnace-Basic Oxygen Furnace. The dominant primary steelmaking route, using iron ore and coking coal to produce steel.
Bainitic Armor Steel	An armor steel with a bainitic microstructure offering good toughness under dynamic impact. Used where moderate hardness and toughness are both required.
Bharatmala	A central government road and highway development program targeting national corridors, coastal roads and border connectivity.
CAGR	Compound Annual Growth Rate. The mean annual growth rate of a metric over a specified period, assuming compounding.
Carbon Border Adjustment Mechanism (CBAM)	A European Union trade policy that imposes a carbon price on imports of carbon-intensive goods, including steel, from countries with less stringent climate regulations.
Carbon Capture, Utilization and Storage (CCUS)	Technologies that capture CO emissions from industrial processes and either store them underground or use them in other processes.
CDP	Carbon Disclosure Project. A global framework for companies and governments to report environmental data, including emissions and climate risk.
CRGO Steel	Cold Rolled Grain Oriented Steel. A specialty electrical steel used in power transformers. India currently imports almost its entire requirement.
CRNO Steel	Cold Rolled Non Oriented Steel. An electrical steel used in EV traction motors and household appliances.

Terms	Definition
DHA	Dual Hardness Armour. A twolayer armour steel - hard front face to break projectiles, tough rear face to absorb shock.
Digital Product Passport	A digital record tracking a product's raw material origin, carbon footprint, and recyclability across its lifecycle.
DRI	Direct Reduced Iron. Iron ore reduced to metallic iron without melting, used as feedstock for electric arc furnaces. Also called sponge iron.
EAF	Electric Arc Furnace. A steelmaking furnace powered by electricity that melts scrap or DRI to produce steel.
EPFO	Employees' Provident Fund Organisation. India's statutory body managing retirement savings contributions from employers and employees.
ESG	Environmental, social and governance. A framework used by investors and buyers to evaluate a company's sustainability and ethical performance.
EV	Electric Vehicle. A vehicle powered by electric motors. The EV transition is driving demand for advanced steel grades in batteries and body structures.
FDI	Foreign Direct Investment. Investment by a foreign company or individual in business interests in another country.
GRI	Global Reporting Initiative. An international framework for sustainability reporting by companies and governments.
HAM	Hybrid Annuity Model. A public-private partnership model where the government funds ~40% of the project cost and the private developer recovers the rest through annuity payments.
HHA	High Hardness Armor. A high hardness armor steel grade used primarily in battle tanks to defeat armor-piercing projectiles.
HSLA Steel	High Strength Low Alloy Steel. Steel with small quantities of alloying elements for greater strength than conventional carbon steel, used in shipbuilding and heavy structures.
HDRI	Hydrogen-based Direct Reduced Iron. A process using green hydrogen to convert iron ore into metallic iron, producing water vapor instead of CO as a byproduct.
Index of Eight Core Industries	A composite index tracking production in eight key infrastructure sectors in India. Steel carries a 17.92% weight in this index.

Terms	Definition
InvIT	Infrastructure Investment Trust. A pooled investment vehicle that owns and operates infrastructure assets, used by NHAI for asset monetization.
Iron Ore	The primary raw material for steelmaking consisting mainly of iron oxides. India has abundant domestic reserves concentrated in Odisha, Jharkhand, and Chhattisgarh.
Jal Jeevan Mission	A Government of India program targeting the provision of safe tap water to every rural household, driving rural steel demand through pipeline and storage infrastructure.
LGSF	Light Gauge Steel Framing. A construction system using cold formed, thin galvanized steel sections as structural frames. Popular in affordable housing and modular construction.
MTPA	Million Metric Tons Per Annum. A unit of capacity used for ports, refineries, and pipelines.
MoU	Memorandum of Understanding. A formal agreement outlining the terms of an understanding between two or more parties.
MRV	Monitoring, Reporting, and Verification. A framework for measuring and verifying greenhouse gas emissions, increasingly required for export market access and green financing.
MSME	Micro, Small and Medium Enterprises. The MSME and secondary steel sector together control ~47% of India's national steel capacity.
MT / MTPA	Million Tons / Million Tons Per Annum. Standard units for measuring steel production capacity and output.
National Green Hydrogen Mission	A Government of India initiative with a INR19,744 crore outlay to establish India as a global hub for green hydrogen production.
National Infrastructure Pipeline (NIP)	A Government of India initiative cataloguing over INR111 lakh crore in planned infrastructure investments across transportation, energy, and urban development.
National Steel Policy (NSP)	The Government of India's long-term policy framework for the steel sector, setting capacity, consumption, and sustainability targets through 2030 and 2047.
NHAI	National Highways Authority of India. The central body responsible for developing and maintaining national highways.
NIIF	National Investment and Infrastructure Fund. India's sovereign wealth fund providing long-term capital to infrastructure sectors.
PEB	Pre-Engineered Building. A building system where structural components are factory manufactured and assembled onsite. Widely used for industrial and logistics facilities.
PLI Scheme	Production Linked Incentive Scheme. A government program offering financial incentives to manufacturers for incremental production above a base year.
PM Gati Shakti	A national master plan integrating infrastructure planning across 16 central ministries to eliminate logistical bottlenecks and accelerate connectivity projects.

Terms	Definition
PMAY	Pradhan Mantri Awas Yojana. India's flagship affordable housing program, a key driver of demand for TMT bars and structural steel.
RHA	Rolled Homogeneous Armor. The benchmark armor steel grade offers a balance of hardness, toughness, and weldability. Used in light armored vehicles.
RVFS	Registered Vehicle Scrapping Facilities. Government authorised facilities to dismantle end-of-life vehicles and channel recovered steel scrap back into supply chains.
Sagarmala	A port-led development program targeting investments to boost port handling capacity to 10,000 MT by 2047 and develop coastal industrial clusters.
SBTi	Science-Based Targets initiative. A framework enabling companies to set emissions reduction targets aligned with the Paris Agreement.
SIGHT Programme	Strategic Interventions for Green Hydrogen Transition. A component of India's Green Hydrogen Mission providing financial incentives to electrolyser manufacturers and hydrogen producers.
Smart Cities Mission	A Government of India initiative to develop 100 cities into sustainable, citizen friendly urban environments through smart infrastructure and digital services.
SRTMI	Steel Research and Technology Mission of India. A body that co-funds industry relevant steel research at 60-75% of project costs.
TCFD	Task Force on Climate-related Financial Disclosures. A framework for companies to disclose Climate related financial risks, widely used by institutional investors.
TMT Bars	Thermo Mechanically Treated Bars are reinforcement steel bars used extensively in construction, housing, and civil infrastructure across India.
TMCP Steel	Thermo Mechanically Controlled Processed Steel. A high strength, high toughness steel used in shipbuilding for hull plates and load-bearing structures.
ToT	Toll Operate Transfer. A public asset monetization model where the government transfers toll collection rights on operational highways to private entities for a fixed period.
UHSS	Ultra-High Strength Steel. Steels with very high yield strength used in aerospace landing gear, aero-engine bearings, and advanced automotive safety components.
Viksit Bharat 2047	India's vision to become a developed nation by 2047, the centenary of independence, targeting a US$10 trillion economy with advanced manufacturing and energy self-sufficiency.
VGF	Viability Gap Funding. A government grant provided to infrastructure projects that are economically justified but not financially viable without support.
WSA	World Steel Association. The principal global industry association for the steel sector, publishing key benchmarks including global per capita steel consumption data.

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Survey No 83/1, Raidurgam
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Horizon Tower, JLN Marg
Opp Jaipur Stock Exchange
Jaipur, Rajasthan - 302018

Kochi
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NH-49, Maradu PO
Kochi - 682 304
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6th floor, Sector V, Building Omega
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Electronics Complex, Bidhan Nagar
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Dadar (W), Mumbai - 400 028
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5th Floor, Block B-2
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Mindspace-Gigaplex
IT Park, MIDC, Plot No. IT-5
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