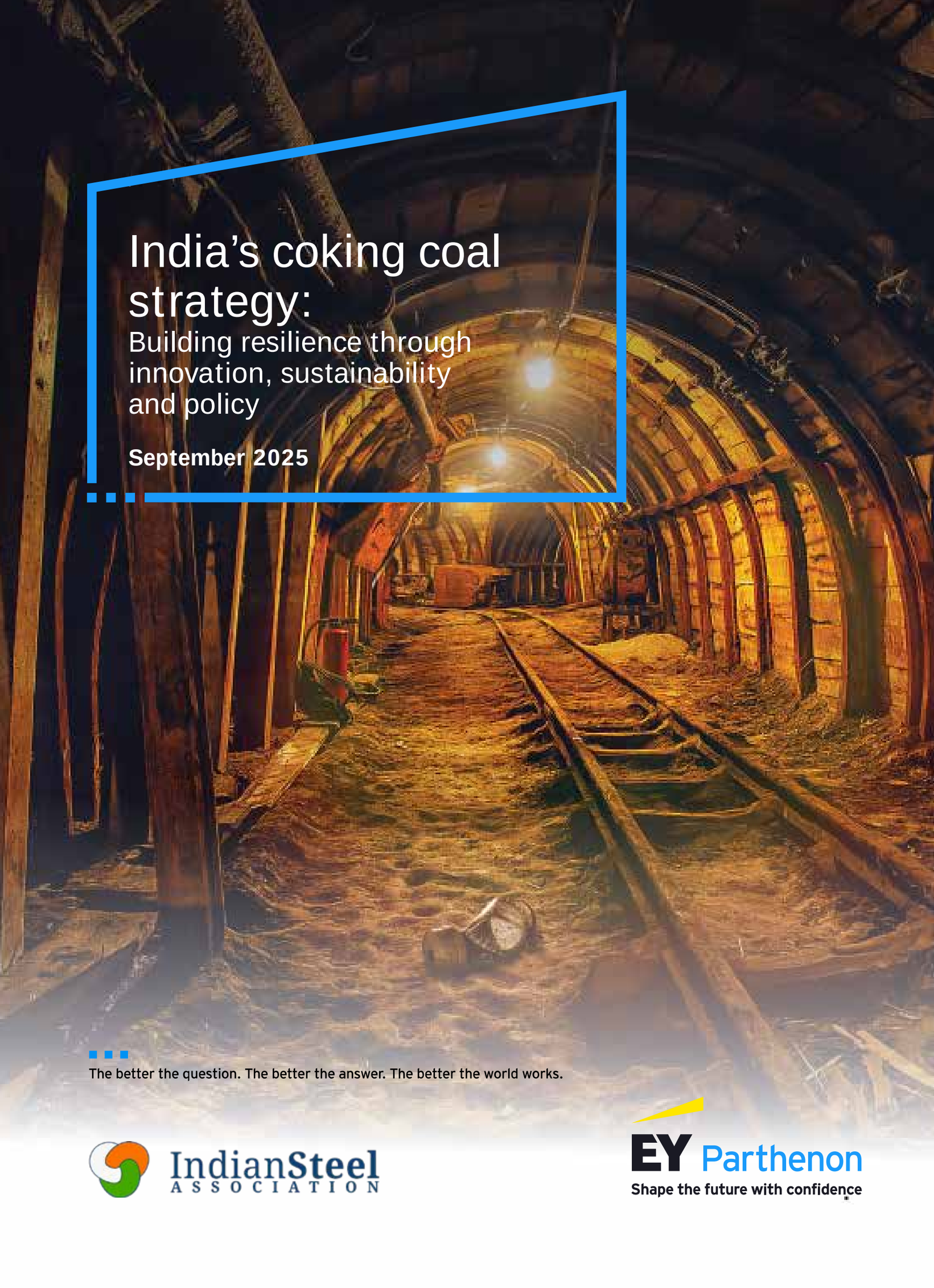

# India’s coking coal strategy:

## Building resilience through innovation, sustainability and policy

**September 2025**

The better the question. The better the answer. The better the world works.

IndianSteel ASSOCIATION

EY Parthenon

Shape the future with confidence

# About ISA

The Indian Steel Association (ISA) serves as the voice of the Indian steel industry, both in domestic and global forums. It plays a leading role in all deliberations related to public and regulatory policies, raw materials, international trade, logistics, environmental concerns, technology, and other aspects of steelmaking.

The Indian steel industry relies on ISA to advance its critical agenda of sustained growth–both in steel production and in driving steel demand.

ISA was formed in 2014 and represents about 65% of the total domestic capacity. Its members include seven executive members: JSW Steel Limited, Tata Steel Limited, Steel Authority of India Limited, Jindal Steel and Power, ArcelorMittal Nippon Steel India, Rashtriya Ispat Nigam Limited, and JSW Bhushan Power & Steel Limited. There are also 12 affiliate members: NMDC Steel Limited, Jindal Stainless Steel Limited, Arjas Steel, ESL Steel Limited, Saarloha Advanced Material Pvt Ltd (Kalyani Group), Rungta Mines Limited, Odisha Metalliks Pvt Ltd (OMPL), JSW Ispat Special Products Limited, MS Agarwal Foundries Pvt Ltd, Evonith Steel, Maruti Ispat & Energy Pvt Limited, and RL Steel. Additionally, ISA has two associate members: Karnataka Iron and Steel Manufacturers Association (KISMA) and the Institute for Steel Development and Growth (INSDAG).

# About Coking Coal Summit

Coking coal, an essential component in steel production, faces significant challenges in aligning with a more environmentally conscious future due to its high carbon footprint. However, several promising strategies have the potential to reshape the industry's narrative and drive it toward greater sustainability.

The ISA Coking Coal Summit, a premier annual event, serves as a dedicated platform for discussing coking coal accessibility and developing strategies to foster the sustainable evolution of the coking coal supply chain within the Indian steel sector.

The summit addresses a wide array of critical topics – including the future availability of coking coal, improving the efficiency and sustainability of supply chain logistics, implementing decarbonization initiatives and innovative technologies, integrating digital solutions, and examining the role of price reporting agencies. It aims to create an exclusive forum for industry leaders to engage in meaningful dialogue.

This platform brings together experts, scholars, industry pioneers, policymakers, and other key stakeholders to exchange insights, share ideas, and present real-world experiences.

The summit facilitates discussions among prominent figures from the global coking coal and steel industries, including senior industry leaders, government officials, and expert consultants. These interactions are expected to contribute significantly to building a more resilient and sustainable coking coal ecosystem for the steel industry.

# Foreword

**Naveen Jindal,**
President of the Indian
Steel Association

“India’s steel industry is entering a transformative era, driven by rising domestic demand and global competition. Coking coal remains the backbone of steelmaking, and securing a reliable, high-quality supply is a strategic necessity for national growth. With stronger resource security, technological innovation and clear policy support, India can build a stronger and globally competitive steel sector.

**Alok Sahay,**
Secretary General and
Executive Head,
Indian Steel Association

"The realization of India's self-reliance in coking coal fundamentally depends on dramatic advancements in beneficiation and associated infrastructure. Tripling washed coal output through the accelerated deployment of Washery Developer-Operator models, combined with mechanization of underground mines and enhanced first-mile connectivity, will be crucial. These concerted policy and operational reforms will improve coal quality and logistical efficiency, enabling the steel industry to meet growing production demands with greater sustainability and reduced import reliance.

"The future of the coking coal supply chain hinges on our ability to leverage emerging digital technologies such as predictive analytics, automation, and digital twins. By embedding these tools into mining operations and coal blending processes, we can unlock significant operational efficiencies and build a supply chain that is both agile and resilient. This digital transformation will be a key enabler for India's steel industry to navigate market volatility while optimizing resource utilization and environmental compliance.

**Vinayak Vipul,**
Partner,
Business Consulting,
EY-Parthenon

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# Executive summary

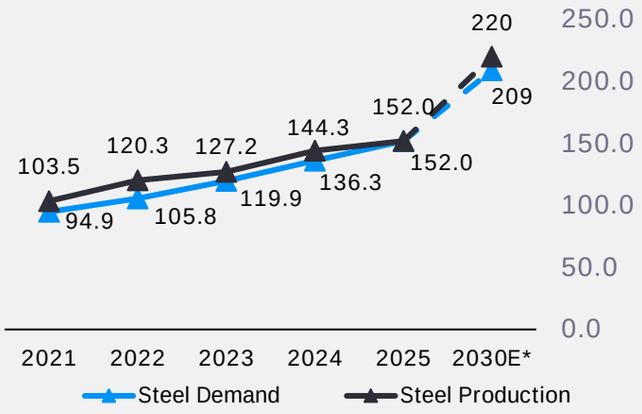
# 1 Executive summary

India's steel sector stands at a critical inflection point amid rapid industrial expansion and robust economic growth, with steel demand closely tied to the nation's manufacturing, construction, and infrastructure booms. In FY25, India's GDP grew by 6.4%, driven by key sectors such as automotive (7.3%), construction (9.4%), and infrastructure (4.4%), which together underpin a steel demand forecast that continues to climb steadily

India remains the world's second-largest steel producer, accounting for 8% of global output at 152 million tonnes in 2025, predominantly using the Blast Furnace–Basic Oxygen Furnace (BF-BOF) route, which relies heavily on coking coal as a critical raw material. This reliance places coking coal at the heart of India's steel production ecosystem and broader industrial growth story, supporting not only the steel industry but also allied sectors such as cement, chemicals, and power generation

Simultaneously, the steel sector is a significant contributor to greenhouse gas emissions (12% of India's total), emphasizing the urgent need for cleaner steel production technologies aligned with India's commitment to net-zero emissions by 2070. The pace & extent of shift towards greener modes of production will play a major role in determining the trajectory of the coking story landscape in India

Trends in India's steel sector (Mn.T)




** With capacity of 300 MTPA, assuming utilization of 73%*
*Source: JPC and EY analysis*

The coking coal and steel value chain in India faces multifaceted challenges spanning mining, extraction, beneficiation, end-use, and cross-cutting dimensions

## Mining and extraction

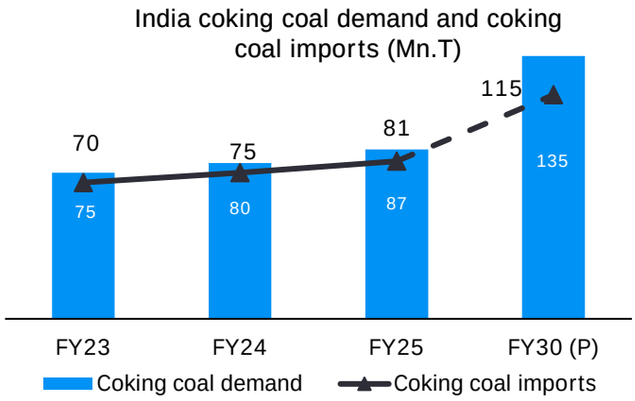
- Domestic coking coal production remains insufficient, with raw coal output at 66.8 million tons in FY24 but only about 5 million tons of washed coal meeting industrial specifications. High ash content (25%–35%) and sulphur levels in indigenous reserves reduce quality and usability. The Jharia coalfields, home to some of India's best-quality reserves (12 billion tons), suffer from legacy issues including underground fires and land subsidence, complicating extraction efforts.
- Limited geological data, underfunding, lengthy environmental clearances, land acquisition challenges and community resistance hamper exploration and auctioning of new coking coal blocks. Regulatory delays and complex socio-environmental concerns further restrict mining expansion.
- Infrastructure bottlenecks such as railway congestion in Odisha and Jharkhand, inadequate coal evacuation systems and limited mechanization curtail production scalability and increase operational costs.

## Beneficiation and processing

- Limited capacity of coal washeries and blending facilities constrains the upgrade of raw coal to steel-grade washed coking coal. Existing washeries operate below optimal efficiency, particularly public sector units, which average around 32% capacity utilization.
- Technological gaps persist in beneficiation, with slow adoption of advanced equipment such as heavy media cyclones, flotation columns and zero-liquid discharge systems needed for sustainable operations.

## End use and market dynamics

- Heavy reliance on imports (~90%) exposes steel to global price swings, freight costs, and geopolitical risks like the Russia-Ukraine war and shifting trade policies.
- Divergent global price benchmarks complicate procurement and inflate landed costs, eroding competitiveness.
- Lack of a strategic stockpile heightens vulnerability to supply shocks and price spikes, threatening steel output continuity.




*Source: Ministry of Coal and EY analysis*

## Other challenges

- Patchy adoption of advanced mining, AI optimization, and clean fuel alternatives.
- Skill shortages in specialized mining, beneficiation, and equipment maintenance limit efficiency and safety gains.
- Decarbonization is hampered by poor hydrogen infrastructure, weak scrap collection, and high costs.
- Policy and pricing reforms are needed to attract investment, improve transparency, and ensure supply security.

In response to these substantial challenges, concerted efforts by government and industry focus on structural reforms and technological modernization:

## Mining and extraction

- Mission Coking Coal aims to scale washed coal output to 15 million tons by 2030, backed by new washeries, advanced beneficiation, and private participation under the Washery Developer Operator (WDO) model. Incentives such as 20–30% capital subsidies and accelerated depreciation encourage investment.
- Policy reforms–100% FDI in commercial coal mining, revenue-sharing auctions, and faster environmental/land clearances–improve ease of doing business and production reliability.
- Infrastructure upgrades, including 39 First Mile Connectivity (FMC) projects, strengthen evacuation via mechanized transport, in-pit crushing, and rail corridors.
- States like Jharkhand, Chhattisgarh, and Odisha support transparent mining policies, digital surveillance, single-window clearances, and conservation programs.

## Beneficiation and processing

- Modern washeries with automation and real-time quality monitoring (e.g., laser analyzers) improve yield and lower ash, enhancing steelmaking suitability.AI-driven blending and predictive modeling stabilize coke quality and hedge against cost volatility by combining imported and domestic coal.
- Trade policies enforce quotas on low-ash metallurgical coke and pursue anti-dumping investigations to support domestic producers and ensure balanced imports.

## End use and market measures

- Domestic pricing transparency: The Coal India Coking Coal Index (CICCI) provides an early domestic benchmark, with efforts to deepen liquidity and link it to commodity derivatives for price risk management.
- Diversified imports: Trade partnerships expand sourcing beyond Australia to Russia, US, Mongolia, Mozambique, and Canada, supported by logistics corridor development.
- Consolidated procurement: A “one nation, one buying” policy is under development to coordinate coal purchases, enhance bargaining power, and overcome earlier grade mismatch challenges.

§ Strategic reserves: Proposed policies aim to build national stockpiles, mandate inventory norms, create port-based storage, and monetize idle assets to buffer supply risks.

## Cross-cutting and sustainability initiatives

§ Low-carbon steelmaking: The National Green Hydrogen Mission and incentives accelerate hydrogen-based DRI, EAF adoption, biochar use, and CCUS technologies.
§ Innovation ecosystem: R&D institutions such as NML and CSIR-CIMFR, alongside the Ministry of Steel schemes, drive efficiency in mining, beneficiation, and emission reduction.
§ Future-ready workforce: National and local skilling programs equip workers for advanced coal mining and processing technologies.
§ Environmental safeguards: Pollution control systems, land reclamation, afforestation, and water treatment reduce ecological impact and balance industrial growth with sustainability.

To secure a resilient, competitive, and sustainable steel and coking coal ecosystem, India must pursue a strategic, multi-pronged agenda:

§ Boost domestic output: Expand coking coal production and beneficiation with advanced technology and private sector investment to cut import reliance and improve quality.
§ Secure supply: Diversify import sources and develop strategic reserves, supported by CICCI-linked risk management tools.
§ Green transition: Scale hydrogen-based DRI, scrap recycling, renewable integration, and CCUS with supportive policies and infrastructure.
§ Ease of doing business: Streamline exploration, clearances, and land acquisition through faster approvals and community engagement.
§ Digital and mechanized operations: Deploy AI, automation, and mechanized mining for higher productivity, safety, and compliance.
§ Future-ready workforce: Build skills and institutional capacity aligned to next-generation technologies.
§ Collaborative governance: Strengthen industry–government partnerships and consortium-based sourcing to enhance resilience and competitiveness.

02

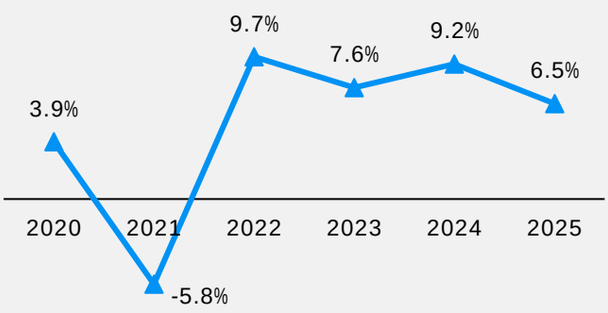
# Context setting and national vision

# 2 Context setting and national vision

**India's industrial expansion and growing steel demand are fueling a decisive shift toward low-carbon steel, aligning with the nation's 2070 net-zero ambition.**

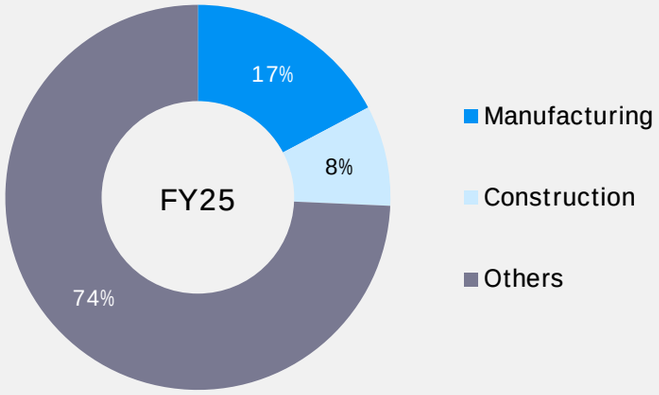
India has delivered strong economic growth, with FY25 growth projected at 6.4%, supported by favorable macroeconomic conditions such as resilient domestic demand and stable inflation. The manufacturing sector has been a key driver, with industries such as automotive, construction and infrastructure growing by 7.3%, 9.4% and 4.4%, respectively.

India's GDP growth over the years ( in %)




*Source: WorldBank, PIB, IBEF, and EY analysis*

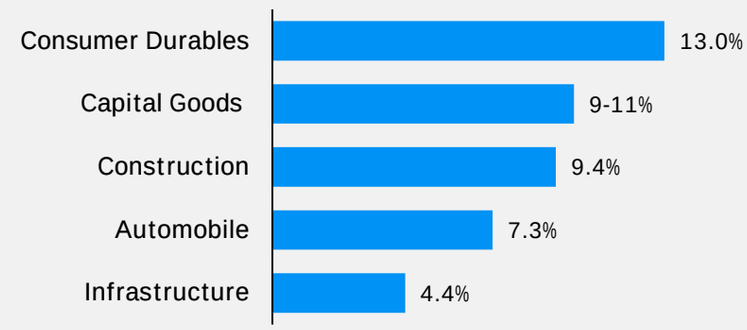
Sectors and their contribution to GDP (in %)




## Steel as a pillar for Atmanirbhar Bharat

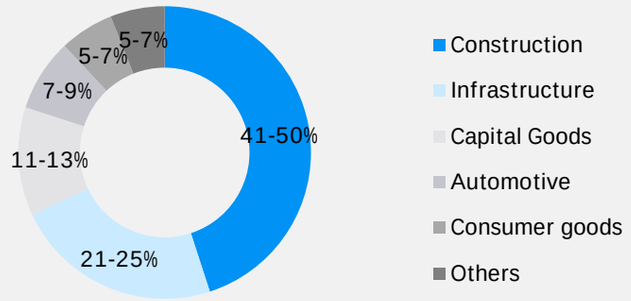
Internal reforms such as Make in India and Atmanirbhar Bharat, along with supportive government schemes and policies including the Pradhan Mantri Awas Yojana (housing for all), Gati Shakti Master Plan and Production Linked Incentive (PLI), together with evolving global market dynamics, have driven strong growth across these industries. This growth has been instrumental in boosting India's steel demand, which underpins the expansion of these sectors.

End-use industry growth FY25 (in %)




*Source: SIAM, PIB, Mymetalogic and EY analysis,*

## Steel demand across key industries ( in %)

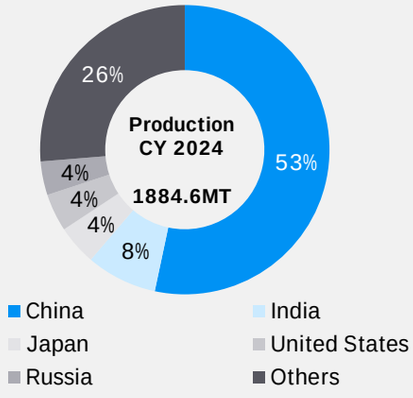



*Source: World bank, ICICI, CRISIL and EY analysis*

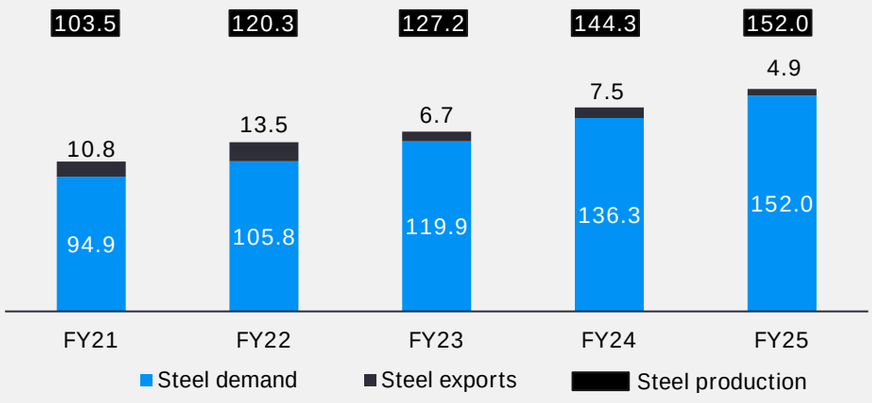
With vigorous development plans across manufacturing sector to achieve self-reliance, steel industry will continue to be at the core of this industrial growth. Rising construction activities to accommodate a growing population and urbanization, increasing demand for vehicles and capital goods, and expansions of manufacturing and infrastructure needs will continue to drive the demand for steel. Moreover, the multiplier effect of manufacturing growth is also expected to boost steel consumption in allied sectors such as packaging and electronics, thus making steel a critical component of India's economic growth.

India remains the world's second-largest consumer of steel, driven by robust industrial activity. It is also the world's second-largest steel producer, with an output of 152 MT in 2025, second only to China. However, India's steel exports have declined in recent years due to global trade barriers, rising competition from China, subdued global demand, and increasing domestic consumption from infrastructure and industrial growth, which now absorbs most of the production capacity.

## Global steel production (in %)




## Indian steel industry overview (Mn.T)




*Source: WSA, JPC and EY analysis*

India's installed steel capacity is spread across production routes such as Blast Furnace–Basic Oxygen Furnace (BF-BOF), Direct Reduced Iron (DRI), and Electric Arc Furnace (EAF). While BF-BOF accounts for about 65% of installed capacity, it contributes a slightly lower share of actual production at around 58%, while the sector is heavily reliant on this route, the other routes have started to gain prominence.

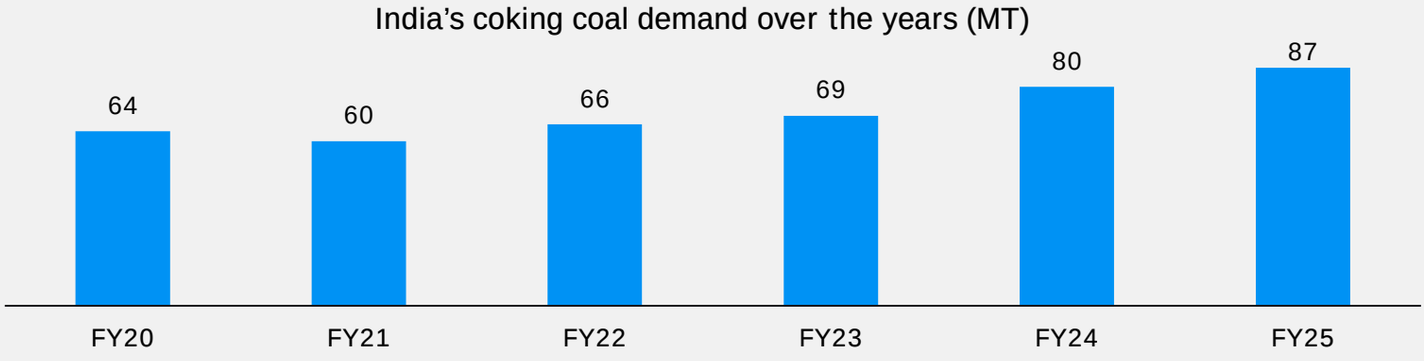
**The Mission Coking Coal sets an ambitious target of 140 million tonnes of *raw* domestic coking coal by 2029–30, has necessitate reforms to expand beneficiation capacity, fast-track mine approvals, and address logistics bottlenecks essential for achieving Atmanirbharta . India's heavy reliance on imports—nearly 90% of prime hard coking coal—underscores the urgency to scale captive mining and adopt advanced washing and blending technologies, crucial for cost reduction and supply stability. Unlocking greater beneficiation capacity and operationalizing washery developer-operator models are essential steps to improve domestic coal quality and logistics, supporting the steel sector's growth and import substitution goals.**

Arun Maheshwari

Director (Commercial and Marketing), JSW Steel

## Coking coal in India's economic and industrial strategy

With the BF-BOF route holding the largest share in Indian steel production, the sector–though efficient–has developed a heavy reliance on coking coal, a vital raw material in the blast furnace process for converting iron ore into molten iron. Consequently, coking coal has become integral to India's steel sector and its broader industrial growth. While steel remains the dominant consumer, coking coal is also used in industries such as cement, chemicals, petrochemicals, and foundry, though these account for only about 5% of total demand–reflecting the steel sector's central role in driving consumption.

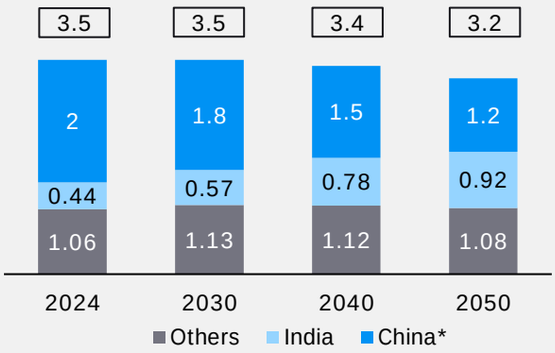



*Source: Ministry of Coal , Ministry of Steel, ISA and EY analysis*

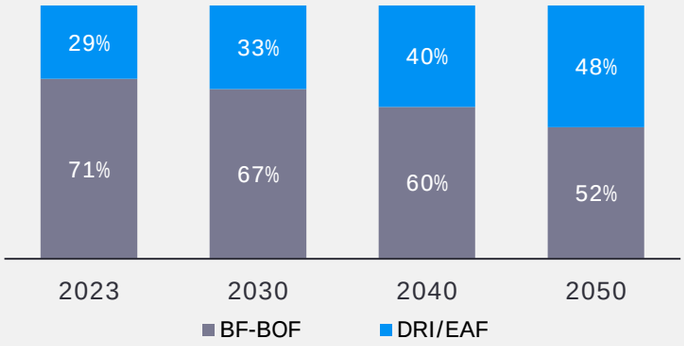
With rising coal consumption in steel production, the industry has also become a major contributor to greenhouse gas (GHG) emissions–accounting for 7% to 8% globally and 12% in India. This necessitates the urgent need for cleaner technologies and comprehensive decarbonization efforts across the sector. Growing concerns about the steel industry's carbon footprint–particularly its reliance on coking coal and energy-intensive processes–are now driving a fundamental shift toward greener practices. This transformation is centered on the development and adoption of low-carbon steel, produced through cleaner energy sources, alternative raw materials, and innovative technologies that significantly cut GHG emissions. In response to GHG emissions, global steelmakers are taking proactive steps to decarbonize and align with international climate goals, with many producers and nations pledging net-zero emissions by 2050.

## Steel–coal nexus: A green and secure future

Overview of global greenhouse gas emissions from metal and mining (GT)




Global steel decarbonization roadmap




*Source: Our world in data, World emissions, NITI Aayog, and EY analysis*

India, the world's second-largest steel producer, is also stepping up to the challenge. Acknowledging the sector's central role in industrial and economic growth, the country has committed to achieving net-zero emissions in steel by 2070. To advance this goal, India has introduced a steel decarbonization roadmap that sets out a phased approach to reducing emissions while safeguarding energy security and industrial competitiveness. This emphasises India's determination to align with global climate goals while addressing domestic challenges such as resource constraints, infrastructure gaps, and the need for inclusive growth. The roadmap emphasizes the adoption of innovative and emerging technologies including Electric Arc Furnaces, hydrogen-based Direct Reduced Iron, and Carbon Capture, Utilization and Storage (CCUS).

**With the rising share of green energy sources, China is the first country to achieve a reduction in greenhouse gas emissions in 2025 driven by structural changes in its energy system rather than by economic slowdown."*

## Net-zero emission target years for the steel industry


As these technologies scale, coking coal demand is expected to decline in most countries, with India and China as key exceptions due to their continued reliance on the BF-BOF route. For India, this reflects an important transition in its steel production model–balancing economic growth with sustainability–while reinforcing its role in the global move toward low-carbon industrial development.

*Source: SEAISI, OECD and EY analysis,*

03

# Global coking coal landscape

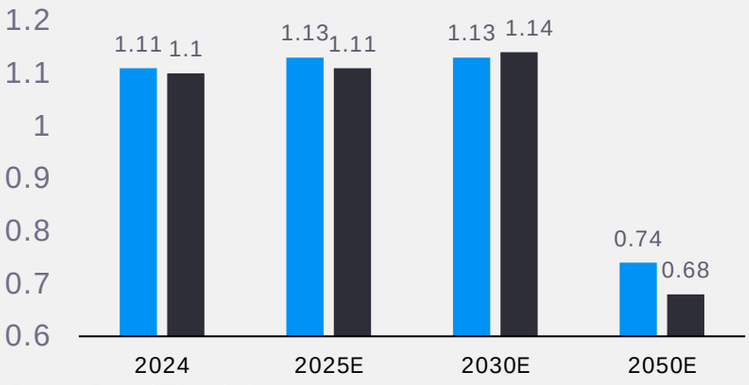
# 3 Global coking coal landscape

**Despite global shift towards green steel, coking coal will continue to witness surging demand driven by leading steel producers such as China and India.**

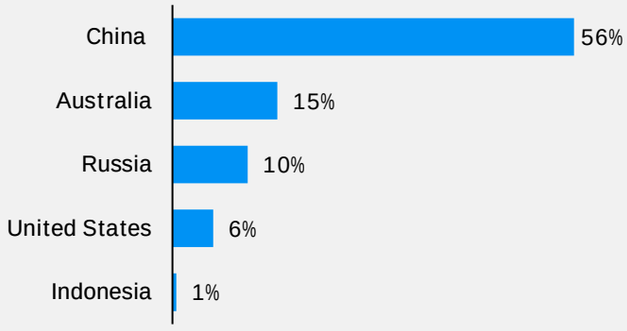
The global coking coal market is dominated by a few major producers and exporters, with reserves concentrated in a limited number of countries. Australia holds the largest share of high-quality reserves, followed by China, Russia, Canada, and Mongolia, all of which benefit from abundant resources and established mining infrastructure. While global coking coal reserves are estimated in the hundreds of billions of tons, their economic viability depends on factors such as depth, geological conditions, environmental regulations, and market demand. Moreover, not all reserves are easily accessible or suitable for steelmaking. High-quality coking coal is defined by low ash and sulphur content, balanced volatile matter, and strong caking properties–key attributes for producing durable coke in blast furnaces.

## Steel–coal nexus: A green and secure future

Global coking coal demand & Supply trend NZE scenario, Mn. T



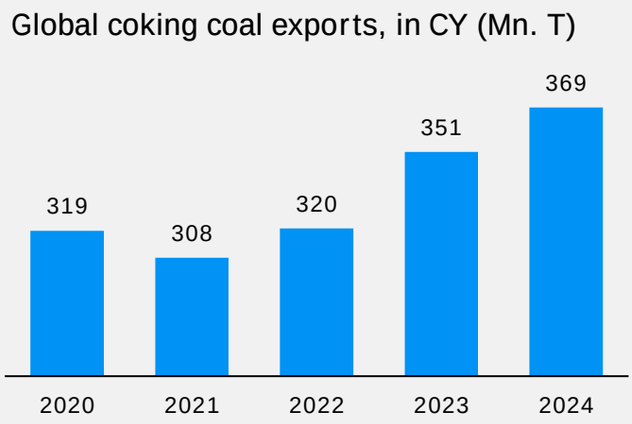

Top coking coal producing countries, CY2024 (%)

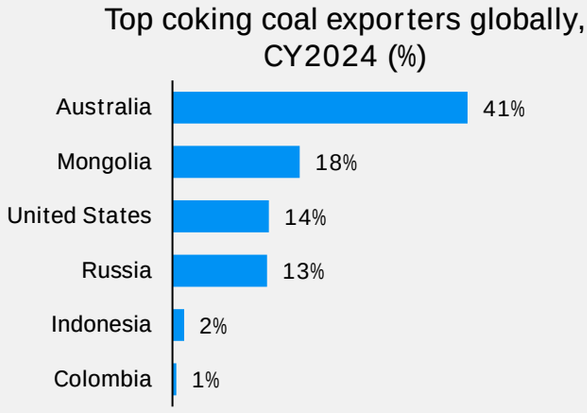



*Source: IEA and EY analysis*

China and Australia are the world's largest producers of coking coal, with Australia being the largest exporter, supplying over half of the global coking coal demand. China, while a major producer, primarily uses its output to support its vast domestic steel industry. Other countries such as Mongolia, Russia, and the US significantly contribute to coking coal exports and are pivotal for the growth of the global steel industry.

In 2024, global coking coal trade reached a record high of 369 million tons, driven by strong demand from major Asian steel producers. Australia remained the leading exporter with stable exports of 153 MT, while Mongolia surged to become the second-largest exporter with an 18% share and 56 MT, overtaking Russia, which held a 13% share and exported 49 MT. The United States and Indonesia contributed 14% and 2%, respectively, with the US boosting exports by 11% to 52 MT in CY24. Meanwhile, Canada experienced a decline in export volumes due to weakening demand from key markets, while Colombia's exports surged, supported by Asia's emergence as a new strategic market for the country.




*Source: IEA, OECD and EY analysis*

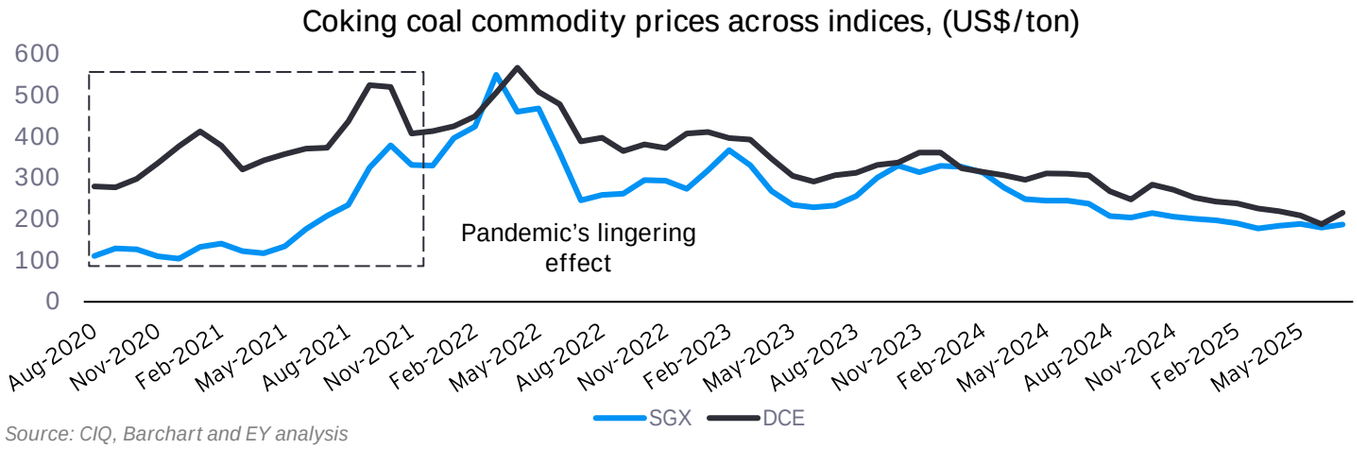
Global coking coal trade is highly exposed to geopolitical shocks, given its concentration in select regions. These uncertainties are known to cause disruptions in supply chains, eventually reflecting on commodity prices, amplifying volatility, and making it challenging for buyers and sellers to manage their sales. In such cases, a robust pricing indexation mechanism becomes essential to ensure a transparent and market-sensitive benchmark to manage risks, stabilize prices, and ensure trade continuity.

## Geopolitical shocks and global price indexation


*Source: IEA,CIQ and EY analysis*

The global trade landscape has witnessed significant instability in recent years, primarily due to a series of global developments such as geopolitical tensions, shifting trade policies, supply chain disruptions, and economic slowdowns. These factors have collectively contributed to heightened volatility in international commodity prices, which, in turn, has impacted the cost and availability of key imports and exports, creating challenges for global businesses. This surge in commodity prices has directly influenced trade volumes due to disrupted and tightened global supply chains. Additionally, limited access to critical raw materials and the lack of robust raw material security have further intensified Indian import costs. Together, these dynamics reflect a structurally stressed trade environment, where supply-side constraints and cost pressures are reshaping the balance between value and volume of trade.

Global price benchmarks for coking coal–much like those for other metals traded on exchanges such as NYMEX and LME–offer transparent, market-based reference points that underpin international contracts, reduce pricing disputes, and mirror real-time supply–demand dynamics. Over time, these indexes have exhibited both significant and subtle fluctuations in metal prices, driven by a complex interplay of factors such as global demand–supply shifts, geopolitical developments, monetary policy changes, energy price movements, and speculative trading. These price variations across indexes not only reflect changing market sentiment and regional economic conditions but also impact procurement costs, inventory planning, and pricing strategies for industries dependent on metal inputs worldwide.




*Source: CIQ, Barchart and EY analysis*

Anchoring coking coal purchases to these widely recognized benchmarks enables steelmakers around the world to synchronize their supply-chain planning, hedge price risks, and maintain operational predictability, even amid volatile markets. Yet India's nearly complete reliance on imported coking coal exposes domestic producers not only to index volatility but also to additional freight differentials and currency fluctuations, which can widen landed-cost bands by US$15–25 per ton. Such vulnerabilities make it imperative to explore how India's own Coking Coal Price Index (CICCI) seeks to capture country-specific trade characteristics and cost elements, providing a benchmark tailored to domestic supply-chain realities.

*Source: IEA, CIQ and EY analysis,*

## Dynamics of Coking Coal Price Index in India

India's steel sector depends on imported coking coal for nearly 90 percent of its annual requirement making the industry exceptionally vulnerable to international price movements. Coking coal pricing is determined by several global indexes, each employing unique methodologies and cargo specifications. These differences produce significant price divergence, complicating procurement strategies for Indian steelmakers and inflating landed costs beyond the index values themselves. Recognizing these challenges, the Indian government introduced the Coal India Coking Coal Index (CICCI) in January 2025. Although CICCI represents a vital step toward domestic price discovery, its scope and liquidity remain limited.

Coking coal prices on global benchmarks exhibit notable disparities. Platts IODEX, which tracks quarterly negotiated contracts for Australian premium hard coking coal (HCC), averaged US$225 per ton (FOB Australia) in Q2 2025. Argus Media's daily spot assessment of HCC recorded a slightly lower average of US$218 per ton (FOB Australia) in July 2025, while the McCloskey Coal Report placed Appalachian HCC at US$230 per ton (FOB U.S. Gulf Coast) in June 2025. These variances–up to US$12 per ton between indexes–stem from divergent cargo quality definitions, trade volumes, and timing of assessments. Moreover, global FOB prices exclude freight, insurance, and currency–rupee fluctuations, adding an US$15 to US$25 per ton to the landed cost for Indian buyers.

CICCI offers weekly price assessments for imported HCC CIF Mumbai and domestic washed HCC ex-mine. In August 2025, CICCI reported INR22,500 per ton (≈US$272 per ton CIF Mumbai) for imported HCC and INR18,200 per ton (≈US$220 per ton ex-mine) for domestic washed HCC. While CICCI aligns loosely with Platts IODEX, its limited coverage–restricted to two grades and a small set of weekly trades–means the index often reflects sporadic bid–offer data rather than robust market liquidity. The absence of CICCI-linked forward contracts further prevents strategic hedging against price swings. Consequently, Indian steelmakers continue to navigate cost uncertainty through direct negotiations, occasional spot purchases, and premium freight surcharges to secure timely supply.

## Evolving global landscape of coking coal supply

China and Australia dominate the global landscape of Coking coal production, each playing a distinct role in shaping supply and demand dynamics. Australia stands out as the world's largest exporter of coking coal, meeting almost half of global demand and serving as a critical supplier to major steel-producing nations such as India, Japan, and South Korea. Its high-quality reserves and strong export infrastructure have made it indispensable to the global steel value chain. China, on the other hand, is the largest producer of Coking coal but consumes the vast majority of its output domestically to fuel its massive steel industry, which accounts for more than half of the world's steel production. This heavy reliance on domestic resources ensures stability for its steelmakers but leaves relatively little surplus for the global market. However, in recent years, new supply regions have started to emerge, reshaping trade flows and diversifying global sourcing strategies.

### Mongolia

It has become one of the fastest-growing suppliers, primarily serving China due to geographical proximity and cost advantages. Despite infrastructure and logistical bottlenecks, investments in rail connectivity and border trade facilities are helping Mongolia expand its export potential.

### Mozambique

It has surfaced as an important frontier for coking coal, with substantial reserves in the Tete province. Backed by foreign investments, especially from Indian and Brazilian firms, Mozambique is steadily becoming a strategic alternative for Asian steelmakers seeking to diversify away from traditional suppliers.

### Canada

It continues to scale up its role, offering high-quality premium hard coking coal. With stable political conditions and well-established export channels, Canadian coal is increasingly attractive to buyers in Asia.

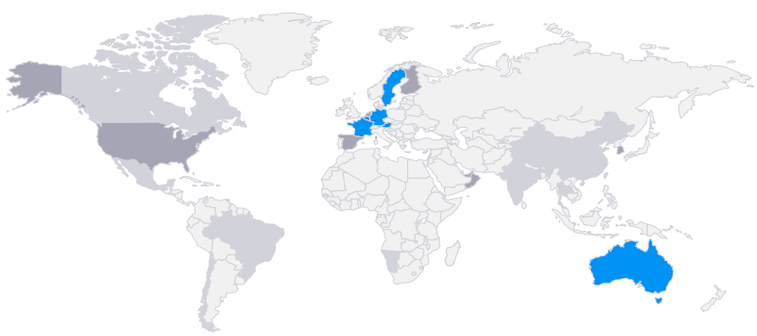
### Other African countries

Other African countries such as Tanzania and Botswana are also being explored for coking coal deposits, signaling the possibility of broader regional participation in the global market over the coming decade.

## Shifting Demand Patterns in a Decarbonizing Economy

The global steel industry is undergoing a major technological shift as it pursues ambitious decarbonization goals, with new innovations offering the potential to reduce emissions by more than 90% compared to the traditional BF-BOF route. Alongside growing adoption of EAF and DRI technologies, cleaner fuels such as natural gas and green hydrogen are increasingly being deployed to produce low-carbon steel. At the innovation frontier, processes like electrochemical reduction and molten oxide electrolysis–when powered by renewables–hold the promise of carbon-neutral steel production, potentially eliminating coal from the technology mix. However, the pace of transition will not be uniform; while advanced economies may move rapidly, much of Asia, which dominates global steel output, is expected to rely on the BF-BOF process in the short to medium term due to cost, infrastructure, and resource constraints, thus sustaining coking coal demand for years to come.

Global progress map for green steel production




*Source: Green Steel Tracker, Climate action tracker and EY analysis*

*Source: IEA, PIB and EY analysis*

While demand-side shifts are beginning to reshape the coking coal market, equally significant changes are underway on the supply side. Across the coking coal value chain–from extraction to processing and delivery–intensive research and development efforts are reimagining how the resource is mined, beneficiated and transported.

## R&D efforts to improve mining efficiency

The role of coking coal in steelmaking is at the heart of industrial development, yet its supply and utilization are undergoing a profound transformation. Globally, research and development efforts are reshaping the way coal is mined, beneficiated, and processed, with an emphasis on efficiency, sustainability, and adaptability. These changes cut across the value chain and can be broadly understood through three stages: extraction, beneficiation, and processing, with technologies increasingly underpinning each stage of this transformation.

### Extraction

At the extraction stage, global mining companies are embracing technologies that improve resource recovery and operational control. Advanced fleet management systems and GPS-based truck dispatching, for instance, are being deployed to optimize haul cycles, reduce idle time and ensure more predictable supply chains. Autonomous haulage fleets in coal and iron ore mines have set benchmarks for productivity and safety while reducing fuel consumption and emissions per tonne of coal moved. In recent years, operators are also exploring hybrid and electrified equipment fleets to reduce diesel reliance alongside mine-site renewable energy integration, addressing both operational efficiency and carbon footprint.

### Beneficiation

As natural reserves of premium hard coking coal become increasingly constrained, beneficiation is gaining renewed importance. In global steel hubs, advanced coal washeries and coal preparation plants are being upgraded with high-capacity flotation columns, spiral concentrators and water recycling systems. The emphasis is on improving the yield of metallurgical-grade coal and on achieving this with minimal environmental impact. Zero-liquid discharge plants are becoming the standard, particularly in regions with strict water usage regulations, ensuring that beneficiation remains sustainable.

Another critical area of innovation is the integration of real-time quality monitoring systems into coal washing processes. Online analyzers that assess ash and moisture content during washing allow operators to adjust in real time and consistently meet blending requirements for coke ovens.

### Processing

Traditional coke oven technologies are increasingly being replaced or supplemented with advanced systems that prioritize efficiency, flexibility and lower emissions. Coal blending optimization stands at the forefront of these innovations. Predictive modeling software now enables steelmakers to craft precise blends of imported and domestic coals, ensuring that coke properties remain stable. This practice allows producers to manage fluctuating prices and achieve consistent furnace performance.

Emerging designs like non-recovery and heat-recovery coke ovens are also being widely adopted. These ovens capture byproducts such as coal gas and tar, which are then used for power generation or chemical feedstocks. Such approaches turn what was once waste into a profitable energy stream while significantly reducing particulate emissions.

On the frontier of sustainability is the concept of biocoke, where biomass-based materials partially substitute for coal in coke production. Pilot projects are demonstrating that biocoke can reduce overall $CO_2$ intensity, particularly when integrated with electric arc furnaces. Studies suggest emission reductions of up to 12% in EAF routes and nearly 50 to 60% in integrated blast furnace operations.

Process control technologies such as the Coking Process Management System (CPMS) are also maturing, stabilizing furnace operations and cutting energy use. Similarly, fluidized bed carbonization and vertical shaft kiln (VSK) techniques are providing more uniform coke with reduced energy input, illustrating the tangible value of such innovations.

04

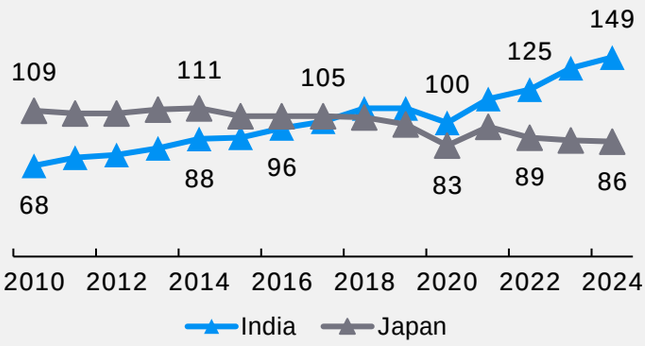
# India’s coking coal landscape

# 4 India’s coking coal landscape

**India’s steel production target of 300 MT by 2030, coupled with continued reliance on coal-based routes, will sustain strong coking coal demand.**

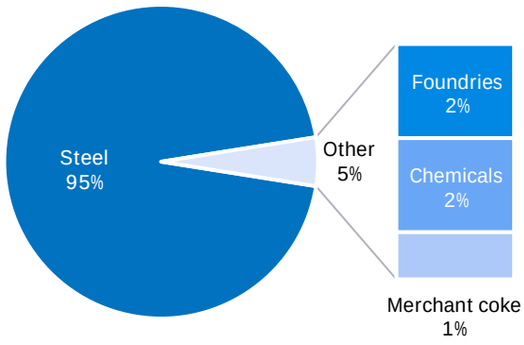
India’s position as the world’s second-largest steel producer fundamentally underpins its coking coal demand, with sector dynamics extending far beyond blast furnace operations. In FY2025, India produced about 152 million tons of crude steel, reflecting strong and steady growth since surpassing Japan in 2018. This steel production trajectory translates directly into a robust appetite for premium coking coal, now estimated at roughly 87 million tons consumed annually. The steel industry alone accounts for nearly 95% of this volume, highlighting the intrinsic relationship between Coking coal supply and the sustainability of domestic steel expansion. India’s aspirations to scale will require a corresponding ramp-up in coal supply, placing stress on both resources and logistics.

Crude steel production in CY (Mn.T)




*Source: World steel , NIC*

Coking coal consumption



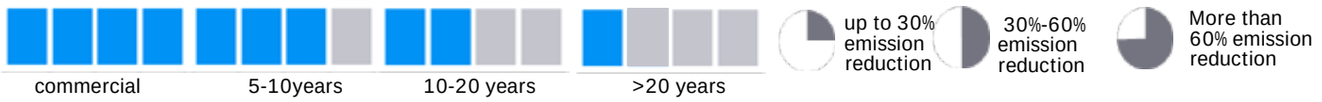

*Source: Ministry of Coal, Coal Controller’s organisation*

However, the demand landscape extends beyond steel. Other industries–chiefly foundries and chemicals–constitute another 5% of total coking coal consumption. Additionally, merchant metallurgical coke supports niche sectors including chemical compounding, non-ferrous smelting, insulation and carbon product manufacturing. This segment is typified by an estimated 7 million tons of installed capacity but currently operates at about 30% utilization, hamstrung by a tide of cheaper imports and prompting sustained calls for anti-dumping duties to protect domestic producers. Furthermore, key by-products from coke ovens, such as coal tar and coke oven gas, benzene, toluene, etc., vitalize downstream chemical industries that manufacture carbon fibres, electrochemical binders and anode precursors. Although these specialty end-uses are modest relative to steel’s vast appetite, they remain critical for aluminium production and refractory materials, reiterating the sector’s structural reliance on high-quality coke products.

India's long-term decarbonization vision–anchored by the target of net-zero greenhouse gas emissions by 2070–has catalyzed a surge of policy and technological pivots within the steel sector, which currently accounts for about 12% of India's total emissions. The rollout of the Green Steel Taxonomy in late 2024 marks a seminal shift, making India the world's first jurisdiction to codify formal green steel standards. Today, decarbonization strategies increasingly focus on substituting traditional carbon-intensive blast furnace-basic oxygen furnace (BF-BOF) routes with cleaner alternatives: ramping up scrap recycling, scaling up hydrogen-based direct reduced iron (H2-DRI) and gradually integrating renewable energy. Newer pathways like natural gas-based DRI and enhanced metallic recycling are anticipated to decrease the share of BF-BOF post-2050 leading to lower Coking coal requirement, contingent on adoption rates and supportive policy frameworks.

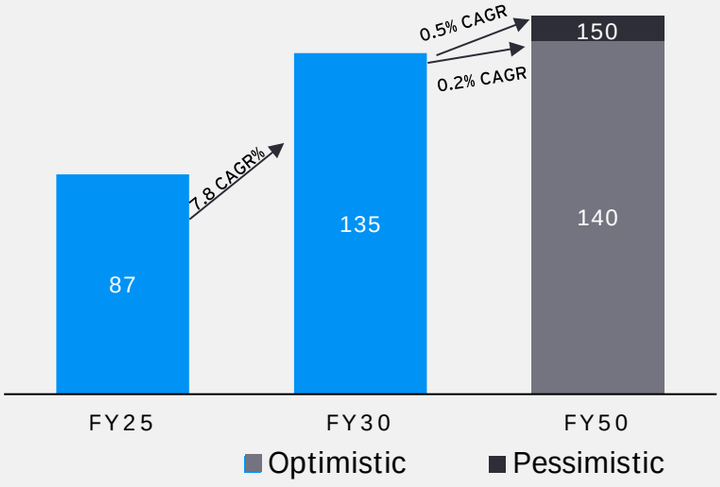
However, while India is committed to transitioning to green steel, several interrelated challenges slow its pace compared to global peers. High costs–especially green hydrogen priced at around US$4 to US$5 per kilogram–make low-carbon methods economically less viable without subsidies or carbon pricing. Coupled with this is limited infrastructure–insufficient hydrogen storage and distribution networks, weak scrap collection systems and scarce natural gas pipelines–hindering scalable alternative routes. Moreover, India's steel industry is dominated by relatively young coal-based capacity built under a "build now, decarbonize later" model, locking in dependence on the BF-BOF route. Resource constraints–like low-quality iron ore and informal steel scrap markets–also limit the shift to cleaner feedstocks. Finally, market pressures and mindset inertia–where firms hesitate to adopt costlier unfamiliar technologies–are only now being nudged by external forces like the EU's CBAM and internal policy support such as the National Green Hydrogen Mission.

| Production routes | Description | Emission reduction | Adoption status | Adopting countries |
|---|---|---|---|---|
| Biomass for BF-BOF | Blending biomass with coal to use as fuel or as a sintering reducing agent . | | | Australia,Belgium, Brazil |
| BF-BOF to Scrap -based EAF | Replacing BF with NG-DRI and BOF with EAF powered by renewable energy | | | Sweden, Austria,Spain |
| BF-BOF using CCU/CCS/CCUS | Capturing emissions and using it as feedstock for methanol production. | | | Austria , Belgium , France |
| DRI using Syngas | Direct reduction using blend of H2 and CO gas (syngas) to reduce iron ore . | | | India, South Africa |
| NG-DRI to Hydrogen DRI | Replacing 30% natural gas with hydrogen up to 100% | | | Algeria,Egypt,India Russia,US |
| Green Hydrogen DRI | Use of 100% low carbon or green hydrogen for direct reduction | | | Austria,Germany |
| Electrochemical process | Molten oxide electrolysis to run a zero -carbon production facility | | | US |
| Electrowinning | Produce solid state iron at low temp and feed it to coal EAF | | | France |
| Electric Smelting | Addition if iron ore and coal directly to a metal slag phase to reduce iron ore | | | Sweden, Germany |
| Solar-thermal direct reduction | Using concentrated solar energy to heat and reduce iron ore directly, minimizing fossil fuel requirement. | | | Australia, India (pilot stage) |
| Digital optimization of process energy | Real-time AI-driven sensors and controls to reduce inefficiency and lower energy/emissions in EAF and BF/BOF. | | | EU, India, US |
| Waste plastic to reductant | Recycling mixed waste plastics to produce hydrogen-rich reducing agents for DRI or BF processes. | | | Japan |



These shifts intensify scrutiny of the domestic balance of coal supply and demand. Presently, India produces around 60 million tons of raw coking coal each year, yet output of washed coal–a necessity for steel manufacturing–remains limited to just 5 million tons. This gap shows persistent challenges in upgrading raw resources to industrial specifications. India's best-quality reserves are clustered in the Jharia coalfields of Jharkhand, an area with 12 billion tons of coking coal but plagued by legacy issues such as underground fires, subsidence and a need for large-scale community rehabilitation. While the Ministry of Coal has set an ambitious target to increase domestic coking coal production to 140 million tons by 2030, supported by investments in new mining capacities, digital mining technologies and infrastructure upgrades, the reality is that a majority of demand is still satisfied through imports.

Indian Coking Coal Demand (Mn. T)




Indian Coking Coal Reserve (Billion tons)

| State | Proved | Probable | Possible |
|---|---|---|---|
| Jharkhand | 4.2 | 3.8 | 4 |
| Odisha | 1.8 | 1.5 | 1.2 |
| Chhattisgarh | 0.9 | 0.5 | 0.6 |
| Others | 1 | 0.7 | 0.8 |

*Source: EY Analysis, Geographical survey of India, Ministry of Coal*

Improving domestic beneficiation capacity has become a cornerstone of recent government policy. Indian coking coals, with their characteristically high ash content (25% to 35%) and sulfur, present formidable challenges for steel use. The adoption of advanced beneficiation technologies–such as heavy media cyclones, flotation and spiral circuits–continues apace. Efficient beneficiation can reduce ash content to the range of 12 to 15%, enhancing coking properties and overall value. Recognizing the need for progress, the Ministry of Coal and affiliated agencies have set targets to triple India's washed coking coal output to at least 15 million tons by 2030, backed by mandates for new washeries and strong incentives for technology adoption. Additionally, research institutions like the Central Fuel Research Institute (CFRI) pursue innovative approaches including oil agglomeration and oleo-flotation, aiming to extract more value from difficult-to-process coals.

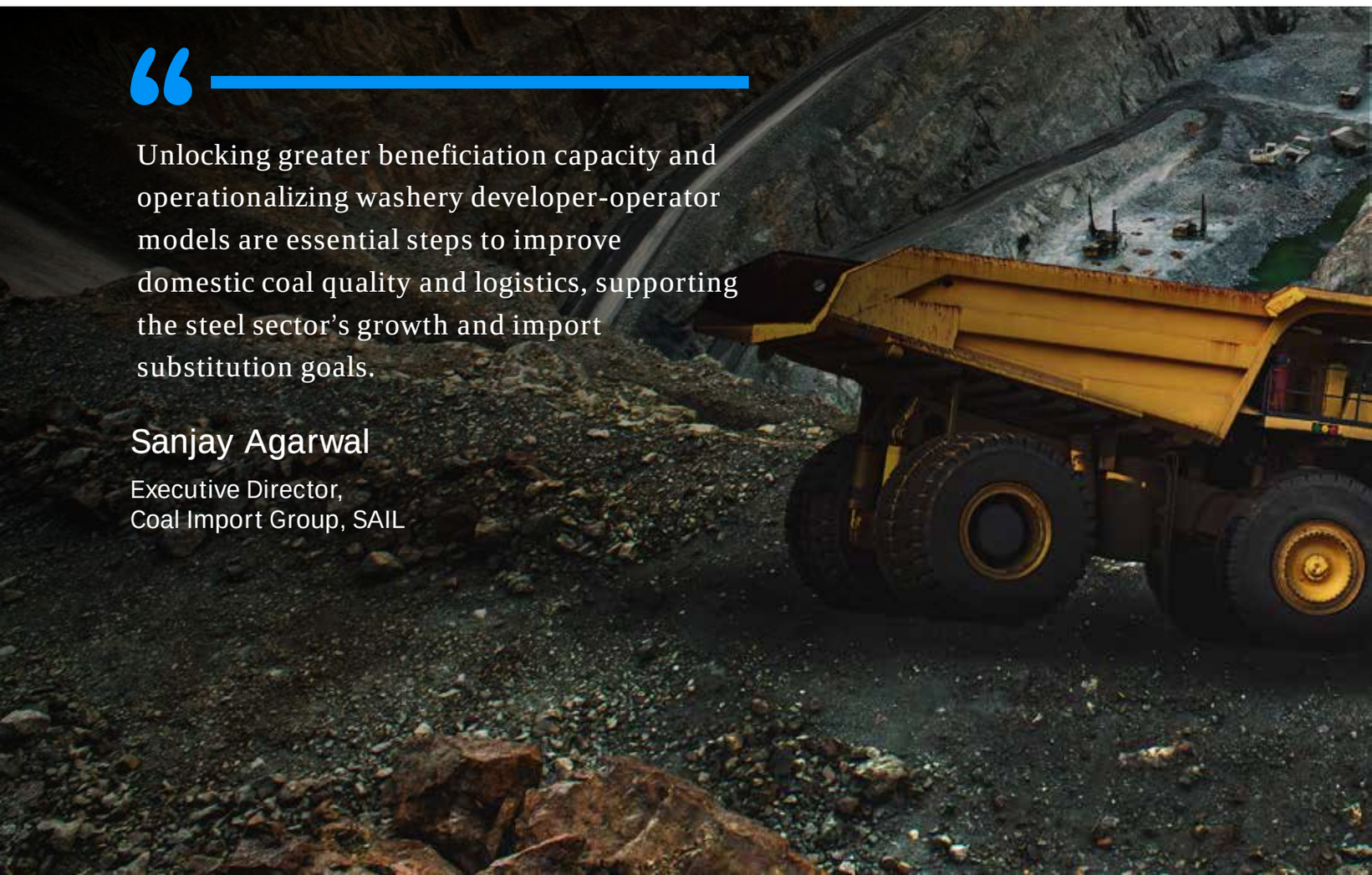
The sector's potential remains challenged by persistent infrastructure bottlenecks. While some large miners have adopted IoT-driven efficiencies and automated systems, much of the industry still depends on outdated practices. Private sector participation also lags, hindered by heavy regulations and high capital requirements, slowing the pace of critical upgrades.

| Stage | Bottleneck |
|---|---|
| Coal evacuation | Railway congestion in Odisha, Jharkhand |
| Washery processing | Insufficient washery units |
| Blending facilities | Limited blending plant availability |

To address key bottlenecks, the government has launched target initiatives.

| Initiative | Description | Outcome |
|---|---|---|
| Mission Coking Coal | Boosts domestic coking coal production via new mines, washeries, private-sector mining models | Production rose from 44.79 MT (FY21) to 66.47 MT (FY25); new 5 MTPA washery started operations; 11 mines opened under revenue-sharing with private partners |
| WDO Sub-sector in NRS Auctions | Prioritizes washed domestic coking coal in linkages to steel plants, improving quality and availability | Introduced March 2024 under NRS policy–supports greater use of domestic washed coking coal |
| SHAKTI Policy (Revised 2025) | Enables imported-coal-based steel plants to secure coal domestically under revised linkage terms | ICB (Imported Coal Based) plants allowed coal supply under updated SHAKTI 2025 policy |
| Extension of Linkage Tenure (NRS Auctions) | Enhances planning certainty by extending coal linkage tenure to 30 years | Tenure extension introduced via amendment to NRS linkage auction policy, boosting domestic supply reliability |
| Diversifying coal imports and promoting alternatives | Reduces reliance on coking coal imports by encouraging blending, DRI, gasification, and alternate sourcing | Prime Minister urged industry to explore domestic alternatives (DRI, gasification) and diversify import sources (e.g., US, Russia, Mozambique) at India Steel 2025 event |

Such limitations have made import dependency an inescapable reality. Despite domestic ambitions, ~90% of coking coal requirements are now met by imports–81 million tons in FY2025–primarily from Australia, with Russia, the US, and Canada emerging as alternate suppliers. Overcoming this reliance on imports by scaling up beneficiation, strengthening logistics corridors, and fostering domestic innovation will be crucial for India as it works to balance its coal requirements with climate commitments and economic ambitions.



> Unlocking greater beneficiation capacity and operationalizing washery developer-operator models are essential steps to improve domestic coal quality and logistics, supporting the steel sector's growth and import substitution goals.

**Sanjay Agarwal**

Executive Director,
Coal Import Group, SAIL

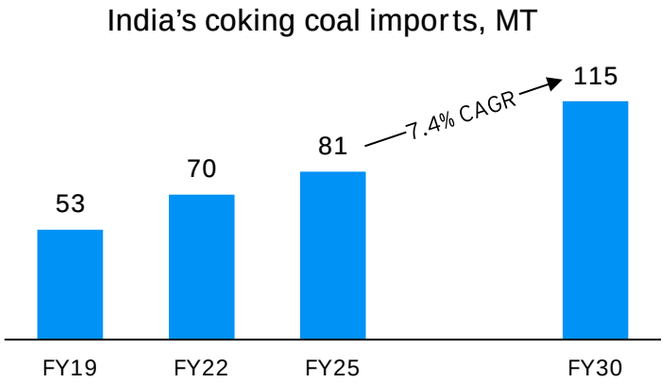
05

# Import dependence and trade dynamics

# 5 Import dependence and trade dynamics

## Limited domestic output and heavy import reliance exposes India to geopolitical risks, accentuating the need for indexation and stockpiling policies

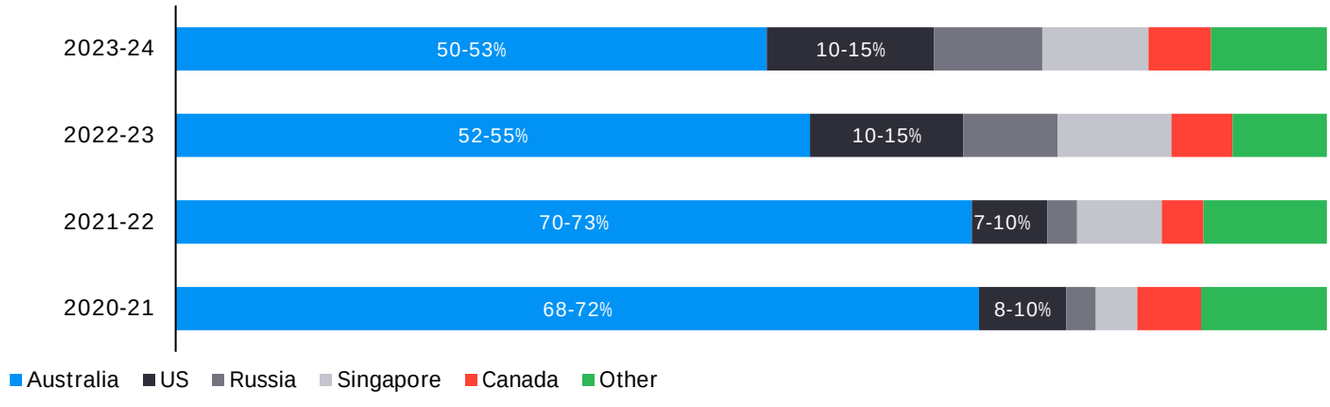
Domestic coking coal in India typically contains ash levels ranging from 25% to 35%, higher than the globally preferred standards. High ash content results in poor-quality coke and operational issues. This has resulted in lower domestic coking coal output, creating heavy reliance on imports, which account for 90% of the coking coal requirement.




*Source: Ministry of Coal and EY analysis*

The National Steel Policy has announced ambitious targets of achieving 300 MT of steel capacity by 2030. This includes capacity addition efforts primarily through the BF-BOF route, accounting for 50% of the total capacity expansion. This is expected to drive demand for coking coal in the coming years, resulting in higher imports.

While Australia continues to be a leading exporter, concerns over natural calamities that disrupt supply chains have compelled Indian steel mills to import from other reliable sources such as Russia and the US. Additionally, India is intensifying its diversification efforts by exploring emerging regions capable of supplying high-grade coking coal.




*Source: Ministry of Coal and EY analysis*

**Global coking coal price volatility and geopolitical supply disruptions are creating significant uncertainties for Indian steel producers. Strengthening diversified supply chains while aligning with global decarbonization trends is critical to safeguarding India's steel competitiveness and energy security.**

Amita Khurana
Group Chief- Raw Material Procurement, TATA Steel

In 2021, India signed a memorandum of understanding aimed at boosting Russian coking coal supplies to 40 million tons annually by 2035. To facilitate this, Russia has proposed an intergovernmental agreement focused on enhancing logistics and port connectivity for smoother trade. Indian steelmakers have been increasingly turning to Russian coking coal, attracted by discounts ranging from 20% to 30% compared to Australian alternatives. Russia's Coking coal exports primarily originate from Western Siberia's Kuznetsk Basin (Kuzbass), which contributes around 50% to 60% of the country's total coal output. Other significant coal-producing regions include Eastern Siberia, the Far East, Kansko-Achinsky, Zabaikalsk and Khakassia. The coal grades commonly exported to India include GZh-grade (high-volatile), G-grade (semi-soft high-volatile) and PCI (Pulverized Coal Injection), all of which are essential for steelmaking applications.

Mongolia, with its substantial reserves and competitive pricing, has increasingly explored supplying coking coal to India as a strategic alternative to reliance on Australian and Russian sources. Although its landlocked geography previously posed logistical bottlenecks, recent developments have improved connectivity. India has been actively developing the Eastern Maritime Corridor linking Vladivostok to Chennai while also considering the International North-South Transport Corridor (INSTC) via Chabahar port as an additional route. In a significant step forward, India initiated a trial import of 1 Mn. ton of Mongolian coking coal in mid-May 2025 for quality testing and evaluation.

Canada has also significantly boosted its coking coal exports to India, supplying monthly approx. 0.33 Mn. Tons in the current FY–a 38% year-on-year increase. This surge was driven by competitive pricing from Canadian suppliers, making their cargoes more appealing than those from the US Canadian coal, particularly from high-quality reserves at mines like Elkview and Fording River in British Columbia, is prized for its low ash and low sulfur content, making it ideal for steelmaking applications.

This heavy reliance on diverse import sources brings unpredictability in procurement costs, creates roadblocks in operational planning, and puts pressure on margins, particularly for small and mid-sized players that cannot absorb such shocks effectively. These challenges are further aggravated by global indexes, which rely on generic benchmarks that exclude India-specific dynamics such as freight costs, port duties, and local supply-demand imbalances. This makes a compelling case for India to strengthen its coking coal price indexation mechanism–already in place but still evolving–by making it more robust and better aligned with domestic market realities. A stronger index would enhance transparency, enable more efficient contract structuring, and help stakeholders manage input costs more effectively.

### Data collection

- Coal subsidiaries for production data
- Ports for import prices
- Steel industry stakeholders for demand trends
- Auction platforms for coal allocation and pricing

### Price definition

- Categorization for price definition by grade
  - Washed and unwashed
  - Hard and semi-soft coking coal
  - Imported and domestic
- Others include sulfur, ash and moisture content among others

### Index methodology

- Need for transparency to ensure all stakeholders are aware
- Monthly computation that allows for timely tracking of fluctuating price
- Forward-looking index that provides insights into future trends

This growing need for the robust index also brings India's trade policies for coking coal into focus. The current trade regime allows unrestricted coking coal imports under the Open General License (OGL) but lacks strategic measures to stabilize prices against global supply disruptions. India's trade policies have historically been reactive–adjusting import duties, exploring bilateral deals or signing MOUs with producing countries–but these measures are often short term and lack coordination with long-term pricing strategies.

### India Australia Economic Cooperation and Trade Agreement:

- Under the Ind-Aus ECTA, tariffs on coking coal imports were eliminated, making imports significantly cheaper for Indian stakeholders
- The agreement facilitates long-term supply partnerships between Indian steel manufacturers and Australian mining companies

### MoU with Russia:

- 2021 -To collaborate on both coking coal supply and technologies related to coking coal and steel production, thus boosting engagement
- 2019 – Between Coal India and Russian entities (FEAAISE and FEMC) to explore cooperation on coking coal mining

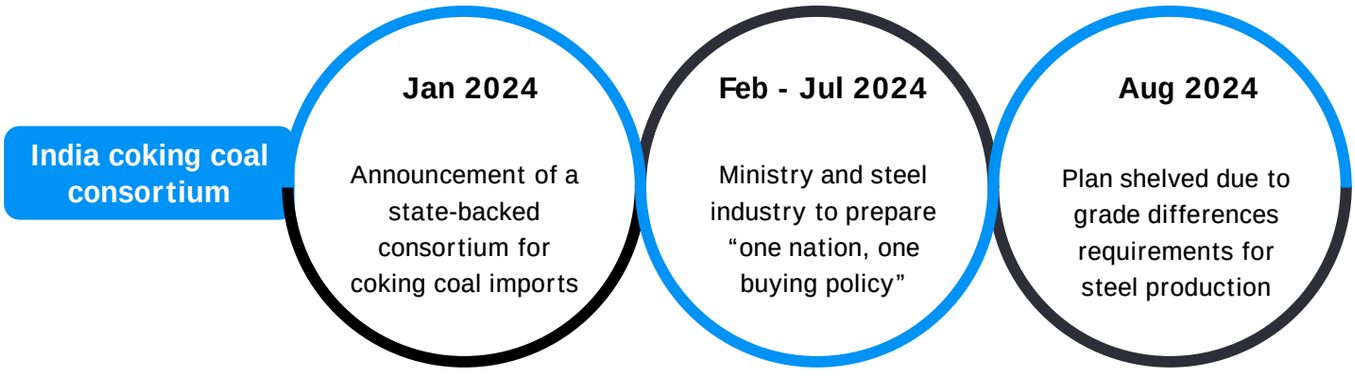
### Indian ownership of mines in Mozambique:

- JV involving Coal India, SAIL, RINL, NMDC, and NTPC - International Coal Ventures Pvt. Ltd. (ICVL) own stake in three key mines in Mozambique: Benga (operational), Zambeze, and Tete East.
- SAIL through ICVL, to double Mozambique's production capacity from the current ~2 MTPA to ~4 MTPA

To address these limitations, India undertook trade facilitation steps. The government, in consultation with steel industry stakeholders, tried to develop a "one nation, one buying coking coal policy" aimed at consolidating demand and enhancing bargaining power in global markets. In addition, efforts were made to form a consortium of state-owned companies to streamline imports and ensure supply security for domestic steel producers, especially during times of shortage. These measures were taken toward more coordinated long-term strategies to secure India's coking coal needs.

**India's coking coal strategy centers around boosting domestic production, but imports remain essential due to limited reserves. To enhance self-reliance and cost competitiveness, securing overseas resources by acquiring stakes in diverse mines and streamlining logistics should be the approach.**

Sanjay Kumar Singh
Director Strategy and External Relations, Jindal Steel Ltd.




*Source: CIQ, International Centre for Sustainable Carbon, PIB and EY analysis*

Despite Indian steelmakers, facing persistent supply concerns and high prices along with inefficiencies in individual import strategies, by August 2024, the government backed consortium was shelved due to differing raw material grade needs and doubts over securing long-term discounted deals. Steel players then returned to spot market purchases to boost liquidity as advised by the Ministry of Steel.

## Strategic stockpiling

India's growing dependence on imported coking coal to support its steel industry has exposed a critical vulnerability in its supply chain: the absence of a strategic stockpiling mechanism. Despite being one of the world's largest steel producers, India currently lacks a formal reserve system for coking coal, making it highly susceptible to disruptions in global supply chains and abrupt price fluctuations. This absence becomes particularly concerning during periods of geopolitical tension, natural disasters or export restrictions from major coal-producing nations. In such scenarios, Indian steelmakers face both physical shortages and soaring costs, jeopardizing domestic steel production and impacting infrastructure, construction and manufacturing sectors.

### Russia-Ukraine War

- The war has disrupted global energy markets and created a tight supply-demand balance for coking coal.
- EU sanctions on Russian coal have forced countries to seek alternative suppliers like Australia, the US, Canada, and Mozambique, but these are geographically distant and limited in capacity.

### Trade and tariff wars

- Tariffs and trade policies between the US and China can directly affect coal exports.
- For instance, China imposed a 25% tariff on US coal during the Trump administration, and future policies could reintroduce such barriers

### Export duty on Russian coal

- Existing problems relating to logistics in Russia, and sanctions threaten to throttle supplies impacting Indian buyers.
- Despite market instability, Indian buyers are unable to lessen their dependence on Australia.

Stockpiling could serve as a strategic buffer, allowing India to stabilize supply during periods of volatility and negotiate better pricing by reducing panic-driven procurement. It would also enhance the country's resilience against global shocks and strengthen energy and resource security. As India moves toward becoming a global manufacturing hub under initiatives like "Make in India," developing a comprehensive coking coal stockpiling policy–similar to those used for crude oil and food grains–is no longer optional but essential for ensuring uninterrupted industrial growth.

1 **National coking coal reserve:**
Mechanism similar to crude oil can be introduced for coking coal to insulate Indian steel industry from global geopolitical shocks

2 **Public-Private stockpile models:**
Encouraging partnerships between government and major steel producers to co-invest in reserve infrastructure managed through a transparent allocation system

3 **Mandate stockholding norms:**
Introduce a policy that requires steel players to maintain a minimum number of days' worth of coking coal inventory, based on their consumption levels

4 **Infrastructure monetization:**
Monetize and modernize idle assets like the old washeries to enhance blending and storage capacities

5 **Port partnerships:**
Partner with major ports to develop coastal stockpiles near import entry points and improve logistics efficiency and reduce turnaround times

6 **Long-term contracts:**
Secure long-term deals with coking coal exporting nations with provision for periodic stockpile additions during low-demand periods

Govt. Pvt.

*Source: Coalindia, PIB and EY analysis*

## FOB vs Extraction Cost

An important structural factor driving India's continued dependence on imported coking coal, is the significant cost gap between the extraction price in producer countries and the FOB (Free on Board) price charged to Indian buyers. This gap represents the substantial value exporters capture along the supply chain, from mining to port dispatch. Even where extraction costs are relatively low–such as in Russia and Mongolia–FOB prices remain considerably higher, leaving exporter margins in the range of $60–$140 per MT. These margins persist regardless of cost differences across geographies and highlight the strong pricing power of exporting nations. Beyond this, logistics and shipping add further pressure on Indian buyers, with geography amplifying costs–for instance, Mongolia's landlocked position necessitates coal transit via Russia or China, increasing landed costs in India.

The persistent wide margin between extraction cost and FOB price is explained by multiple factors that exporters sustain despite complex global conditions:

- Cost Stickiness: Exporter costs linked to energy supply and infrastructure show limited short-term flexibility, sustaining a price floor above extraction cost.
- Supply Discipline: Key suppliers such as Australia strategically manage export volumes to maintain price levels, supported by oligopolistic market dynamics.
- Infrastructure Constraints: Geographic bottlenecks (e.g., logistics transit routes for Mongolian coal, port capacity limitations) incur added costs and limit supply elasticity.
- Resilience Amid Shocks: Political sanctions on Russia, energy price fluctuations, and weather disruptions have yet to erode exporter margins materially, reflecting strong market positioning.

Indian steelmakers and government entities can monetize the extraction-to-FOB margin gap by acquiring or co-owning overseas coking coal mines in producer countries, unlocking several strategic advantages:

§ Margin capture: Owning extraction assets allows India to pay costs closer to mine-level economics, reducing total landed cost and improving steel competitiveness.
§ Supply security: Direct control over mine output assures long-term stable supply independent of market volatility or geopolitical disruptions.
§ Strategic raw material autonomy: Aligns with Atmanirbhar Bharat by reducing import vulnerabilities and enhancing resource self-reliance.
§ Economic scalability: Overseas acquisitions can be leveraged through joint ventures or consortiums with domestic and international partners to spread capital and operational risk.

However, these opportunities come with significant risks that need to be weighed carefully before pursuing large-scale overseas acquisitions. Overseas coking coal asset acquisition involves inherent risks, including:

§ Political and geopolitical uncertainty: Host country policies and diplomatic relations affect operational continuity and asset security.
§ Capital intensity and gestation: Mine acquisitions require significant upfront investment and several years before commercial production scales.
§ Operational complexities: Management challenges, including labor, environmental and regulatory compliance, increase project risk.
§ ESG and financing constraints: Growing environmental, social and governance (ESG) scrutiny, along with rising capital costs, complicates financing and progress.

Sustaining a coal strategy dependent on imports leaves Indian steelmakers exposed to volatile global pricing, currency risks, and geopolitical uncertainties, while consistently transferring a large share of value creation abroad. This not only constrains domestic economic gains but also weakens the international competitiveness of Indian steel. Unless mitigated, such dependence undermines India's ambitions of industrial self-reliance and risks slowing investment momentum in the sector.

06

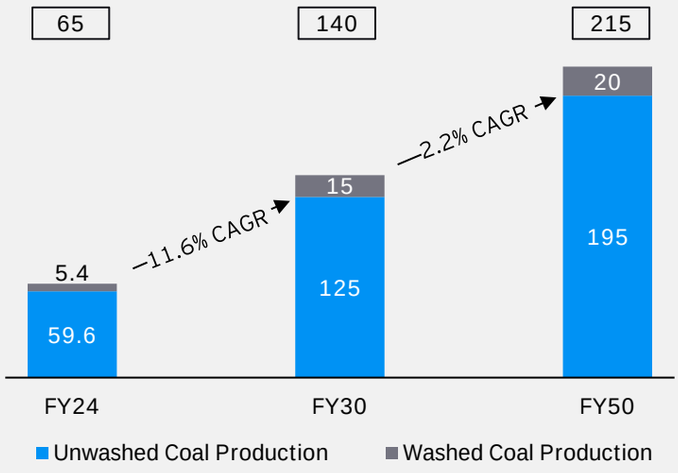
# Towards Atmanirbharta in coking coal

# Towards Atmanirbharta in coking coal

**Aligned with the Atmanirbhar Bharat vision, the coking coal sector needs to strengthen policy, pricing and exploration reforms to achieve self-reliance**

## Policy support for domestic coal mining

Achieving self-reliance in coking coal is vital for securing India's steel sector and reducing dependence on costly imports. To this end, the government is pursuing a comprehensive reform agenda that spans key focus areas–ranging from trade policy and coal block exploration to pricing rationalization, environmental clearances, FDI facilitation and technology upgradation. These strategic interventions aim to unlock domestic potential, attract investment, and build a robust, future-ready mining ecosystem.




*Source: Ministry of Coal, IEA and EY analysis*

Domestic coking coal production struggles to meet the steel industry's rapidly growing needs, resulting in a substantial supply shortage. To tackle this, the government is implementing the "Atmanirbharta Coal Mission," a specific policy designed to address these issues, as part of the larger Atmanirbhar Bharat program. The mission seeks to reduce dependence on imports and strengthen domestic production capabilities. India's Mission Coking Coal, embedded within this initiative, aims to scale domestic coking coal production, improve quality through beneficiation and secure long-term, cost-effective linkages to steel producers. The target is to raise domestic coking coal output to 140 MTPA by FY30, with 105 MT expected from Coal India Limited and its subsidiaries, and the remainder from private block allocations.

With rising demand from the expanding steel sector, the government has introduced a series of policy reforms to boost domestic production, ensure resource efficiency and attract private participation. These measures aim to create a more competitive, transparent and investment-friendly environment–laying the foundation for long-term sustainability and self-reliance in the coal ecosystem.

## Operationalizing WDO (Washery Developer–Operator) Models

### Key ideas

- Mission mandates installation of washeries on major coking coal blocks, including large-scale projects in West Bokaro, to reduce ash content from raw 29% to 45% to below 18%, matching steel-grade specifications.
- Subsidies offering 20-30% capital cost support and accelerated depreciation benefits incentivize investments in washing and beneficiation infrastructure.
- Private sector participation encouraged through WDO routes, adding ~11 new washeries with combined significant capacity to boost beneficiation.
- Reforms allow production sharing from washeries, improving profitability and incentivizing higher operational efficiency.

### Benefits

- Improves coal quality to international-grade levels suitable for steel production.
- Enhances utilization: Private washers operate at >75% capacity versus PSU washers at ~32%.
- Enables blending flexibility to optimize feedstock cost and reduce import dependency.
- Reduction in ash decreases furnace burden and improves downstream steel quality and emissions profile.

## First-mile connectivity (FMC) projects

### Key ideas

- Focuses on mechanized coal evacuation via in-pit crushing, belt conveyors, and railway sidings integral to PM Gati Shakti infrastructure corridors
- 39 FMC projects cover a cumulative capacity of 386 MTPA, streamlining transport from mines to end-use centers
- Cluster-based approach in major coalfields including West Bokaro, reducing transit losses and preserving coal quality

### Benefits

- Reduces logistical costs and supply chain bottlenecks
- Enhances coal dispatch speed and reliability for steel hubs (e.g., Bokaro Steel Plant)
- Curtails coal loss/deterioration during handling, improving cost competitiveness

## Policy and regulatory reforms

### Key ideas

- Transition to revenue-sharing auction model allows bidders to quote % of gross revenue, aligning government returns with production performance
- Enables captive miners to sell up to 50% of output commercially, opening coal supply to market competition
- 100% FDI permitted under the automatic route for coal mining and associated assets such as washeries and crushing plants
- Regulatory clearances through single-window portals reduce approval timelines for mining leases, environmental and land clearances

### Benefits

- Attracts private and foreign investments to build capacity and inject technology
- Improves ease of doing business and reduces project gestation periods
- Encourages efficient mining maximizing coal recovery and supply reliability

However, despite designing robust policy framework, which is expected to boost domestic coking coal production and reduce the import dependency, the path to self-sufficiency is marked with substantial challenges. This includes **exploration and auctioning of new coking coal blocks**, and **environmental clearances and land acquisition.**

## Challenges around exploration, auctioning and land acquisitions

### Exploration and auctioning of new coking coal blocks

The first major challenge lies in the exploration and auctioning of coking coal reserves. Historically, coking coal mining in India has been underfunded and underdeveloped, with only small quantities of reserves explored, resulting in a lack of reliable data. The absence of critical geological information–such as resource estimates, and the quality and quantity of reserves–makes it difficult for potential bidders to assess the commercial viability of these blocks, limiting their ability to make informed decisions. Additionally, the high capital expenditure required for exploratory drilling further discourages interest and often leads to limited participation from industry stakeholders who are hesitant to invest large sums without a clear expectation of returns.

### Environmental clearances and land acquisition

Coking coal mining in India also faces major socio-environmental challenges, primarily due to land acquisition issues, ecological concerns and resistance from affected communities. Many coal blocks are located in geologically unstable or ecologically sensitive regions, often inhabited by tribal populations, where mining risks further destabilization and environmental degradation. These projects frequently encounter opposition from locals and civil society, compounded by poor coordination among government departments, which hampers effective rehabilitation and compensation efforts. Additionally, the sector's high carbon footprint raises health, safety and climate concerns, intensifying scrutiny during the approval process.

To unlock the full potential of coking coal reserves in India, a comprehensive approach is needed–one that simultaneously addresses technical, financial and socio-environmental challenges. A key strategy in this effort lies in promoting public-private partnerships to finance regional geological surveys. Pooling resources from both government and private stakeholders could reduce the financial risks for individual entities while expediting the development of comprehensive, high-quality geological datasets. Additionally, leveraging advanced technologies such as drone-based aerial surveys, high-resolution satellite imagery, remote sensing and geostatistical modeling can significantly improve the identification of potential resource zones early in the process by providing initial data that enhance the accuracy of preliminary assessments and reduce geological uncertainty. Furthermore, conducting a phased approach for exploration–starting with surveys, followed by targeted drilling and sampling–can support effective risk management and allow for more flexible budgeting and better allocation of resources.

However, the success of these technical efforts hinges equally on addressing the human and environmental dimensions of mining. To navigate concerns around land acquisition delays and disputes, it is critical to engage local communities early and proactively, particularly through open dialogue. Building awareness, fostering mutual trust and incorporating community perspectives early in the project lifecycle can significantly reduce resistance and pave the way for more inclusive and sustainable outcomes. Concerns around displacement and rehabilitation can be effectively managed by ensuring transparent processes, offering fair, timely and market-aligned compensation, and providing viable resettlement options. In addition, robust planning and implementation led by credible governance structures and independent oversight bodies are essential to maintaining accountability and trust. Furthermore, embedding sustainability into project design–through responsible land use, environmental safeguards and adherence to best practices–can help mitigate ecological risks such as deforestation, pollution and biodiversity loss. These steps not only address immediate concerns but also contribute to the long-term social license to operate for mining projects.

A critical institutional challenge in the Indian mining sector lies in the effective functioning of the District Mineral Foundation (DMF), which was established to channel a portion of mining revenues into improving the welfare of affected communities. While the intent of the DMF is progressive, several systemic issues have limited its impact. In many districts, DMF budgets remain underutilized due to weak planning capacity, lack of technical expertise, and delayed project execution. Furthermore, there is often inadequate alignment between DMF allocations and the actual needs of mining-affected populations, with spending skewed toward short-term, visible infrastructure rather than long-term investments in health, education, and livelihood security. Governance and transparency gaps–such as limited participation of local communities in decision-making and inadequate public disclosure of fund utilization–further undermine trust and accountability. Addressing these challenges requires strengthening institutional capacity at the district level, enforcing stricter transparency measures, and ensuring DMF projects are planned in consultation with local stakeholders, so that these funds genuinely act as a tool for inclusive development rather than remain an underperforming fiscal pool.

Even after overcoming geological and administrative hurdles, inefficient pricing mechanisms and burdensome duties can still deter private and foreign investment. A well-aligned policy framework that streamlines exploration and acquisition while ensuring rational pricing and duty structures is essential for creating a competitive, transparent and investment-friendly mining environment. This synergy can ultimately accelerate domestic production, reduce import dependency, and support the broader vision of Atmanirbhar Bharat.

## Pricing policy and rationalization of duties

India's steel sector remains heavily reliant on imported coking coal, with the import bill exceeding USD 15 billion in FY2022–23 as domestic deliveries fell short of demand. Historically, the government has sought to manage this dependence by adjusting import duties and imposing quantitative restrictions to protect domestic producers. Yet, despite these interventions, local players continue to face stiff competition from cheaper global imports, limiting long-term pricing stability.

India's 2.5% import duty on coking coal (and 5% on metallurgical coke) was eliminated in May 2022 to lower input costs; but this reduction only yielded a US$10–12/ton benefit–insufficient to bridge the competitive gap. This duty structure created a disconnect: downstream met coke was effectively cheaper than its raw material, undermining domestic producers' margins. In response to rising import volumes–5 MT in 2024 (vs. 2.9 MT in 2019–21)–the government imposed quantitative curbs on low-ash met coke, limiting imports to 2.85 MT/year or 0.71 MT per quarter, from January 2025. These restrictions were extended for another six months through December 2025, while anti-dumping investigations were launched into met coke imports from key exporting countries.

Simultaneously, freight and terminal charges on domestic coal must be reviewed. Elevated rail and handling costs currently make local coal less competitive. Rationalized transport pricing can narrow this cost gap, encouraging use of domestic supply.

Controlled quantitative restrictions on low-ash metallurgical coke imports also play a strategic role. The government's six-month import quota–capped at approximately 713,583 tons per quarter–aims to shield domestic coke producers from surging imports, which have risen over 60% in four years. Extension of these quotas, with calibrated flexibility for higher-ash grades, can preserve supply stability without disrupting industry operations. The government's coal policy calls for a comprehensive review and rationalization of rail tariffs, terminal charges, and material handling fees to align cost structures more closely with actual service levels and international benchmarks.

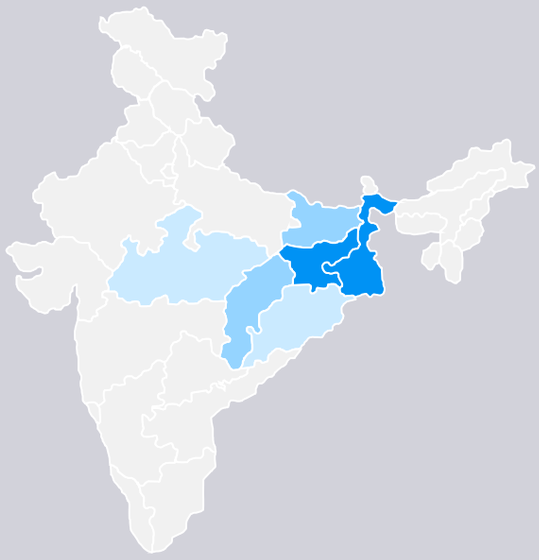
Improved cost efficiency in coal evacuation systems, including enhanced First Mile Connectivity (FMC) infrastructure and mechanized loading/unloading, will further reduce handling losses and bulk logistics costs..

These reforms will yield several tangible benefits. Domestic producer margins would improve, revitalizing the metallurgical coke sector. Lower logistics and fairer tariff structures will enhance the cost competitiveness of domestic coal. Controlled quotas and price transparency mitigate exposure to international volatility while safeguarding supply chains. Strategically, these policy interventions align with Atmanirbhar Bharat, strengthen India's positioning ahead of global trade shifts (such as the EU's carbon border tax), and support energy security and sustainable steel growth. Together, they represent a foundational shift toward a resilient, competitive and self-sufficient steel-coal ecosystem.

## Ease of doing business

Coking coal reserves in India are largely concentrated in the eastern and central parts of the country, particularly in the states of Jharkhand, Chhattisgarh and Odisha. These regions host some of the largest and most economically viable coal deposits, making them key hubs for the nation's steel and power industries, which rely heavily on coking coal for operations such as steel production in blast furnaces. The dominance of these states in the mining sector stems from both the abundance of natural resources and the strategic efforts by state and central governments to promote mining as a driver of economic development. Over the years, there has been a steady increase in mining activities, supported by infrastructure development, policy reforms and investment-friendly initiatives.

India's coking coal reserves



*Source: Ministry of Coal and EY analysis*

**Coal mining policy**

- India opened its coal sector to commercial mining by private and foreign players in 2020
- This promoted increased competition, improved transparency and attracted new players to the ecosystem

**Revenue-sharing auction**

- Shift in auction mechanism from fixed royalties to revenue-sharing model
- This lowered entry barriers, improved alignment with the government, and incentivized bidders to develop blocks more efficiently

**Infrastructure support**

- Development of mining corridors with rail, road and port connectivity in coal-rich states
- Ministry of Coal encouraged coal washeries and coal logistics hubs to be set up near mines for better efficiency

**Production incentives**

- Government provides targets and financial support CIL for ramped up coking coal production
- Push for domestic procurement by PSUs to help stabilize demand

While these reforms were designed to expand coking coal mining and production, the sector continues to face persistent challenges that limit operational efficiency and dampen investor confidence. Lengthy and complex environmental clearance processes, particularly in ecologically sensitive areas, often delay project execution. Land acquisition remains a major hurdle, complicated by outdated records, tribal land rights and local resistance. The sector also struggles with a shortage of advanced mining technology and skilled labor–especially for underground operations–alongside limited policy support for capacity building. Frequent policy shifts and lingering legal uncertainties further undermine investor sentiment.

Even so, key states such as Jharkhand, Chhattisgarh and Odisha have taken proactive steps to strengthen the mining ecosystem by introducing quicker clearances, efficient mining administration, and transparent auction mechanisms for block allocation.

**Jharkhand**

- Demonstrated a strong commitment to advancing its mining sector through enhanced exploration, sustainable practices and infrastructure development
- The State Industrial Policy identifies mineral-based industries as a thrust area, offering strategic and infrastructural support for their establishment
- Offers significant opportunities to set up washeries for both coking and non-coking coal
- Implementation of Jharkhand Integrated Mines and Mineral Management System (JIMMS) to streamline operations and ensure transparency. It automates mining processes and facilitates stakeholder collaboration to curb illegality and irregularities

**Chhattisgarh**

- State government set new benchmarks in economic and industrial development through a **transparent mining policy, e-auction mechanisms and digital surveillance systems**
- Prioritized environmentally sensitive and scientifically driven mining practices, actively monitoring illegal activities via satellite imagery and surveillance tools
- Systematic methods are being promoted in minor mineral quarries with a **strong focus on environmental conservation**
- Additionally, the government has built **new infrastructure to enable rapid and smooth coal evacuation**, further strengthening its commitment to sustainable growth

**Odisha**

- Actively supported mining through regular auctions of coal blocks to both public and private entities, and created a single window for investor facilitation and tracking to monitor investments, enabling the online submission, payment, tracking and processing of approvals
- State's Exploration Program focuses on identifying auction-ready blocks for minerals in high demand
- Addressed ecological concerns by establishing a unique land bank for compensatory afforestation, facilitating forest clearances and promoting environmental restoration
- The Integrated Mines and Minerals Management System (i3MS) and Sand Mine Portal, enhance transparency and efficient mineral administration through automation, integration with railway freight systems, and advanced monitoring using drones and satellite technology
- These systems also support statutory clearance authentication, resource mapping, and capacity building through specialized training programs

Improving ease of doing business is critical to unlocking India's investment potential in this capital-intensive sector, which demands long-term commitment. A streamlined regulatory environment–characterized by simplified clearances, digitized processes and reduced compliance burdens–not only accelerates project timelines but also builds investor trust. Transparent policies, efficient dispute resolution, and enabling infrastructure add to this confidence. Coupled with targeted incentives and policy stability, these reforms can create a more predictable and attractive investment climate, positioning India as a preferred destination for Foreign Direct Investment (FDI).

*Source: Ministry of Coal, PIB and EY analysis*

## Investment potential and FDI landscape

India's ongoing steel production surge presents a compelling investment opportunity in coking coal mining and processing infrastructure. As the country aims to quadruple its steel demand over the next 25 years, demand for critical inputs such as coking coal will rise sharply, driven by robust infrastructure investment and industrial expansion. This growth trajectory highlights significant scope for capital inflows, technological modernization, and strategic partnerships in the sector.

To support this, the Government of India has liberalized investment norms. Foreign Direct Investment (FDI) of up to 100% is now permitted under the automatic route in coal mining and associated processing infrastructure, including washery, crushing, coal handling, and separation units. In addition, the Mines and Minerals (Development & Regulation) Amendment Act, 2021 (MMDR Amendment) allows captive mine owners to sell up to 50% of their output in the open market, creating new investment opportunities across the supply chain.

### India investment trends

- However, despite these reforms, actual FDI inflows into coal remain limited. In FY23, foreign investment amounted to just USD 13 million in a single coal mine in Jharkhand.
- This stands in contrast to India's strong performance as a global investment hub–ranking 15th in annual FDI inflows in 2025 and attracting over US$80 Bn. in FY25, a 14% increase over the previous year.
- The disparity exhibits that while overall investor sentiment toward India is robust, the coal sector still requires targeted incentives and proactive engagement to unlock its potential.

### Overseas Asset Acquisition

Meanwhile, private Indian steel majors are actively investing overseas to secure long-term coking coal supplies.

JSW Steel, for instance, is in talks with BHP to acquire Australian coking coal assets with a capacity of 20 MTPA. The company is also evaluating opportunities in the US, Chile, and Mozambique to further diversify its supply sources.

Tata Steel, on the other hand, has acquired a 5% stake in the Carborough Downs Coal Project in Queensland, Australia. This undeveloped underground project is expected to produce low-ash, high-quality coking coal suitable for steelmaking.

Attracting targeted FDI into domestic coking coal mining and processing offers several strategic advantages, from boosting production efficiency and strengthening supply chain resilience for steelmakers to enabling localized capacity building and technology transfer. These investments reduce reliance on imports, advance the Atmanirbhar Bharat vision, and facilitate the adoption of advanced mining and beneficiation techniques. In doing so, they can modernize India's coking coal sector, making it more competitive, sustainable, and aligned with global best practices.

*Source: Ministry of Coal, EY-Best Practices in Mining, Ministry of Mines and EY analysis*

## Technology upgradation in mining

Technology upgrades are central to this transformation. Advanced solutions are essential for safe and efficient extraction from challenging geological zones, higher mining productivity, reduced coal losses, enhanced coal quality through beneficiation and deshaling, and stronger environmental and safety compliance–particularly in underground operations.

| | |
|---|---|
| **Mechanized underground mining** | § Adoption of **longwall mining and continuous miners** across key coal mines to improve productivity in deep, complex mines<br>§ **Private sector projects** gradually deploying these technologies to expand mechanized extraction of coking coal in India |
| **Coal washing and beneficiation** | § **Modernizing** key coking coal washeries with **advanced automation, with upgraded circuits and improved ash reduction,** to improve coal quality<br>§ Supporting the washeries with **improved design of water network to optimize water consumption** and use of **laser-based coal analyzer** for real-time data of coking coal quality |
| **Digitized and automated mining** | § **Digital and IoT tools like actuators, LIDAR and SMART systems** are enhancing safety, asset use and supply chain efficiency in mining<br>§ **Advanced analytics and cloud computing** help miners optimize operations, predict coal quality and drive data-based productivity |
| **Safety and environmental technology** | § **Gas detection systems**, remote controlled equipment, **ventilation in deep underground mines** and **real-time worker tracking to reduce risks and enhance worker** and underground **safety**<br>§ Environmental measures such as d**ust suppression, wastewater treatment, and Zero Liquid Discharge (ZLD) systems** to minimize environmental impact |

These interventions mark an important phase of transformation, driven by rising demand for high-quality coking coal to support India's steel industry. In response, the sector is steadily modernizing–adopting underground mechanization, smart mining systems, digital monitoring and advanced beneficiation processes. Yet, sustaining and scaling these advancements requires strategic investment in institutional support, research and development (R&D) and skill development. These pillars are critical for adapting global innovations to Indian conditions, preparing a future-ready workforce, and building a resilient ecosystem capable of meeting the long-term demands of steel production.

## PCI & Alternative Fuels

In 2024–25, India's steelmakers made notable progress in improving Pulverised Coal Injection (PCI) efficiency while actively testing alternative injectants to curb dependence on imported PCI-grade coal. Producers achieved higher PCI rates through furnace upgrades, digital controls and blended coal strategies, enabling coke rate reductions without compromising metallurgical performance. At the same time, natural gas and hydrogen injection trials advanced, supported by infrastructure upgrades and policy incentives under the National Hydrogen Mission. These trials delivered measurable reductions in coke consumption and emissions, with some mills modifying furnaces to operate under hydrogen-rich conditions.

Beyond PCI, the sector moved decisively toward electric arc furnace (EAF) expansion and greater scrap utilization, supported by government incentives and strengthened logistics. Gas-based direct reduced iron (DRI) and hot briquetted iron (HBI) technologies also gained momentum, offering partial substitution for coal-based inputs. Biochar emerged as a renewable carbon alternative, with pilot trials and feasibility studies underway, though adoption remains limited. Government action complemented industry initiatives through targeted policy updates, infrastructure investment and R&D support, collectively fostering a more diversified, resilient, and decarbonized steelmaking ecosystem with lower exposure to global coal market volatility.

## Institutional Support, R&D and Skill Development

Driving self-reliance in India's coking coal ecosystem requires a strong foundation of research, innovation and skilled human resources. This vision is being supported by robust institutional infrastructure, cutting-edge R&D led by premier institutes such as NML and CSIR-CIMFR and coordinated efforts by the Ministry of Steel through targeted funding programs. At the same time, national skill development missions and localized training initiatives are equipping the workforce with specialized capabilities, ensuring that technological progress is matched by human capital. Together, these elements create a comprehensive framework to modernize the sector and reduce import dependence.

- **Institutional infrastructure** is vital for translating policy into action, supporting technological advancement and operational efficiency in the coking coal sector
- **Key research bodies like NML and CSIR-CIMFR** lead innovation–NML has pioneered processes like direct-reduction sponge iron and blast furnace simulators, improving steel productivity at major plants
- **CSIR-CIMFR provides end-to-end R&D support**, focusing on mining efficiency, safety, environmental sustainability and coal beneficiation, forming the core of India's coal innovation ecosystem

- The **Ministry of Steel leads national R&D** efforts via its '**Promotion of R&D in the Iron and Steel Sector**' scheme, offering up to **70% financial support for transformative, industry-linked innovations**
- Key focus areas include **non-coking coal utilization, heat recovery systems and coal beneficiation**–projects already underway with institutions like NML, CMPDI and IIT Kharagpur
- The scheme is **backed by annual government funding of INR 5 to 10 crore**, underscoring a strong commitment to reducing import dependence and enhancing domestic coal quality

- A **skilled workforce is critical for the evolving coking coal sector**, with national initiatives like the **National Skill Development Mission and PMKVY** supporting large-scale training efforts.
- Localized programs–such as the **Jharia rehabilitation-linked skill development plan**–are essential to align community upliftment with coal sector needs.
- **Sector Skill Councils, ITIs and dual education systems** are helping build **specialized manpower** for roles like **mining technicians and coal-washery operators**, supporting the sector's modernization.

Achieving Atmanirbharta in coking coal is not merely a strategic necessity but a foundational pillar for India's self-reliance in steel production and broader industrial resilience. While challenges persist–ranging from geological complexities and environmental sensitivities to limited domestic output–the path forward lies in a calibrated blend of policy support, targeted FDI, cutting-edge technology adoption and skill development. By strengthening domestic exploration, streamlining regulatory processes, and enabling private and global participation, India can unlock its vast coking coal potential. Ultimately, a self-reliant coking coal ecosystem will enhance supply security, reduce import dependency and catalyze sustainable growth in the core sectors driving India's economic future.

07

# Sustainability, greenification and carbon concerns

# 7 Sustainability, greenification and carbon concerns

## Rising domestic production is set to heighten environmental concerns, while the green steel transition will reshape coking coal usage

Technological advances to expand the domestic coking coal industry are expected to put pressure on the environment, as extraction poses considerable ecological challenges. Mining contributes significantly to land degradation, pollutes water resources, deteriorates air quality and intensifies climate change. These impacts highlight the urgent need for India's coal mining industry to strike a sustainable balance between economic growth and environmental preservation.

Opencast mining has a severe impact on land and water resources. It causes deforestation, destroys ecosystems, and displaces flora and fauna. The physical alteration of landscapes through topsoil removal, overburden dumping, and subsidence leads to land degradation, rendering areas unfit for agriculture or vegetation. As of 12 January 2024, 299 mines were found inactive, with 297 abandoned and 82 requiring restoration, according to the Indian Bureau of Mines. Biodiversity loss is evident, with studies showing up to a 50% decline in species diversity in mining-affected areas like Jharkhand. Additionally, mining pollutes water bodies through acid mine drainage and heavy metals, causing water scarcity and harming aquatic life. Excessive water use and disrupted drainage patterns further reduce groundwater availability, affecting local communities and ecosystems.

Air pollution from mining operations, particularly opencast coal mining, poses serious respiratory health risks due to dust generated from blasting, coal transportation and exposed surfaces. These activities also emit methane–a potent greenhouse gas–and pollutants such as nitrogen and sulfur oxides, contributing to smog, acid rain and deteriorating air quality. Moreover, India's reliance on coking coal for steel production adds substantially to carbon dioxide emissions, exacerbating global warming and climate change. The expansion of mining also intensifies land use conflicts, as it encroaches on agricultural land and fuels disputes between mining companies and farmers.

Tackling these environmental challenges is critical to ensuring the sustainable growth of coking coal mining and requires balancing economic efficiency with ecological preservation. While opencast mining is favoured for its cost-effectiveness and higher output, it often comes at a steep environmental cost. This highlights the need for stakeholders to implement advanced pollution-control technologies and enforce strict safeguards. Promoting cleaner, more responsible mining practices is vital not only for minimizing ecological damage but also for enhancing public acceptance and ensuring the long-term sustainability of coal operations.

### Land reclamation

- Plantation on external and internal OB dumps is done by State Level Expert Agencies, with a four-year maintenance period after each planting cycle, as per approved EIA/EMP
- Major OCPs (>5 MM³ Coal + OB) are monitored annually via satellite imagery, while other OCPs are monitored every three years.
- Coalfield-wise vegetation cover maps are prepared every three years to monitor land use changes.

### Water pollution

- Mine water is treated through sedimentation at mine sumps and surface settling tanks before discharge, while on-site workshops ensure proper maintenance of HEMMs.
- Residential effluent colonies are managed by conventional systems and Sewage Treatment Plants (STPs)
- Dewatering approved by CGWA; piezometers monitor groundwater levels per NOC.
- Groundwater recharge in villages through ponds, rainwater harvesting and desilting.

### Air pollution

- Dust control via mist/fixed sprinklers, rain guns at coal plants, conveyors, crushers and bunkers.
- Fog cannons and water sprinklers used on haul and transport roads.
- Majority of coal is transported via railways and pipe conveyors under First Mile Connectivity (FMC), significantly reducing road-based transport and associated dust emissions.
- Continuous Ambient Air Quality Monitoring Stations (CAQMS) implemented, along with surface miners to reduce blasting impacts.

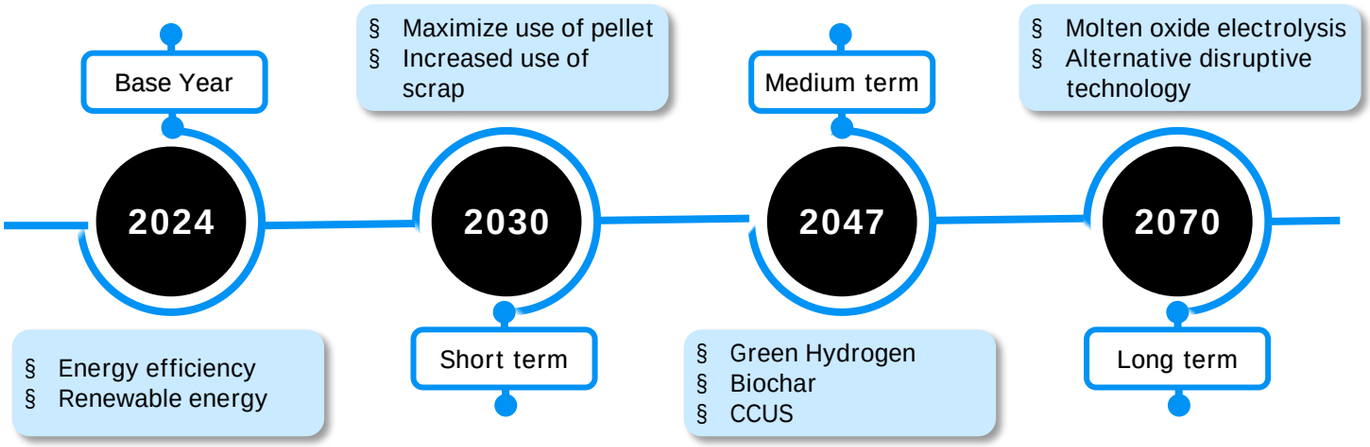
*Source: PIB, Ministry of Steel, Ministry of Coal and EY analysis*

**Coking coal would remain an indispensable input for Indian Steel Industry in the foreseeable future considering the commercially viable technological options available for steel making to meet the growth aspiration of India. But at the same time, decarbonisation of steel industry is also required to be fast paced to make the right balance to decouple emission and growth, which essentially requires optimisation of coal consumption to technical minimum levels through innovation, efficiency, carbon and material circularity, use of alternative materials as reductants and removal of residual emissions using CCUS.**

Prabodha Acharya
Chief Sustainability Officer
JSW Group

Beyond the air pollution caused by open-cast mining, steel production itself poses a major threat due to high greenhouse gas emissions. To counter this, the industry is moving toward green steel by adopting cleaner technologies and renewable energy, aiming to lower its carbon footprint and ensure sustainable growth.

## Green steel transition pathway




However, until the green transition reaches scale, the BF-BOF route will remain the dominant steelmaking process, continuing to drive significant emissions. In the interim, these impacts can be mitigated through greater energy efficiency, wider use of renewable energy, increased pellet consumption, and higher scrap integration in production.

### Pulverized Coal Injection

- High PCI adoption among ISPs helps lower coke rates, with scope to increase injection levels from the current 130–170 kg/t to ~200 kg/t for greater energy savings in BF-BOF operations
- Cuts coking coal dependence by replacing part of costly imported coke with cheaper non-coking coal, thus lowering costs
- Boosts efficiency by improving blast furnace performance, stability and productivity while reducing coke consumption
- Bridges the gap to green steel by providing short-term efficiency and emission benefits as the industry transitions to cleaner technologies

### Scrap usage

- India's National Steel Policy aims to scale up steel production using scrap-based Electric Arc Furnace (EAF) routes, targeting 35–40% reliance by 2030.
- Greater scrap usage delivers substantial energy savings compared to traditional blast furnace methods while creating a closed-loop production cycle that minimizes raw material extraction, reduces waste, and advances environmental sustainability.
- To secure reliable scrap availability, the government introduced the 2019 Steel Scrap Recycling Policy and the Vehicle Scrappage Policy, supported by a network of RVSFs and Extended Producer Responsibility mandates.
- In parallel, duty exemptions on imported ferrous scrap have been extended through FY 2026, providing a bridge until domestic scrap generation and processing capacity scale up to meet industry needs.

### Renewable energy

- Indian steel plants remain among the most emission-intensive in the world, largely because of heavy reliance on coal-based grids and captive power generation
- Greater integration of renewable energy presents a compelling and achievable pathway to cut emissions intensity while accelerating the sector's decarbonization journey
- Ambitious plans are underway to raise renewable energy's share in steelmaking power supply to 43% by 2029–30, a sharp leap from just 7.2% in FY2021–22
- A supportive policy framework with fiscal incentives and subsidies is being rolled out to encourage green capacity investments and storage solutions, ensuring reliable round-the-clock clean energy for steel plants

*Source: Ministry of Steel, Ministry of Coal and EY analysis*

## Green Hydrogen

§ Green hydrogen steel production currently costs nearly double conventional methods, compared with traditional steel. Costs are projected to halve by 2030 as economies of scale and technological advancements take effect.
§ Partial substitution of coal or fossil fuels with green hydrogen in existing furnaces can reduce $CO_2$ emissions by 20–30% in the near term, without requiring full infrastructure overhaul.
§ Industrial green hydrogen steel projects are operational or planned in Germany, Sweden, and EU, producing thousands of tonnes annually and serving as global benchmarks.

## Carbon capture

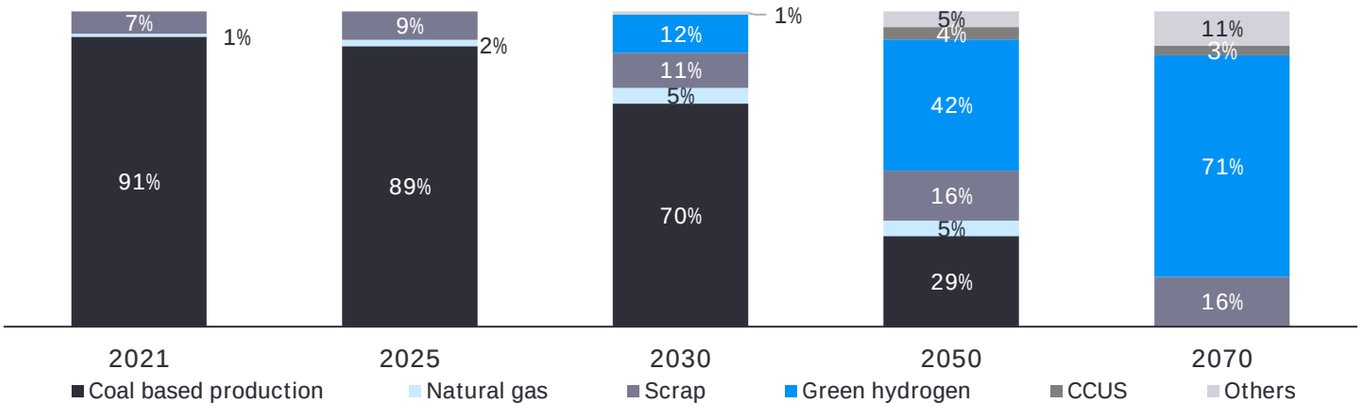
§ Coal-based blast furnaces and rotary kilns account for a major chunk of India's iron production, with blast furnaces averaging only 15 years of age against a 40-year lifespan
§ Gas-based shaft furnaces can adopt green hydrogen, but their role is limited; hydrogen use in rotary kilns remains unproven
§ Up to 56% of emissions from legacy steel plants can only be addressed through Carbon Capture, Utilization and Storage (CCUS)
§ With continued investments in blast furnaces and rotary kilns until 2030, CCUS will be central to India's deep decarbonization strategy for iron and steel

## Biomass and biochar

§ Biomass, when converted into biochar, offers metallurgical properties similar to coke, making it a renewable alternative for steelmaking while carbon emissions by up to 20%.
§ The PAT scheme under the National Mission for Enhanced Energy Efficiency incentivizes industry-wide energy reduction, indirectly encouraging biochar and biofuel adoption
§ Adoption is limited due to strong competition from cheaper, coal-based fuels such as coke and Pulverized Coal Injection (PCI) coal
§ Co-firing biochar with coal, recognized under the UNFCCC, provides a pathway to mitigate carbon emissions

India's green steel transition will unfold in phases–beginning with energy efficiency, renewable integration, and greater scrap utilization, before moving toward advanced solutions such as hydrogen, biochar, and CCUS technologies. The journey will not be without hurdles, from high costs and infrastructure gaps to technology readiness concerns. Yet, it presents a significant opportunity to transform the steel sector into a global leader in sustainable production. Going forward, scaling innovation, accelerating policy reforms, and fostering collaboration between industry and government will be critical to achieving deep decarbonization. With the right momentum, India can not only meet domestic green steel demand but also establish itself as a competitive exporter in the emerging low-carbon global economy.

India's steel decarbonization roadmap




*Source: Ministry of Steel, Ministry of Coal , IEEFA and EY analysis*

08

# Summary insights and way forward

# 8 Summary insights and way forward

## Meeting India's steel demand requires diversifying imports, boosting domestic coking coal, leveraging technology, and fostering industry–government collaboration for sustainable, self-reliant growth.

India's coking coal sector is undergoing major reforms under the Atmanirbhar Bharat initiative to reduce import dependence and boost domestic production. As the country advances toward its US$5 trillion economic vision, rapid urbanization and infrastructure growth are driving demand for coking coal, a critical input for steelmaking. However, domestic reserves are hampered by high ash and sulphur content, making them unsuitable without advanced beneficiation. Infrastructure bottlenecks–such as limited washeries, railway congestion, delays in block auctions, environmental clearances, and land acquisition–further hinder scalability. Overcoming these challenges is essential to securing raw material supply for the steel sector and sustaining industrial growth.
The coking coal landscape is evolving rapidly, shaped not only by rising demand but also by transformative drivers:

- Policy reform: Recent government measures–including 100% FDI in coal mining, new auction mechanisms, support for washeries, and infrastructure development–are addressing systemic bottlenecks and encouraging both domestic production and overseas asset acquisition.
- Sustainability and net-zero goals: The sector faces growing pressure to decarbonize, accelerating the shift toward low-carbon technologies such as scrap-based EAF, green hydrogen–DRI and CCUS. This requires stronger collaboration in R&D, investment, and workforce skilling.
- Technological advancements and agentic layers: Adoption of artificial intelligence, digital process automation, smart mining, and copilots is improving efficiency and supply security, reducing losses across the value chain, and enabling better resource management.

| Demand-side growth | Supply-side security | Government and policy frameworks | Technology and efficiency |
|---|---|---|---|
| § Steel and other consuming industries' capacity expansion<br>§ Infrastructure Development (rail/port/defence projects)<br>§ Export competitiveness<br>§ Manufacturing growth | § Domestic mining expansion (faster lease approvals, BCCL efficiency)<br>§ Import diversification (Mongolia corridor, US partnership)<br>§ Beneficiation capacity and development<br>§ Strategic stockpiling | § Mission coking coal implementation (140MT target, washery commissioning)<br>§ Trade and tariff policy (anti-dumping, tariffs)<br>§ Overseas acquisition support | § Blending optimization (30% domestic blend target)<br>§ Digital mining and automation<br>§ Coke oven upgrades<br>§ Washing technology |

| Decarbonization roadmap | External/geopolitical shocks | Capital and financing access |
|---|---|---|
| § Green steel transition (hydrogen DRI pilots)<br>§ Hydrogen infrastructure<br>§ Scrap utilization<br>§ Carbon pricing and CBAM compliance | § Supply chain disruptions<br>§ Price volatility<br>§ Currency fluctuations<br>§ Trade tensions | § Domestic investment<br>§ International funding<br>§ Green finance<br>§ Infrastructure bonds |

With these drivers converging, industry forecasts suggest that coking coal demand will continue to rise in the near to medium term as the country gradually transitions toward greener steelmaking technologies. Through 2030, reliance on imports is expected to remain high–potentially reaching 115 million tons–before new domestic projects, beneficiation advances, and alternative production routes begin to moderate growth.

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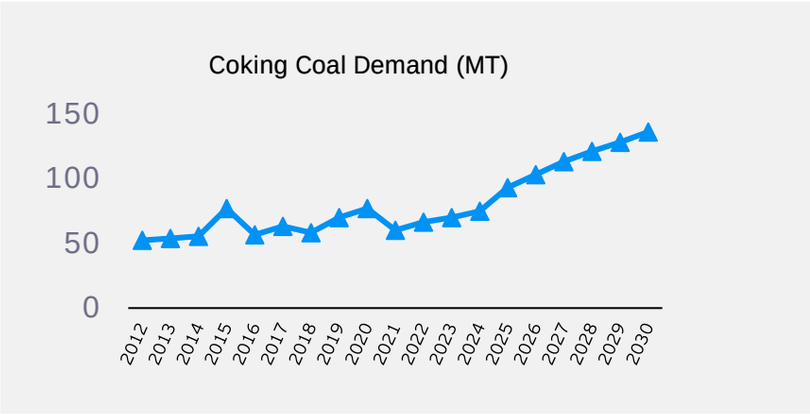
Based on a our analysis of coking coal demand in India, we have projected that the country's demand will reach ~130-140 Mn.T by 2030. This estimate is consistent with projections derived from other sources. The model was built using multiple key factors that directly influence coking coal consumption in India, ensuring a robust and comprehensive forecast. The upward trend in historical data, particularly after 2021, illustrates rising industrial demand, while the slight signs of saturation reflect the impact of accelerating decarbonization efforts.




## Key risk factors identified

### Supply security vulnerabilities:

- ~90% import dependency creates extreme vulnerability to supply shocks
- Australia concentration limits diversification options
- Infrastructure bottlenecks constraining domestic production scaling

### Technology and capital constraints:

- AI-ML blending optimization needed for 30% domestic utilization
- Current margins don't justify
- Advanced beneficiation technology gaps limiting domestic coal quality

### Geopolitical risks:

- Russia sanctions affecting supplier options
- Mongolia logistics challenges through China/Russia routes
- Trade tensions impacting long-term contract stability

## Success enablers

### Policy enablers:

- Critical mineral status for coking coal (NITI Aayog recommendation)30-year linkage tenure providing investment certainty
- Inter-ministerial coordination mechanism establishment
- Overseas acquisition facilitation by government

### Technology enablers:

- Special Purpose Vehicles with integrated steel producers, AI-ML implementation for blending ratio optimization
- Hydrogen DRI pilots for long-term transition pathway
- Advanced beneficiation for domestic coal quality improvement

### Infrastructure enablers:

- West Bokaro coalfield strategic development priority
- Railway infrastructure gap projects
- National coal trading exchange platform launch
- First mile connectivity projects' completion

India's coking coal and steel value chain stands at a defining inflection point–anchored in current reliance yet steadily pivoting toward a future shaped by technology, sustainability, and resilience. The advent of agentic AI, frontier R&D, and advanced automation positions the sector beyond incremental gains, preparing it for structural transformation. Government and private players together hold the levers to unlock this trajectory: deepening exploration, modernizing processing, enabling transparent pricing, and embedding ESG at the core of mining and steelmaking. The path forward is not about replacing coking coal overnight, but about integrating it within a diversified, future-ready ecosystem where efficiency, innovation, and decarbonization reinforce one another.

## Reinventing production: Safer, leaner and cleaner

Automation, robotics and digital twins are transforming mining and beneficiation, with autonomous fleets, drone-assisted mapping, and AI-driven plants already improving yield, safety and turnaround time. Over the next two decades, breakthroughs such as plasma coal gasification, enzyme-based beneficiation, quantum-enhanced mineral mapping, and microbial carbon capture could enable cleaner, more efficient use of low-grade domestic coal. Together, these advances promise greater resource resilience while significantly reducing the sector's environmental footprint.

## Smarter consumption and leaner supply chains

Technologies like blend optimization, AI-driven quality sensors and adaptive feed control are already cutting coal use while maintaining output quality. In logistics, AI-enabled forecasting and route optimization are making supply chains leaner and more resilient, with future platforms expected to autonomously coordinate procurement, production and distribution. At the same time, falling costs of green hydrogen, biochar and renewables–combined with carbon credit pressures–are steadily eroding the viability of coal-intensive practices, pushing industries toward cleaner transitions by default.

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At the same time, falling costs of green hydrogen, biochar and renewables–combined with carbon credit pressures–are steadily eroding the viability of coal-intensive practices, pushing industries toward cleaner transitions by default.

| Recommendation | government actions | private sector actions |
|---|---|---|
| Supply chain coordination | § Establish long-term supply contracts between Coal India Limited (CIL) and steel producers, aligning with private washery capacities.<br>§ Implement performance-linked supply commitments to improve washeries' throughput utilization. | § Private sector washeries to enter into long-term toll washing agreements with suppliers and steelmakers, ensuring steady feedstock and commissioned capacity utilization<br>Integrate digital tracking and quality monitoring systems to optimize washing operations efficiency and overall yield |
| Market liberalization and trade | § Amend policy to allow e-auction platforms and open trade for rejects/middlings, emulating other international coal trading platforms where by-products are frequently traded openly, enhancing liquidity and price discovery.<br>Remove captive consumption clauses to allow steel mills to directly procure washery by-products, enabling flexible trade and secondary use of by-products. | § Washery operators to actively list rejects and middlings on national e-auction platforms<br>Steel players to develop blending strategies incorporating by-products to reduce costs and increase raw material flexibility |
| Resource prioritization | § Issue a mandated phase-out for supply of coking coal to power generation, ensuring prioritization to steel sector, similar to government-led resource allocation prioritization for critical industries.<br>§ Monitor and regulate spot market auctions to prevent unauthorized coal diversion, using real-time tracking | § Power plants to accelerate fuel switching/replacement strategies, leveraging natural gas and renewables<br>Steel industries to collaborate with regulators to form policies and systems, ensuring prioritized coal supply systems |

| Recommendation | government actions | private sector actions |
|---|---|---|
| Global asset and security strategy | § Negotiate bilateral trade agreements with major coking coal exporting nations, similar to India-Australia Partnership which stabilizes supply and promotes long-term investments<br>§ Establish government-backed investment consortia to secure equity stakes overseas and streamline imports | § Private steel producers to aggressively pursue equity stakes or joint ventures in overseas coal mines, as demonstrated by various players<br>§ Deploy hedging and risk management instruments referencing global coal indices tailored with domestic adjustments |
| Regulatory and fiscal alignment | § Enforce uniform national implementation of royalty on ROM basis irrespective of processing location, avoiding multiple taxation<br>§ Issue clear instructions exempting washery by-products from royalty if produced from captive coal | § Mining companies to negotiate with state governments for royalty compliance and recovery mechanisms<br>§ Factor regulatory costs into pricing and operational optimization |
| Mission coking coal - scaling production and beneficiation | § Provide capital subsidies (20%-30%) and accelerated depreciation incentives for expansion of modern washeries and exploration practices<br>§ Set enforceable quality standards and beneficiation targets with monitoring for better quality control | § Invest in next-generation beneficiation and washing plants incorporating online quality analyzers and dry deshaling technology.<br>§ Collaborate with research institutions for adaptive coal blending and beneficiation R&D partnerships |
| Infrastructure and resilience | § Prioritize rail/port connectivity for coking coal movement to improve washery-to-steel linkage<br>§ Commission a comprehensive geological survey to update India's coking coal reserves, grade distribution and beneficiation potential<br>§ Create a National Coking Coal Reserve (strategic stockpile) to buffer supply shocks, akin to petroleum reserves<br>§ Introduce policy incentives for by-product valorization and recovery of rare earths/critical minerals from rejects and fly ash | § Develop digital platforms for real-time coal blending optimization<br>§ Partner with thermal power plants to utilize rejects/ash for blending or carbon material extraction |
| Technology and green transition | § Extend PLI-type schemes for adoption of advanced beneficiation and dry coal preparation technologies<br>§ Provide policy incentives for pilot projects using biochar, hydrogen-based steelmaking and PCI alternatives | § Invest in pilot projects for biochar, hydrogen-based steelmaking, or PCI alternatives to de risk coal dependency<br>§ Instead of fragmented overseas deals, form joint consortia of Indian private steel players for stable overseas sourcing<br>§ Adopt blockchain-based coal supply chain traceability for ESG compliance and avoid penalties in global steel trade |

| | China | Australia |
|---|---|---|
| Technology | Smart Mining using AI | AI and IoT integration for mining |
| Description | Mine-wide AI system processes 500,000+ data points locally, delivering real-time insights via a dynamic dashboard. It enables instant safety alerts and predictive maintenance through vibration analysis. Supporting closed-loop safety and smart decisions, it aligns with the smart mining strategy–empowering “smart miners” and driving rapid gains in safety, efficiency and management through full-chain AI integration | The initiative aims to enhance workers' access to and analysis of data, potentially boosting operational efficiency to the extent that the mine's lifespan could be extended by six years. It includes real-time monitoring of methane, carbon monoxide and dust levels, along with predictive analytics to ensure equipment reliability and tunnel safety. |
| Benefits | 92% boost in production efficiency by reducing task time from 24 to 2 hours | Improved safety, operational efficiency and environmental monitoring |

With agentic AI and advanced automation, the coking coal and steel value chain is evolving from basic digitalization to intelligent, self-improving systems that optimize operations end-to-end. Global case studies already demonstrate how these technologies drive efficiency, sustainability, and the faster adoption of breakthrough practices. Looking ahead, frontier research–from AI-designed catalysts for hydrogen reduction to carbon-negative coal by-products and geo-engineered $CO_2$ sequestration–signals a pivotal shift. These innovations could fundamentally redefine the role of coking coal, paving the way for a more resilient, future-ready steel ecosystem.
Beyond supply and technology, robust price discovery remains a cornerstone for sector resilience. Strengthening CICCI can address this gap.

## Coking Coal Indexation

To transform CICCI into a resilient price discovery mechanism, the government can deploy its regulatory and incentive levers across index methodology, market structure and institutional governance.

Broadening CICCI’s grade coverage to include semi-soft coking coal (SSCC) and blended grades will mirror the diverse cargo specifications employed by Platts and Argus, reducing price gaps and enhancing comparability. Mandating cargo quality standards–such as fixed ash and volatile matter ranges–for all reported trades will align domestic parameters with global norms, ensuring consistency in assessments.

Improving market liquidity requires embedding CICCI within India’s commodity derivatives ecosystem. The Ministry of Finance, in collaboration with the Securities and Exchange Board of India and commodity exchanges (MCX/NCDEX), can authorize CICCI-linked futures and options contracts. These tools would allow steel producers and traders to hedge price risk systematically, similar to how global market participants use Platts-linked instruments. Concurrently, the Ministry of Steel could institute mandatory weekly reporting of executed coking coal trades by public sector undertakings and large private buyers, raising the volume of transactions underpinning CICCI.

Comprehensive landed cost indices should be published alongside CICCI. The Ministry of Commerce and Industry can direct the Coal Controller Organization to release a CIF-plus index that incorporates standardized freight and insurance charges and a rupee-dollar exchange overlay. This approach replicates the Platts CIF Newcastle index and provides Indian importers with a transparent landed-cost benchmark.

Strong institutional governance is essential. Establishing an Index Oversight Committee under the Ministry of Coal–comprising steel producers, indexed producers (Coal India), importers, financial exchange representatives and neutral observers–will ensure methodological integrity and periodic reviews. Regulatory guidelines should require semi-annual reassessment of CICCI's methodology to incorporate advances in data collection, digital trade reporting and global best practices.

By leveraging existing governmental powers–through regulatory mandates, financial exchange authorization and inter-ministerial coordination–India can elevate CICCI from a nascent domestic index to a credible reference that mitigates procurement risks, stabilizes coking coal costs and enhances the global competitiveness of its steel industry.

**The global coking coal market faces uncertainties due to price volatility and geopolitical supply disruptions, impacting Indian steel producers. To mitigate risks and make steel producers more competitive its necessary to have diversified supply chain and enhance domestic production. Adopt cleaner production technologies and improve energy efficiency. Improve quality and quantity of domestic coking coal to meet demand.**

Rajesh Mohata
Chief Procurement Officer
AMNS India

## Future outlook

India's rapid industrialization, fueled by government investment in infrastructure, manufacturing, and industrial projects, is driving a sharp rise in steel production. The National Steel Policy and the Viksit Bharat agenda reinforce this momentum, setting a national objective to double steel production by 2030.

With the blast furnace–basic oxygen furnace (BF-BOF) route remaining the most efficient method for large-scale steelmaking, India's near-term reliance on high-quality coking coal is unavoidable. Demand is projected to reach 140 to 150 million tons per annum (MTPA) by 2050 (with the change in the mix of the production technology, we foresee that the growth in absolute demand for coking coal shall largely be flat), of which domestic production is expected to supply only 15 to 20 MTPA, demonstrating the need for continued imports. To strengthen supply security and reduce exposure to price volatility, India must diversify its import portfolio by sourcing from a wider range of global suppliers beyond Australia.

At the same time, enhancing domestic capabilities will be critical. Beneficiation and blending techniques can improve the usability of Indian coking coal, while the adoption of advanced technologies such as artificial intelligence and machine learning can boost efficiency and support decarbonization. Over the longer term, as India transitions to alternative steelmaking methods, coking coal demand may stabilize or even decline beyond 2030, aligning growth with sustainability.

Achieving this vision calls for strong industry collaboration. Large and mid-sized players must work together, supported by enabling government policies. Industry associations such as the Indian Steel Association (ISA) will play a key role in driving dialogue, cooperation, and alignment. This collective effort embodies the spirit of Vasudhaiva Kutumbakam–the world is one family–by uniting diverse stakeholders in pursuit of an inclusive and sustainable industrial future.

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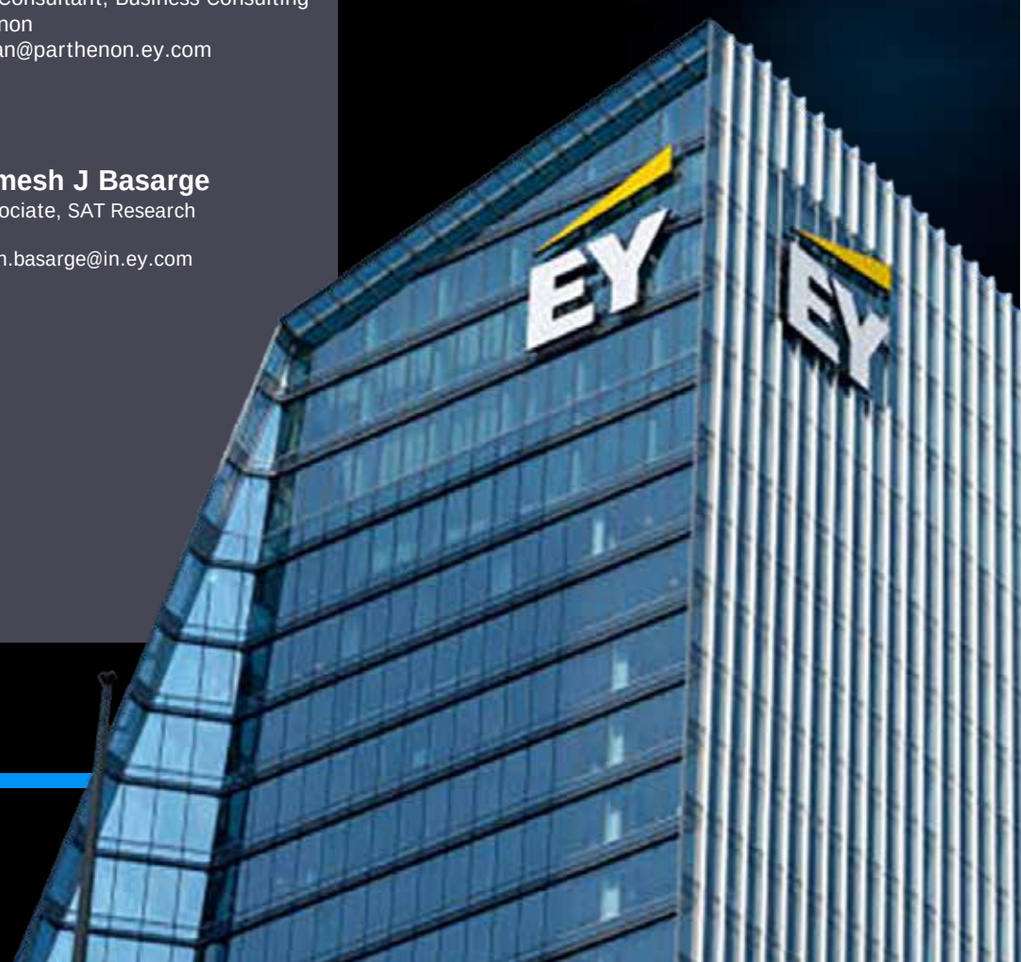

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