# The Rebar Opportunity

## Decarbonising the backbone of India's built environment

Report / October 2025

Building Materials & Technology Promotion Council (BMTPC), established in 1990, is an autonomous organisation under the Ministry of Housing & Urban Affairs (MoHUA), Government of India. BMTPC is entrusted to promote resource-efficient, energy efficient, climate responsive, disaster resistant construction practices including alternate & innovative building materials and technologies for field level applications. BMTPC is also one of the resource institutions for the Ministry to provide S&T support in the area of sustainable building materials & construction technologies including disaster mitigation & management.

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The Lodha Foundation is advised by a distinguished board of thought leaders and domain experts. Their guidance ensures our efforts are strategic, future-focused, and rooted in real-world knowledge.

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The data and analyses presented in this report are based on information available at the time of publication and are intended to provide projections rather than predictions of future outcomes. These projections are subject to change as new data and insights become available. The findings should be interpreted cautiously and used as a guide for planning and decision-making rather than a definitive forecast.

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# Executive Summary

India's built environment is expanding at an unprecedented pace, fuelled by rapid urbanisation and large-scale infrastructure development. At the core of this transformation lies the steel reinforcement bar, or rebar — the hidden skeleton that provides the strength and durability essential for modern construction.

Rebar belongs to the broader category of bars and rods, which in FY24 accounted for 42% (59 MT) of the country's finished steel consumption.[1] Demand is set to rise sharply as India's urban floor area is projected to more than double by 2040, reaching 35 billion square metres.[2] With reinforced cement concrete (RCC) expected to remain the dominant construction method, rebar has become not just another steel product but the structural backbone of India's growth, embedded in virtually every residential, commercial, and infrastructure project.

This growth, however, carries an environmental cost. Steel is responsible for 15%–25% of embodied carbon in construction, which, if neglected, can be locked into structures for decades.[3] To meet development targets, India's finished steel consumption is expected to nearly double to 230 MT by 2030, intensifying pressure to decarbonise.[4] Recognising this, the Ministry of Steel has initiated a national decarbonisation roadmap and developed a green steel taxonomy.[5] Yet, given its scale, centrality, and unique performance requirements, rebar demands focused attention.

Unlike many steel products, which are predominantly produced via the blast furnace-basic oxygen furnace (BF-BOF) route, rebar is manufactured mainly in the secondary sector using electric furnaces. Small steel industries (SSIs) and standalone electric arc furnaces (EAFs) or induction furnaces (IFs) typically operate with scrap charge ratios of 40%–80%, depending on scrap quality and availability.[6] Around 70% of India's rebar comes from this secondary route, with the remaining 30% produced by integrated steel plants (ISPs) through BOFs and EAFs.[7]

Currently, EAF/IF-based rebar production emits roughly 2 $tCO_2/tTMT$.[8] The electric furnace pathway already avoids upstream, energy-intensive processes such as sintering, pelletisation, and coking, resulting in lower emissions — 1.8–2.0 $tCO_2/tTMT$ per ton of rebar compared to 2.7–3.0 $tCO_2/tTMT$ via the BF-BOF route.[9] With greater scrap utilisation and renewable integration, emission intensity could fall below 1 $tCO_2/tTMT$ by 2030, and approach 0.5 $tCO_2/tTMT$ by 2035 as the grid decarbonises further.



RMI India Foundation, in partnership with Lodha Foundation, undertook a sectoral deep dive into rebar decarbonisation.[10] Additionally, the G20 Secretariat, published a paper on enabling steel circularity in India's built environment. Drawing on plant visits, stakeholder consultations, and webinars, the authors identified production challenges, policy gaps, and potential hotspots for reducing emissions.[i, 11] The analysis positions rebar as a pivotal lever in India's green steel transition. Scrap-based steelmaking, powered by renewable electricity, emerges as a near-term, scalable strategy to cut emissions. Even modest improvements in rebar efficiency can deliver an outsized national impact, making accelerated scrap recovery and renewable integration immediate priorities. Beyond 2040, breakthrough technologies like green hydrogen-based reduction and carbon capture, utilisation, and storage (CCUS) will be critical for achieving near-zero emissions in steelmaking.

However, unlocking this potential will require overcoming systemic challenges, including limited availability of high-quality scrap, unfavourable electricity pricing, insufficient product-level emissions data, and concerns about rebar quality consistency.

## Key impact levers for green steel in India's rebar segment

Building on this context, the near-term pathway to green steel in India's rebar market rests on two interventions:

- Maximising scrap utilisation, and
- Increasing renewable energy penetration.

Together, these interventions offer a clear framework for cutting emissions, strengthening competitiveness, and meeting the rising demand for climate-aligned construction materials.

Expanding the supply and use of high-grade scrap is the most immediate opportunity. Each ton of scrap displaces iron ore and coking coal, avoids upstream processing, and reduces furnace energy requirements by as much as half. Yet India's recycling ecosystem remains underdeveloped relative to demand, creating a "scrap gap" that exposes producers to import volatility.

i. The G20 refers to the Group of Twenty. The G20 comprises 19 countries: Argentina, Australia, Brazil, Canada, China, France, Germany, India, Indonesia, Italy, Japan, Mexico, Republic of Korea, Russia, Saudi Arabia, South Africa, Turkey, United Kingdom, United States of America, and the European Union.

Scaling domestic recovery through vehicle-scrappage programmes, organised collection and shredding facilities, and circular-economy parks in scrap-rich states can anchor a secure feedstock base for green steel. Proven refining technologies now enable secondary steel producers/recycled steel producers to achieve the quality demanded for structural rebar consistently.

Renewable electricity integration is an equally powerful lever. Electric and induction furnaces are energy-intensive, and sourcing that power from clean generation can sharply lower emissions without altering production processes. Policies that rationalise tariffs, enable open-access purchases, reward time-of-day flexibility, and support captive or group-captive projects would make renewable power more accessible and cost-competitive, accelerating the shift to green steel across producers of all scales. Transparent measurement, reporting, and verification reinforce this transition. Environmental product declarations (EPDs) and other robust data tools link operational performance to specific product grades, enabling buyers to track embodied carbon and comply with emerging trade standards. Producers investing early in credible disclosure gain a clear commercial advantage in domestic and export markets.

The cost of producing green steel is often overstated. When savings from higher scrap substitution, renewable power procurement, efficiency gains, and by-product valorisation are accounted for, the premium narrows to a manageable level. Coordinated procurement platforms, targeted financing, and demand aggregation across builders, developers, and public agencies can distribute this modest differential and speed up adoption.

The report concludes by proposing a strategic framework for enabling steel producers, bulk buyers, and policymakers to create and sustain a market for green rebar.



This framework spans the entire value chain, outlining actionable interventions across production, demand, and policy measures:

- **Scale supply chain infrastructure:** Improve scrap recovery from urban centres and establish circular economy parks (CEPs).
- **Set performance specifications:** Integrate emissions thresholds, scrap content, and renewable energy use into procurement.
- **Aggregate demand:** Create buyer platforms and joint procurement efforts to signal strong demand.
- **Institutionalise through policy:** Embed EPD-based emissions criteria and scrap utilisation targets in policy, codes, tenders, and green public procurement.

**Exhibit ES1** Strategic framework for accelerating uptake of green rebar

## Steel sector landscape (2024)

**MATERIAL CONSUMPTION**

- IRON ORE: 225 MT — 1.6X by 2030
- SCRAP: 34 MT — 1.4X by 2030

**FUEL CONSUMPTION**

- COKING COAL: 72 MT — 58% of the national consumption
- NON-COKING COAL: 72 MT — 6.5% of the national consumption
- NATURAL GAS: 1,177 MMSCM — 2% of the national consumption
- ELECTRICITY: 72 MTOE — 9% of the national consumption

**PRODUCTION ROUTES**

- BLAST FURNACE – BASIC OXYGEN FURNACE — 43%
- DRI/HOT METAL – ELECTRIC ARC FURNACE — 22%
- DRI – INDUCTION FURNACE — 35%

Crude Steel (~144 MT); ~2X by 2030; Average emission intensity: 2.54 $TCO_2$/tcs

STEEL MELTING SHOPS (SMS)

Sectoral emission: 10%–12% of India's GHG emissions

**FINISHED STEEL PRODUCT CATEGORIES (~140 MT)**

FLAT PRODUCTS (~63 MT)
- PM plates
- HR coil/strip
- Others (cold roll, cold-rolled strips)

NON-FLAT PRODUCTS (~77 MT)
- Bars and rods (59 MT); single largest product category accounting for 42% of finished steel
- Structural
- Railway materials
- Others (wires, wire rods, angles shapes, and sections)

## Impact of increased scrap utilisation and increased grid RE penetration for rebar (2030)

**REBAR (BARS AND RODS)**
Scrap utilisation rate: 21% → 32% → 43%

**BLAST FURNACE – BASIC OXYGEN FURNACE**
**Scrap:** 8% → 15% → 20%
**SEC (GJ/tTMT):** 25.20 → 19.30 → 18.00
**Emission intensity ($tCO_2$/tfs):** 2.97 → 2.26 → 2.12

**COAL DRI – ELECTRIC FURNACE (IF/EAF)**
**Scrap:** 40% → 60% → 80%
**SEC (GJ/tTMT):** 17.10 → 10.90 → 6.90
**Emission intensity ($tCO_2$/tfs):** 1.79 → 1.12 → 0.75

**GAS DRI – ELECTRIC FURNACE (IF/EAF)**
**Scrap:** 40% → 60% → 80%
**SEC (GJ/tTMT):** 9.90 → 7.80 → 5.50
**Emission intensity ($tCO_2$/tfs):** 0.77 → 0.64 → 0.50

**INDIA**
**Energy consumption (GJ)**
8% → 15% → 20%
**Emissions (Mt $CO_2$)**
25.20 → 19.30 → 18.00

**BUILDINGS AND CONSTRUCTION SECTOR**
**Emissions (Mt $CO_2$)**
206 → 151 → 126

## Strategic framework for accelerating uptake of green rebar

**FRAMEWORK FOR ENHANCING SCRAP RECOVERY AND UTILISATION**

- Building regional scrap ecosystems and accelerating scrap recovery
- Establishing CEPs in scrap-intensive regions
- Integrating definitive scrap utilisation targets into the Steel Scrap Recycling Policy, 2019

**FRAMEWORK FOR ACCELERATING THE CONSUMPTION OF GREEN REBAR**

- Establishing performance specifications
- Aggregate demand through buyers' platforms
- Institutionalise through various procurement mechanisms and building codes

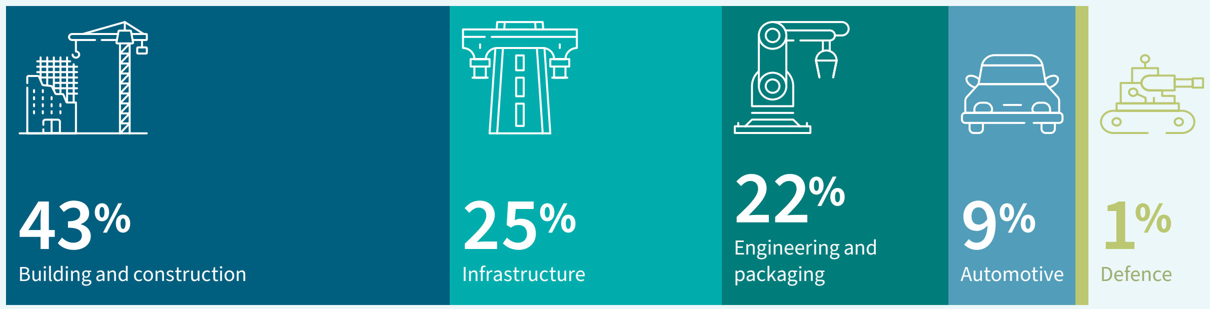
**Note:** 1) MMSCM = Million metric standard cubic metres. 2) 2030 Scenario (average scrap utilisation): BAU (21%) → Scenario 1 (32%) → Scenario 2 (43%). 3) SEC = Specific energy consumption. 4) the grid factors considered for the assessment are per the GoI targets of RE penetration in 2030. RMI Graphic. **Sources:** RMI Analysis; Ministry of Steel, *Annual Report*, 2024; Ministry of Steel, *Greening the Steel Sector in India Roadmap and Action Plan*, 2024.

# Introduction: The Scale and Strategic Importance of Rebar

India's built environment is expanding at an unprecedented rate, fuelled by rapid urbanisation and large-scale infrastructure development. Central to this growth is the steel reinforcement bar, or rebar, which acts as the structural backbone of buildings and infrastructure. Often unseen, it provides the essential strength and durability that support modern India's architectural and engineering ambitions. Yet, this essential component carries a heavy invisible burden, a significant carbon footprint that could make or break India's decarbonisation goals. While much focus is placed on alloy steels and other flagship steel products, this report spotlights rebar — the backbone of construction.

India is the world's second-largest steel producer, accounting for approximately 7.4% or 140 million tons (MT) of the world's total steel output.[12] As shown in **Exhibit 1,** the buildings and infrastructure sectors account for 68% of India's total steel consumption.[13]

**Exhibit 1** Segment-wise distribution of demand for steel in India



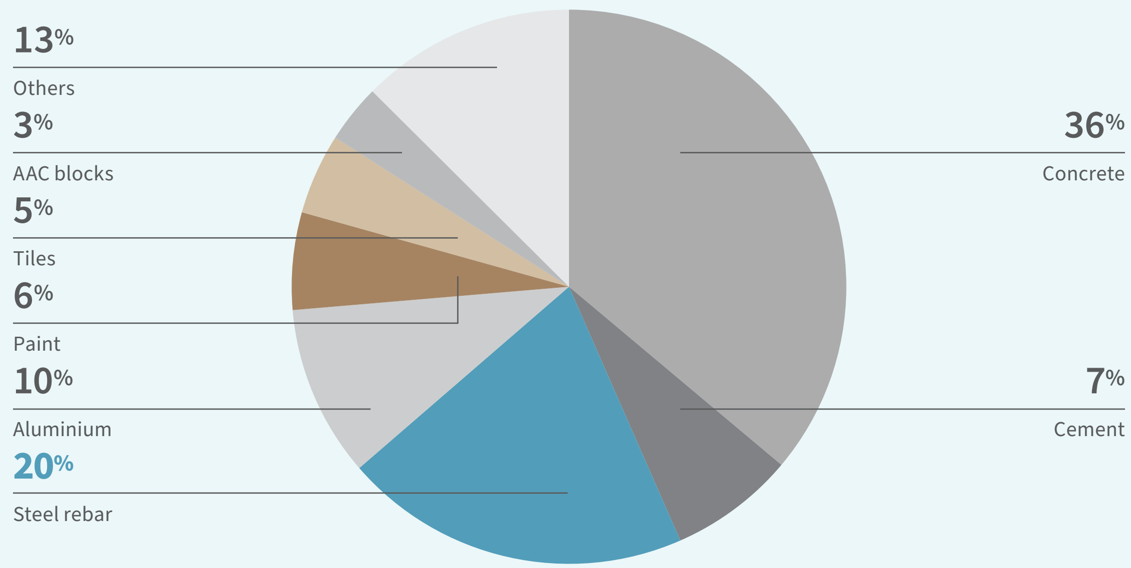

RMI Graphic. **Source:** Ministry of Steel, *Greening the Steel Sector in India Roadmap and Action Plan,* 2024.



At the core of this segment lies the rebar, which is produced in the form of bars and rods. In FY24, bars and rods accounted for 42% (59 MT) of India's finished steel consumption.[14] This demand is expected to rise sharply as urbanisation accelerates. By 2040, India's urban floor area is projected to more than double to 35 billion square metres, with RCC structures expected to remain the dominant form of construction.[15]

This scale makes rebar not just another steel product but the structural backbone of India's construction economy, embedded in almost every residential, commercial, and infrastructure project nationwide. Yet, this essential component carries a heavy invisible burden, a significant carbon footprint that could make or break India's decarbonisation goals. From an emissions standpoint, the environmental implications of this growth are significant. Steel accounts for 15%–25% of the embodied carbon footprint (see **Exhibit 2**), emissions embedded at the point of construction and locked in for decades.[16]

**Exhibit 2** Embodied carbon material footprint of a typical reinforced concrete building




**Note:** Embodied Carbon material footprint of a typical reinforced concrete building (426 KgCO2e/m2). RMI Graphic.

**Source:** Net Zero Urban Accelerator Analysis.

To meet the country's growing infrastructure and development needs, the Government of India aims to nearly double finished steel consumption to 230MT by 2030.[17] To address the environmental impact of this growth and accelerate the shift to low-emission steel, the Ministry of Steel has introduced a taxonomy for green steel.[18] While the national steel decarbonisation roadmap and the green steel taxonomy provide overarching trajectories for the sector, rebar requires distinct attention due to its scale of consumption, its central role in the built environment, and unique technical performance requirements.

Recognising the scale and strategic importance of this opportunity, RMI India Foundation undertook a sectoral deep dive into rebar decarbonisation in partnership with Lodha Foundation.[19] Over the past year, the team visited steel plants in Maharashtra, Tamil Nadu, and Telangana, covering both integrated facilities and micro, small, and medium enterprises (see Appendices for snapshots of rebar production at secondary steel plants). The India G20 Secretariat's publication on circular economy touches upon on enabling steel circularity in India's built environment in one of the chapters.[20] The publication examines the key barriers to low-emission steel production, mapped opportunities to expand circular practices, and outlined strategies to integrate circularity into India's steel sector.

Alongside these analyses, the team engaged with stakeholders across the value chain and hosted two focused webinars — one on market dynamics and procurement strategies and the other on breakthrough technologies in steel making.[21] These efforts provided practical insights into production challenges, procurement practices, and emerging solutions that informed this report.

Drawing on insights from plant visits, stakeholder consultations, and on-ground assessments, this report highlights the unique decarbonisation opportunities presented by rebar and evaluates the sector's readiness for a green transition. It estimates projected energy use and emission intensity of green rebar across India's steelmaking routes in alignment with the Ministry of Steel's 2030 targets. The analysis determines the impact of key decarbonisation levers, such as increased scrap utilisation, improved energy efficiency, and greater renewable energy adoption, at the product, sector, and building-stock levels. Finally, the report presents a strategic framework for steel producers, bulk buyers, and policymakers to create and sustain a market for green rebar in India.



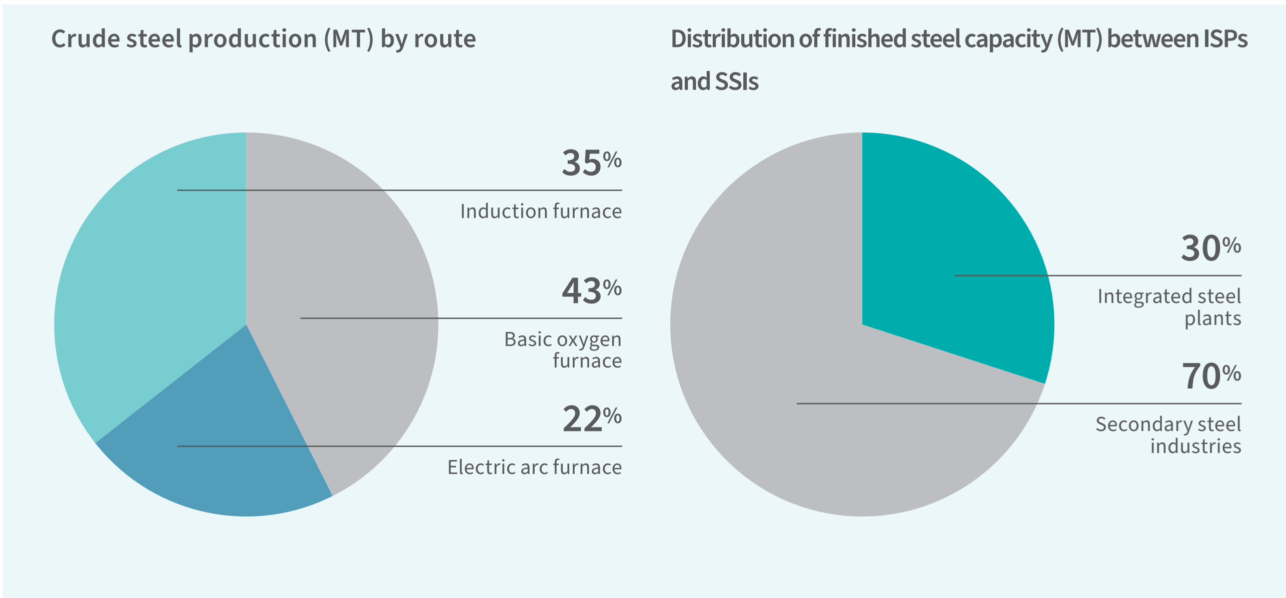
# Rebar's Role in India's Steel Decarbonisation

## Overview of India's steel sector

Steelmaking is highly resource-intensive, requiring significant quantities of iron ore, coal (coking and non-coking), limestone, alloying elements, and energy. In 2023–24, India's steel industry consumed 225 million tons (MT) of iron ore, 58% of national coking coal, 6.5% of non-coking coal, and accounted for about 9% of India's total energy demand.[22]

Steel production in India follows three primary routes: blast furnaces (BFs), shaft furnace direct reduced iron (DRI) using natural gas, syngas, or industrial gases, and rotary kiln DRI using coal. Hot metal from BF is converted to steel in basic oxygen furnaces (BOFs), and in some integrated steel plants also in EAFs, while DRI is processed in EAFs or IFs for steel making. The steel plants in India can be classified as integrated steel plants (ISPs) and secondary steel industries (SSIs).

**Exhibit 3** Route-wise share of crude steel production 2023–24



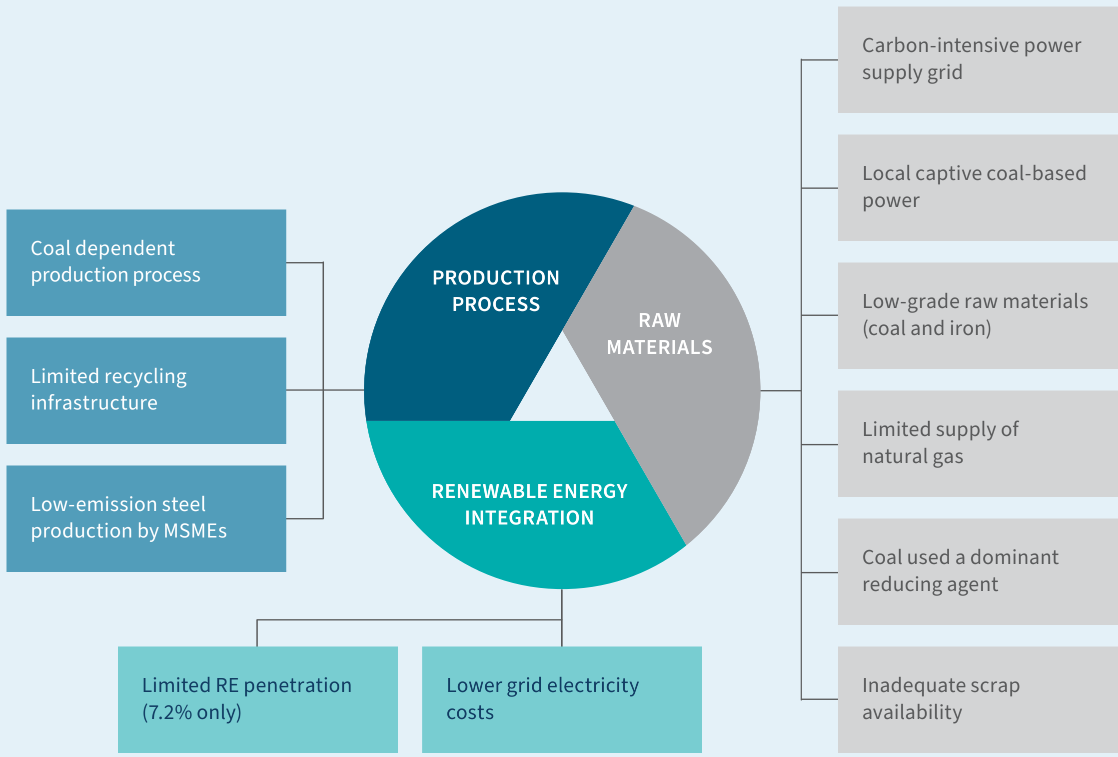

**Note:** Crude steel production is ~144MT; total finished steel production ~140MT. RMI Graphic. **Source:** Ministry of Steel, *Annual Report*, 2024.

## Emission Intensity of Indian Steel

India is the world's second-largest steel producer, and the steel sector accounts for 10%–12% of India's total greenhouse gas (GHG) emissions, making it one of the country's largest industrial emitters.[23]

Emission intensities vary significantly by production route.[24] Coal-based DRI-IF route has the highest emission intensity, while scrap-based steel making has the lowest. The average emission intensity of steel produced in India is ~2.5 $tCO_2$ per ton of crude steel (tcs), approximately 25% higher than the global average.[25] This is due to reliance on low-grade raw materials, coal-based power, limited scrap use, and limited renewable energy integration.

**Exhibit 4** **Key drivers of higher emission intensity in India's steel sector**




RMI Graphic. **Source:** *Greening the Steel Sector Roadmap*, 2024; RMI Analysis.



## The rebar advantage

Unlike most steel products dominated by BF, the BF-BOF route, rebar is largely produced in SSIs and electric furnaces, operating with scrap charge ratios of 40%–80%, depending on scrap quality and availability.[26] Estimates indicate that about 70% of rebar produced is by the secondary steel industry via the electric furnace route (IFs and standalone EAFs), and 30% from ISPs using BOFs and EAFs.[27] Scrap-based steel production bypasses energy-intensive upstream processes such as sintering and pelletisation, and avoids the need for iron ore and coking coal. As a result, rebar produced through the electric furnace route has a significantly lower emissions intensity — around 1.8 to 2.0 $tCO_2e$ per ton — compared to 2.7 to 3.0 $tCO_2e$ per ton for the BF–BOF route.[28]

Rebar's application characteristics also reinforce its suitability for low-carbon production routes. Unlike exposed steel products used in cars or appliances, which require pristine finishes and ultra-precise specifications, rebar is embedded in concrete and protected by a 20–50 mm concrete cover (IS[ii] 456), naturally shielding it from environmental degradation.[29] This makes it less dependent on surface finish, allowing greater flexibility to adopt lower-emission production routes without compromising performance.

Given the sheer volume of rebar consumed in India's construction sector, even marginal emission reductions can significantly impact national-level emissions. While breakthrough technologies such as green hydrogen and CCUS remain long-term solutions, scrap-based steel powered by renewables offers immediate emission reductions.

India's EAF/IF-based steel currently emits ~2 $tCO_2$ per ton of rebar.[30] By 2030, emission intensity could be reduced to <1 $tCO_2$ through higher scrap usage and renewable electricity. With continued grid decarbonisation measures and process optimisation, deeper reductions close to 0.5 $tCO_2$ by 2035 are possible. Beyond 2040, as breakthrough technologies such as green hydrogen and CCUS mature and scale, they will pave the way for near-zero emission steel production.

ii. IS refers to Indian Standard code as published by the Bureau of Indian Standards, Government of India.

# Key Impact Levers for Steel Decarbonisation

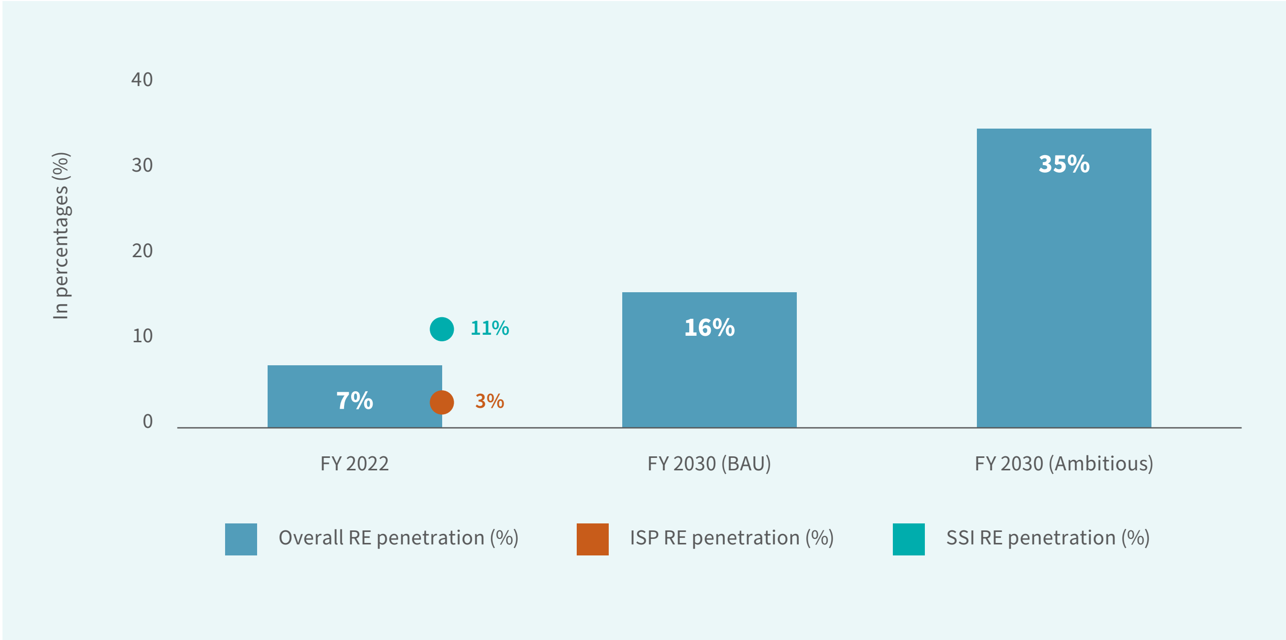
Despite the rebar advantage detailed in the preceding section, stakeholder consultations during site visits and webinars highlighted several barriers to widespread adoption of low-emission rebar. Key challenges include apprehensions over the quality of secondary steel products, constrained domestic supply of high-quality scrap needed for higher scrap substitution, electricity pricing structures that constrain renewable energy (RE) integration, and the absence of credible product-level emissions data.

## Accelerating renewable electricity integration

Renewable energy integration represents one of the most practical and impactful decarbonisation levers for India's electric furnace–based steelmaking, yet adoption remains limited. Renewable energy offers an opportunity to reduce emissions from steelmaking without any modifications to the existing production process. Electricity consumption and RE penetration in the steel sector is expected to increase. The Ministry of Power's mandate for a 43.33% renewable purchase obligation by 2030 is expected to increase this share.[31]



**Exhibit 5** Renewable energy penetration in the steel sector




RMI Graphic. **Source:** *Greening the Steel Sector Roadmap*, 2024.

Renewable energy procurement pathways such as power purchase agreements (PPAs), open access markets, and captive solar or wind plants can reduce power costs by 15%–20% compared to grid tariffs.[32] Yet uptake is constrained by structural barriers in electricity pricing. Captive RE use currently accounts for just 0.39%, largely due to subsidies, cross-subsidies, and tariffs that disincentivise small- and medium-scale industries (SMEs) from adopting RE.[33] For instance, some distribution companies offer 10%–15% discounts to SMEs that maintain a steady base-load demand.[34] While this lowers operational costs, it discourages load flexibility and shifting consumption to high-RE periods, weakening the business case for renewables.

Stakeholder consultations flagged this imbalance, calling for electricity pricing reforms tailored to secondary producers. Suggested interventions include reviewing industrial tariffs and cross-subsidies through State Electricity Regulatory Commissions (SERCs), introducing time-of-day tariffs to reward load shifting, streamlining approvals for open-access PPAs, and providing targeted support for captive RE investments. By unlocking cheaper, cleaner power, India's electric furnace producers can simultaneously lower emissions intensity and operating costs.

## Increasing scrap recovery and utilisation rates

India's ambitious developmental aspirations and pursuit of *atmanirbharta* (self-reliance) depend not only on expanding steel production but also on transforming how steel is sourced, used, and recovered. Every ton of scrap used in steelmaking saves approximately 1.1 tons of iron ore, 630 kg of coking coal, and 55 kg of limestone.[35] It also reduces specific energy consumption by 16%–17%, water use by 40% and greenhouse gas emissions by 58%.[36]

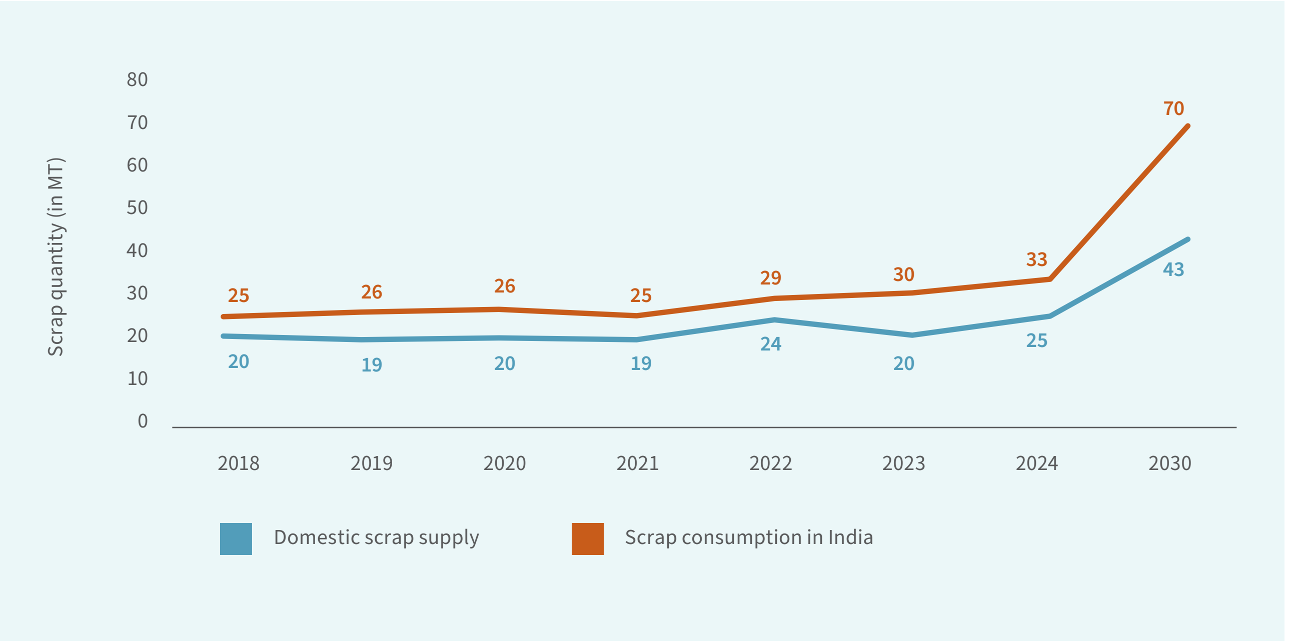
These benefits, along with several structural and market factors, underscore the urgency of accelerating domestic scrap integration:

### Scrap supply is rising, but demand is growing faster

India's domestic ferrous scrap supply has grown steadily, supported by policies such as the National Steel Scrap Recycling Policy, 2017 and the Vehicle Scrappage Policy, 2021. Yet domestic supply currently meets only about 75% of total demand. In FY 2023–24, the country generated approximately 25 MT of domestic scrap and imported a further 9 MT, largely high-quality shredded scrap.[37] By 2030, demand is projected to rise to 70–80 MT while domestic supply is expected to lag at around 43 MT, leaving a deficit of over 20–25 MT (see **Exhibits 6** and **7**).[38] This "scrap gap" underscores the urgency of scaling up domestic recycling to align India's construction-driven steel demand with its emissions-reduction goals. At present, India's recycling rate remains constrained by a highly informal and fragmented collection system, its relatively short industrialisation history, the long service life of steel products (30–50 years), and inadequate scrap collection and processing infrastructure.

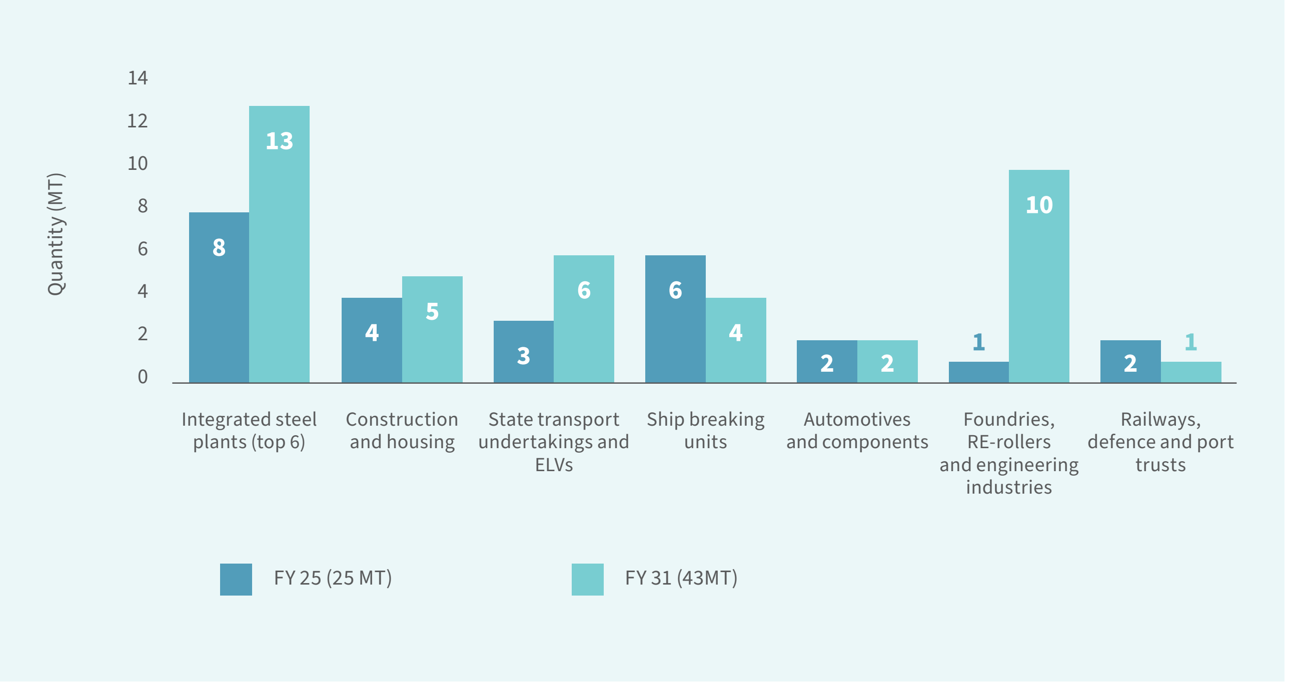


**Exhibit 6** The scrap gap: domestic scrap supply and demand




RMI Graphic. **Source:** RMI Analysis, Joint Plant Committee Analysis.

**Exhibit 7** Domestic scrap generation landscape




RMI Graphic. **Source:** RMI Analysis, Joint Plant Committee Analysis.

## Growing trade exposure and import risk

India is now the second-largest importer of ferrous scrap globally, with more than 70% of imports sourced from just 10 countries, including the EU, the United States, and the United Kingdom.[39] These same markets are tightening exports to prioritise their own green steel transitions. As more countries shift toward EAF-based production routes and introduce domestic scrap retention policies, there will be heightened exposure to price volatility, supply disruptions, and rising trade risks.

## Tightening iron ore landscape

Over 40 recently auctioned mines carry premiums as high as 140%–150%, most acquired by ISPs for captive use.[40] While many auctioned mines have yet to commence production, merchant ore availability is declining. Projections indicate that India may need to import 40–50 MT of high-grade iron ore by 2030, not due to geological scarcity but because of bottlenecks in mining, regulatory clearances, and logistics.[41] This trend disproportionately impacts secondary steel producers, who dominate rebar production, exposing them to supply insecurity, price volatility, and increased import dependence.

Recognising the strategic importance of scrap, the Ministry of Steel has set targets to scale scrap usage to 70–80 MT by 2030 and achieve 50% of total steel feedstock from scrap by 2047.[42] India is strengthening its domestic scrap ecosystem through industry–government joint ventures for end-of-life vehicle processing, vehicle scrappage schemes, and other green steel initiatives. With global competition for scrap intensifying and many countries restricting exports, these measures, combined with targeted fiscal reforms, can enhance scrap availability.

## Quality Assurance in Recycled Steel

Perceptions of inferior quality remain one of the biggest barriers to wider use of recycled steel, even though secondary producers today have the technology and certification systems to meet national standards consistently.

To address this, the Ministry of Steel has taken a progressive stance by moving away from classifying producers as "integrated," "primary," or "secondary" and creating a level playing field for SMEs and large players, with different capacities and following different routes of steel production.[43] The focus is now on whether the final product complies with Bureau of Indian Standards specifications, and no distinction shall be made on account of the input material or production route.



Several quality control orders have reinforced this principle, and government departments have been directed to ensure adherence to the above clarification and avoid any restrictive practices in their tenders. Targeted awareness campaigns could further dispel misconceptions and build market confidence.

On the ground, secondary steel producers are addressing quality apprehensions through systemic sampling, rigorous testing, spectrometric analysis, and mechanical tests demonstrating compliance with IS:1786 for construction-grade steel.[44] Modern EAF and IF plants also deploy advanced refining methods such as argon purging, ladle refining furnace and alloy adjustments to achieve the desired chemistry. For example, ladle refining furnaces can lower phosphorus levels by up to 0.03% and sulphur by 0.007%, at an incremental cost.[45]

With these measures, rebars made from high scrap content can reliably meet BIS standards for tensile strength and elongation, which are critical for durable RCC applications. The intrinsic protection provided by concrete cover, combined with the precision of secondary refining technologies, further mitigates risks linked to scrap variability. Greater transparency through third-party certification and batch-wise traceability can strengthen stakeholder confidence in recycled steel products.

Scrap utilisation: India's average scrap use in steelmaking currently stands at approximately 21%, with IFs and EAFs operating at around 40% scrap charge and the BF–BOF route at about 8%.[46] In comparison, global average scrap usage in steel production is 31%, with countries such as Turkey at 85%, the United States at 68%, the European Union at 57%, and Russia at 42%.[47] Even large primary steel producers such as Japan (39%) and China (34%) achieve higher scrap utilisation than India.[48]

During our stakeholder consultations, steel producers underscored the need for policy reforms in taxation and import duties. Currently, scrap purchases attract 18% GST, while imported scrap faces only nominal customs duties.[49] Reducing or removing these charges for high-grade scrap, while linking their reintroduction to progress in domestic scrap availability under initiatives like the Vehicle Scrapping Policy, 2021, can deliver dual benefits. It would provide secondary steelmakers with immediate access to quality feedstock, enhancing scrap-based production capacity, while simultaneously creating policy pressure to accelerate domestic scrap collection, segregation, and processing infrastructure. This incentive structure can catalyse sectoral decarbonisation and strengthen India's long-term scrap ecosystem.

Increasing scrap availability and utilisation is an effective near-term decarbonisation lever. The following section presents results of a scenario analysis examines the energy and emissions reduction impacts of doubling India's average scrap utilisation rate from 21% to 43% in India's steel sector.

## Product-Level Emissions Data Enables Market Access

Credible, product-level emissions data is becoming the commercial prerequisite for green steel, but most steel producers lack comprehensive measurement and reporting systems that link operational emissions to specific product carbon footprints. Steel buyers require comparable and verifiable product-level emissions data to guide procurement decisions and meet their organisational net-zero commitments. Yet, environmental performance data across the steel supply chain in India remains limited. The most widely recognised frameworks for this are life cycle assessments (LCAs), prepared in accordance with ISO 14040/14044 and EPDs declarations under ISO 14025 — developed using product category rules such as EN 15804 or ISO 21930 for construction products.[50]

**Exhibit 8** Recognised frameworks for the declaration of environmental footprint

**Life cycle assessment standards**
(ISO 14040/ISO 14044)

↓

**Product category rules (PCRs)**
Core PCR standards (EN 15804/ISO 21930)
(Product-specific for steel)

↓

**Third-party verified environmental product declarations**
(as per ISO 14025)

RMI Graphic. **Source:** RMI Analysis.



At present, few Indian steel producers maintain robust plant-level emissions data through continuous emissions monitoring systems and energy management frameworks such as ISO 50001.[51] However, only a few have established product-level measurement, reporting, and verification (MRV) systems that integrate mass–energy balances with specific heats, casts, or production batches. Without such linkages, buyers cannot reliably compare emissions across grades, diameters, or plants.

Furthermore, as global trade tightens around carbon standards, access to low-carbon, traceable feedstock like scrap is becoming essential. The EU's Carbon Border Adjustment Mechanism (CBAM), which imposes carbon costs on imported goods, directly impacts high-emissions steel products. Without a reliable domestic scrap supply chain and traceability systems, Indian steel producers risk losing competitiveness in key export markets and face cost penalties. Clean scrap will no longer be just an environmental good; it will become a market access requirement.

Crucially, this is not only a compliance issue. Establishing a lean MRV-to-EPD pipeline creates commercial advantage by enabling producers to credibly demonstrate performance, build market trust, and capture value in procurement. Such systems require consistent metering and data capture at each production stage, a monthly mass–energy balance to underpin product-level foot printing, and eventual alignment with recognised LCA and EPD program operators. Making EPDs publicly accessible through registries further enhances transparency and confidence in the market. In short, EPDs are no longer an optional reporting exercise but are becoming a commercial prerequisite for green steel purchase.

# Establishing the Impact of Increasing Scrap Utilisation on Energy and Emissions

As India prepares to almost double its steel production capacity, the choice of feedstock and process routes will strongly shape the sector's near-term emissions trajectory. Among available decarbonisation levers, increasing the share of scrap in steelmaking represents a proven, immediately deployable option with measurable energy and emissions benefits. Because rebar production already uses comparatively higher scrap charges than most other steel products, it offers a strategic entry point for scaling scrap integration across the wider industry. This section quantifies the energy and emissions reduction impacts of increased scrap utilisation in steel rebar at the product-level, building sector level, and steel sector level.

To assess the decarbonisation potential of higher scrap utilisation in rebar production, a techno-economic analysis was conducted, evaluating energy use and emissions intensity across three levels:

**Building sector level**
Assesses reductions in embodied carbon in India's construction sector by using rebar of varying scrap percentages.

**Steel sector level**
Estimates the combined impact on total rebar production in 2024 and 2030, expressed in terms of energy use and emissions.

**Product level**
Provides per-ton energy use and emissions estimates for different steelmaking routes.



**Exhibit 9** Scrap utilisation percentages across production routes

| Production route | 2024 | 2030 | | |
|---|---|---|---|---|
| | Base case (%) | Scenario 1 (%) | Scenario 2 (%) | Scenario 3 (%) |
| BOF | 8 | 8 | 15 | 20 |
| EF | 40 | 40 | 60 | 80 |
| Average | **21** | **21** | **32** | **43** |

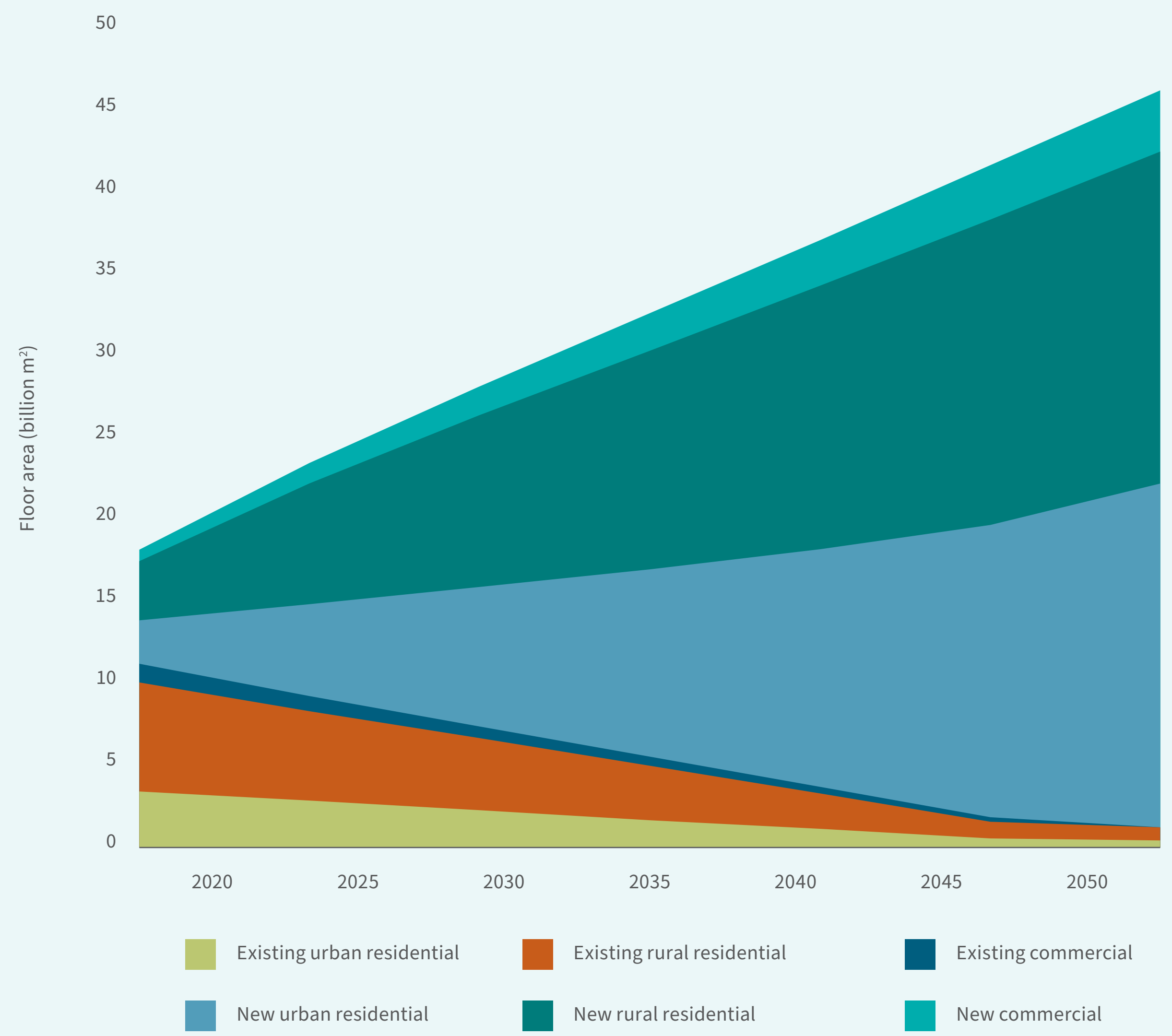
RMI Graphic. **Source:** RMI Analysis.

The assessment incorporates the additional benefits from material and energy recovery associated with higher scrap utilisation and accounts for the anticipated decline in grid carbon intensity from 0.72 $tCO_2$/MWh in 2024 to 0.47 $tCO_2$/MWh in 2030. Collectively, this analysis quantifies the potential for near-term reductions in both energy intensity and carbon emissions across India's steel sector.

## Building-sector level

RCC buildings represent a major end-use sector for steel consumption in India. TMT rebar with an average scrap content of 21% contributes to approximately 92 $MtCO_2e$ emissions. India's building sector is expected to expand significantly, driven by rapid urbanisation, with RCC structures expected to remain the dominant form of construction. This positions increased scrap utilisation in rebar production as a high-impact, near-term lever for decarbonising the sector.

**Exhibit 10** India's building stock projections

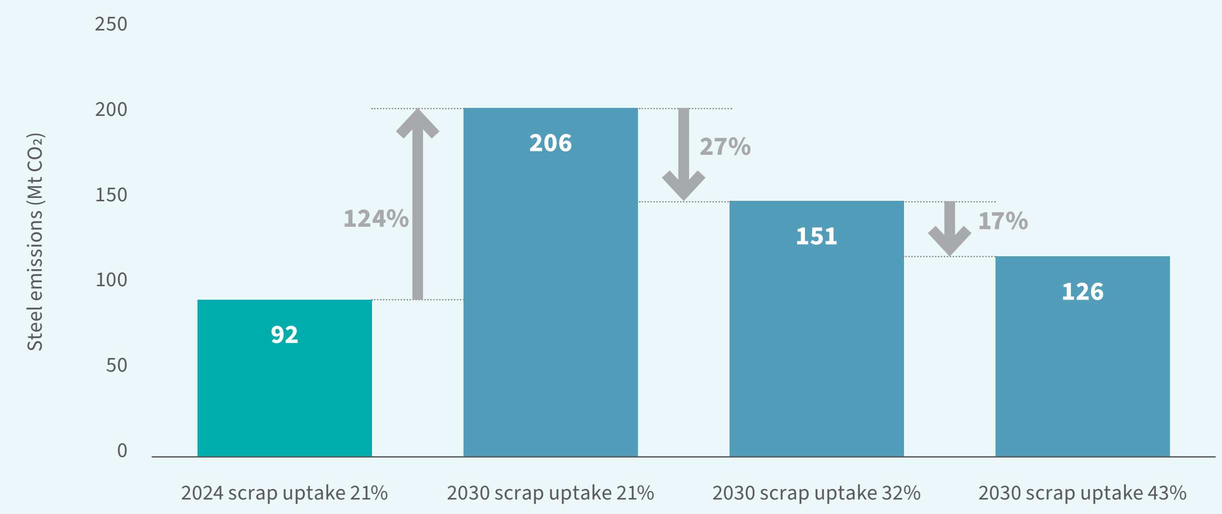



RMI Graphic. **Source:** *From the Ground Up*, RMI, NIUA, 2022.



In the absence of interventions to increase scrap content in rebar production, steel-related emissions from RCC buildings are projected to rise by 2 times between 2024 and 2030. Increasing scrap content to 43% by 2030 could reduce absolute emissions, despite higher material demand

**Exhibit 11** Impact of higher scrap content rebar use in buildings



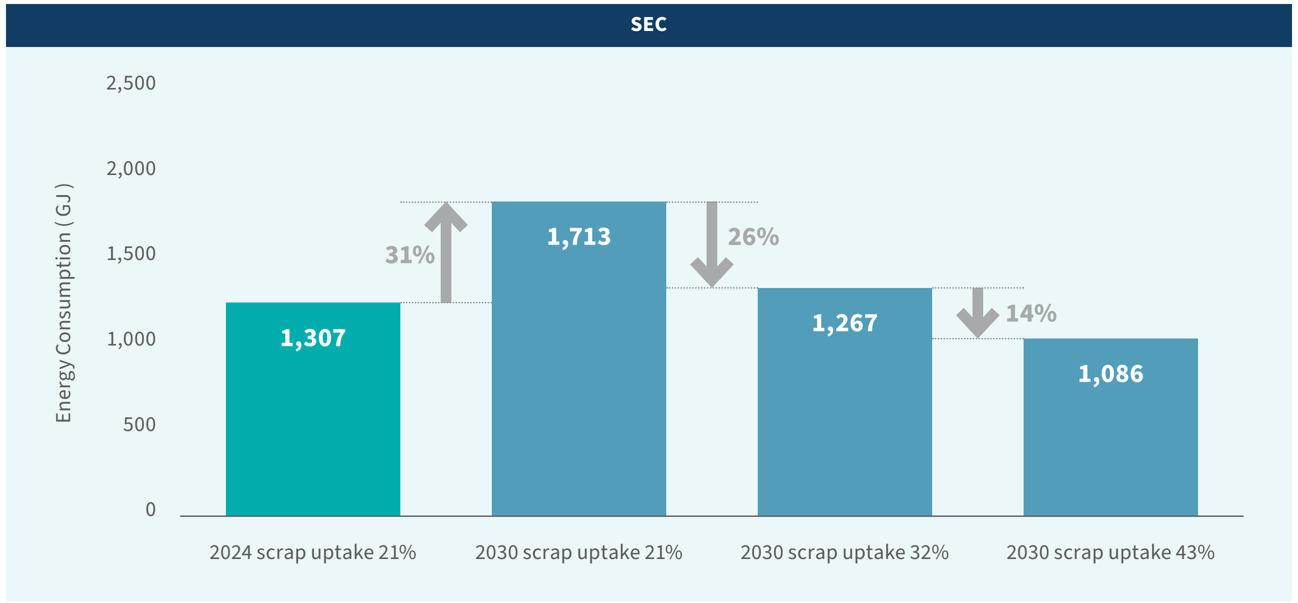

RMI Graphic. **Source:** RMI Analysis.

Scaling the use of recycled steel provides a direct and scalable pathway to reduce the sector's carbon footprint. Beyond slowing emissions growth, higher circularity enables absolute reductions, supporting India's ability to meet rising construction needs while limiting climate impact. The following section extends this analysis to the national level, quantifying the broader energy and emissions benefits of increased scrap utilisation across the rebar supply chain.

## Steel-sector level

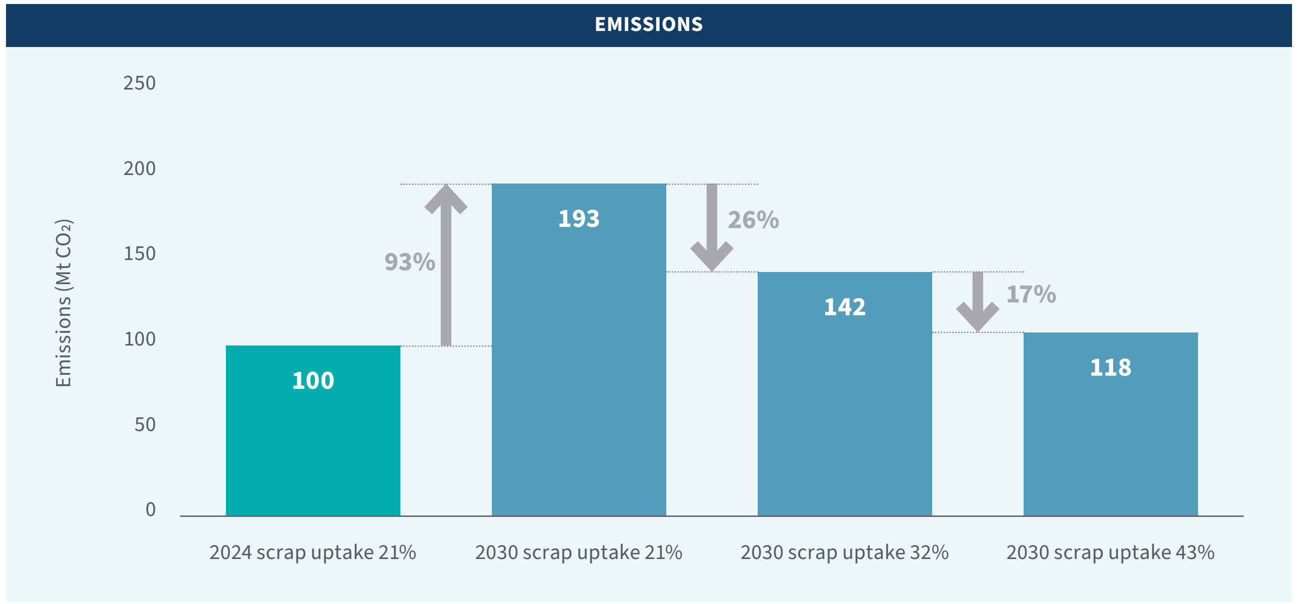
At the sectoral scale, increasing scrap utilisation in rebar production is a critical lever for reducing both emissions and energy consumption. Without intervention, rising demand is projected to drive steel-related emissions by 1.3x and energy use by more than 2x by 2030. By contrast, higher scrap integration can achieve absolute reductions in $CO_2$ intensity and energy demand, even as production grows. This outcome reflects the reduced reliance on primary steelmaking, which is significantly more energy- and carbon-intensive than secondary (recycled) routes. Strengthening recycling and processing systems to scale scrap uptake represents a structural decarbonisation pathway for India's steel sector, effectively decoupling material demand growth from emissions and energy consumption.

**Exhibit 12** Sectoral energy consumption of rebar production




RMI Graphic. **Source:** RMI Analysis.

**Exhibit 13** Sectoral emissions of rebar production




RMI Graphic. **Source:** RMI Analysis.



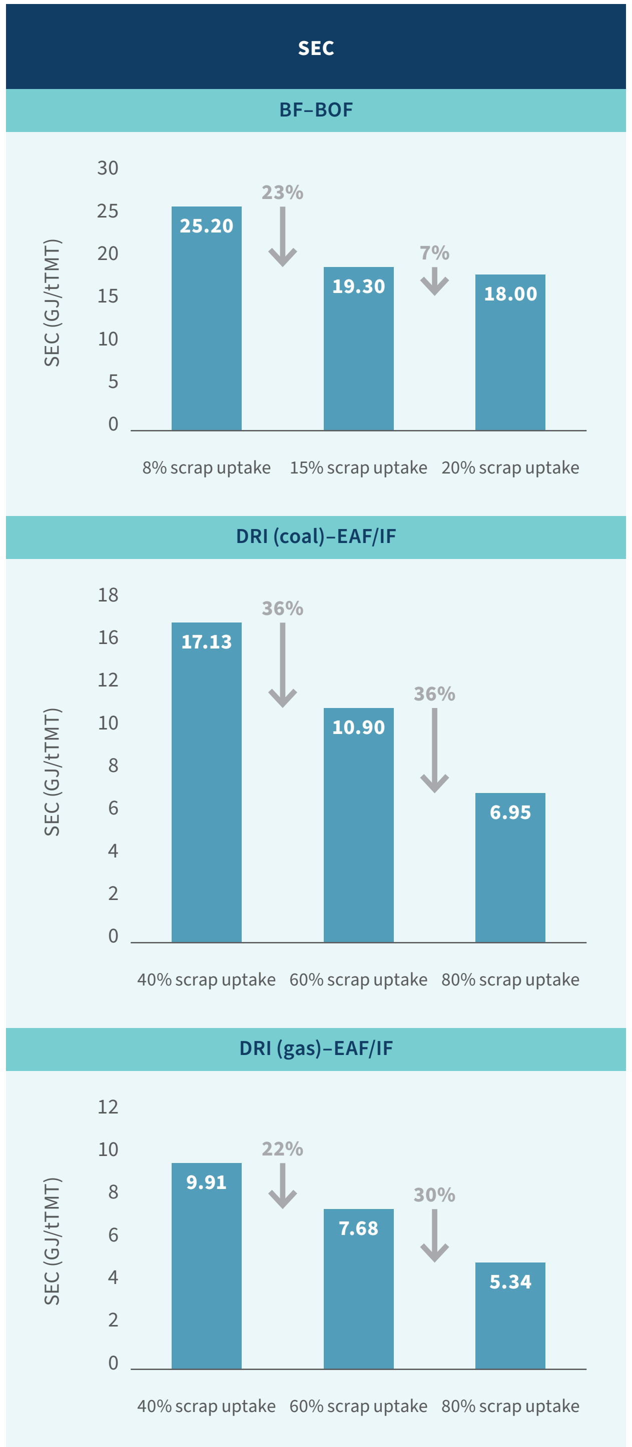
## Product level

This section evaluates how increased scrap use, energy recovery, and by-product valorisation affect emissions, efficiency, and cost across India's three dominant steel production pathways. The analyses indicate that decarbonisation cannot follow a uniform approach; each pathway responds differently to circularity measures due to distinct energy-material dynamics.

Across production routes, the integration of scrap, fuel switching, and process optimisation emerges as a key lever, though the impact and effectiveness of specific measures vary by route. In the BF–BOF route, scrap use delivers the strongest reductions by offsetting coal-heavy upstream stages, while other measures provide only incremental gains and face limits due to ore quality and gas costs. The BF–BOF route is coal-intensive but highly responsive to scrap integration, which provides the most effective abatement by displacing coal-heavy upstream processes. Although incremental measures such as waste heat recovery can deliver efficiency gains, the scope of decarbonisation remains limited without significant fuel switching. Constraints such as iron ore quality and high natural gas costs further restrict alternative pathways, reinforcing scrap scaling as the most viable near-term option. By contrast, the coal-based DRI–EAF/IF route, which dominates India's distributed steel sector, is characterised by high emissions from sponge iron production using high-ash domestic coal. This pathway offers substantial abatement potential through waste heat recovery, by-product utilisation, and progressively greater reductions with higher scrap shares, making it a priority for investment in scrap logistics, recovery infrastructure, and retrofit support. The gas-based DRI–EAF/IF route, meanwhile, is structurally more efficient due to the use of cleaner reductants and integrated practices such as hot charging, positioning it as the most compliance-ready option where gas availability and costs are favourable.

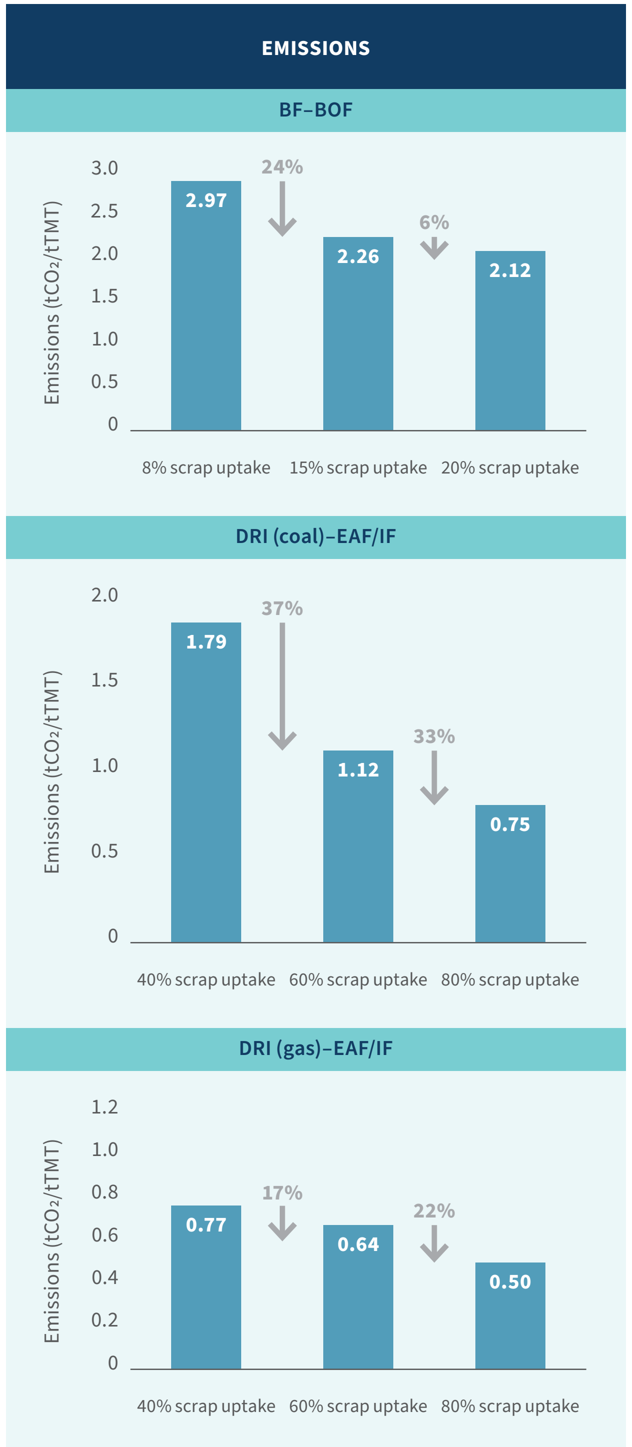
Overall, emissions and energy reductions do not always scale evenly across routes, underscoring the need for a tailored strategy that combines improved fuel quality with expanded scrap utilisation.

**Exhibit 14** Specific energy consumption of different production routes for rebar




RMI Graphic. **Source:** RMI Analysis.

**Exhibit 15** Emissions of different production routes for rebar



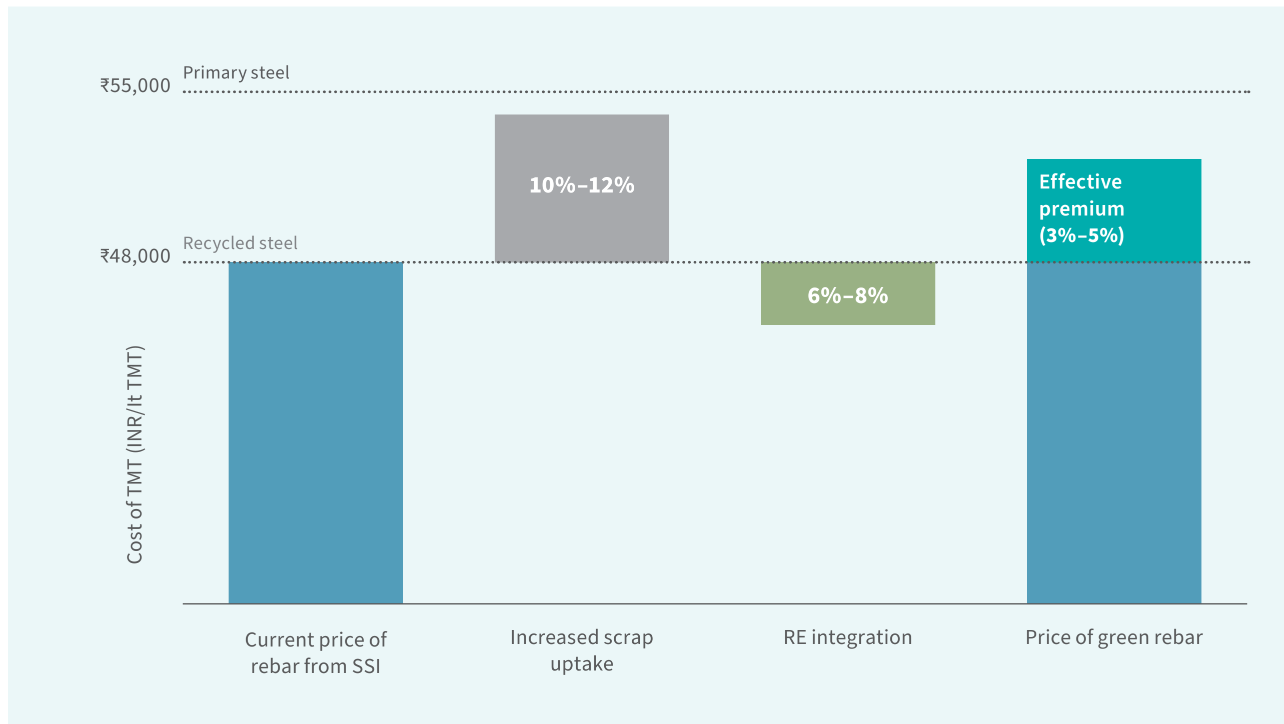

RMI Graphic. **Source:** RMI Analysis.



# Understanding The "Green Premium": Cost Offsets vs. Cost Drivers

The debate around green premium in steel often obscures a critical point: decarbonisation does not necessarily make rebar prohibitively expensive. In India's steel market, a perception persists that low-carbon rebar requires a steep green premium, with many producers anticipating mark-ups of 10%–15% driven by emerging green steel taxonomies, corporate sustainability commitments, and other compliance requirements. In reality, when factoring in cost offsets from higher scrap utilisation, renewable energy integration and process optimisation, the effective premium for green rebar may be closer to 3%-5%.

**Exhibit 16** Key cost offsets and cost drivers for green rebar




**Note:** Indicative figure include gains from RE, process efficiency, and other cost-offsetting measures. RMI Graphic.
**Source:** RMI Analysis.

**Scrap substitution** is one of the most critical decarbonisation levers. Increasing scrap content reduces dependence on higher-cost virgin inputs such as iron ore and sponge iron (DRI). At the same time, for higher scrap substitutions, sourcing higher-grade scrap can increase material costs by 10%-12% depending on regional scrap prices and availability, reflecting a key cost driver that producers must manage.

**Energy and fuel costs** present both a challenge and an opportunity. Energy accounts for roughly one-third of total production cost. Grid electricity is priced at ₹8–12/kWh, and renewable electricity accessed through captive/group captive plants is available at ₹5–7/kWh. Electric furnace routes consume 664–825 kWh per ton of steel, far higher than the 174 kWh required in BOF steelmaking.[52] This dependency on electricity creates both a decarbonisation challenge and an opportunity to leverage large-scale renewable power through PPAs, open-access arrangements, captive plants, and green power markets, which could deliver 6%–8% cost savings over grid power.

**Process efficiency gains** can drive down operational costs. The magnitude of these impacts depends on Plant-specific factors and prior process improvements. Energy-efficient furnaces, waste-heat recovery systems, and advanced rolling mills can reduce energy intensity by 8%–10%, lowering production costs and emissions while improving competitiveness. For example, induction furnace consumption has fallen to around 675 kWh per ton through continuous efficiency upgrades, saving 60–80 kWh per ton and cutting emissions by roughly 42 kg $CO_2$ per ton.[53] Direct rolling, now used by nearly 90% of IF plants, eliminates reheating, saving about 30 litres of light diesel oil per billet and reducing emissions by ~90 kg $CO_2$ per ton.[54] Closed-loop production systems, still nascent in India, can recover and reuse thermal energy within or beyond the plant boundary, becoming increasingly feasible with the growth of scrap-based steelmaking and improved co-location with downstream industries.

**Adopting circular economy principles** could provide marginal additional revenue. Steel production generates multiple by-products, such as blast furnace slag, BOF slag, EAF slag, mill scale, flue dust, and sludge, which can be repurposed across multiple industries and monetised and reintegrated into industrial value chains. Blast furnace slag is widely used in the production of ground granulated blast furnace slag (GGBS), a key supplementary material in low-carbon cement manufacturing. BOF and EAF slags are increasingly utilised in road construction, asphalt mixes, paver blocks, and soil stabilisation. Mill scale is recycled within steel plants or used in ferroalloy production and cement kilns. Flue dust and zinc-rich sludge can be treated to recover zinc for reuse in galvanising and paint applications. Process efficiency and byproduct valorisation can reduce waste and generate revenue streams that marginally offset decarbonisation investments.

Ultimately, decarbonisation at scale is both technically and economically viable. The challenge is not insurmountable costs (such as in green hydrogen or CCUS) but the absence of mechanisms to systematically absorb even a modest premium across the downstream construction value chain. Given that most sustainability requirements remain voluntary, there is limited willingness to pay significant mark-ups for green steel. Progress will depend on soft incentives from climate-conscious leaders, along with procurement, contracting, and financing practices that allow producers to pass through this incremental cost. Doing so will accelerate decarbonisation in India's rebar segment while positioning producers to meet both domestic taxonomy requirements and growing global demand for green steel.

# A Strategic Framework for Accelerating Green Rebar Adoption in India

Predominantly manufactured in electric furnace routes (EAF/IF), rebar is already aligned with scrap-based steelmaking and electricity-driven decarbonisation. By systematically addressing barriers around scrap availability, electricity pricing, quality assurance, data transparency, and perceived costs, rebar production can achieve cost-effective, scalable emissions reductions in the near term. The supply-side advances will only achieve their full impact if matched by demand-side pull. The following section outlines a strategic framework to align producers, buyers, and policymakers in accelerating market adoption of green rebar across the value chain.

**Exhibit 17** Strategic framework for accelerating the uptake of green rebar in India


RMI Graphic. **Source:** RMI Analysis.



## Framework for Enhancing Scrap Recovery and Utilisation

### Building regional scrap ecosystems and accelerating scrap recovery

India's secondary steel sector, dominated by IFs and EAFs, depends heavily on ferrous scrap as the primary input for long products such as rebar, structural steel, and wire rods. India's scrap supply chain has evolved around a few regional clusters, each shaped by local industrial legacies, material flows, and levels of formalisation:

- **Punjab–North India cluster:** Anchored in Ludhiana and Mandi Gobindgarh, this region has a deeply entrenched informal scrap economy, manually dismantling and sorting end-of-life (EOL) machinery, construction steel, and industrial scrap for nearby induction furnace units. Hubs like Faridabad and Ghaziabad support it, but face issues of low traceability, inconsistent scrap quality, and no emissions accounting systems.[55]

- **Maharashtra–Western India port-linked cluster:** Jalna, Pune, and Mumbai form a more industrialised ecosystem, processing automotive, appliance, and urban infrastructure scrap through semi-formal channels. Jalna alone hosts over 150 re-rolling mills and IF units, while Mumbai's Nhava Sheva port enables large-scale imports of shredded and heavy melting Steel (HMS) scrap from the Persian Gulf, the United States, and Europe.[56] Maharashtra is also prioritised by the Ministry of Steel and NITI Aayog for circular economy parks.[57]

- **Other clusters:** Ahmedabad in Gujarat and Raipur in Chhattisgarh act as secondary hubs, benefiting from rerolling capacity and industrial linkages, though their scrap systems are less dense and integrated than Punjab and Maharashtra.[58]

## Establishing circular economy parks in scrap-intensive regions

**Circular economy parks** are integrated industrial ecosystems designed to co-locate scrap aggregation, processing, low-emission steelmaking, and downstream product fabrication within a single logistics and utilities network. Global benchmarks like Kalundborg Symbiosis (Denmark), demonstrate such co-located industrial ecosystems' feasibility and economic resilience. Increasing regional scrap recovery, deploy and scaling of advanced scrap processing technologies will be instrumental in driving the circular economy in the steel sector.[59]

### Establish Circular Economy Parks in Scrap-Intensive Regions

#### The challenge

India's ferrous scrap ecosystem continues to face a structural imbalance between supply and demand. Although steel consumption is rising sharply, domestic scrap generation has not been able to keep pace, resulting in a widening gap that is increasingly being bridged through imports. This dependence on external sources creates significant vulnerabilities, as major scrap-exporting regions such as the United States, the EU, and the UK are progressively curtailing outbound flows to prioritise their own green steel transitions. Consequently, India risks deeper exposure to volatile global markets, supply uncertainties, and price fluctuations, unless domestic collection, processing, and recycling capacities are significantly scaled up.

#### Proposed actions

India must take a cluster-driven, multi-actor approach anchored in circular economy principles to address structural bottlenecks in scrap collection, quality assurance, and processing logistics. The following strategic actions are recommended:

- **Increasing scrap recovery from post-consumer, industrial and urban streams:** Circular economy parks are designed to host advanced scrap processing, recycling, and valorisation infrastructure. However, these facilities require a consistent, high-quality feedstock of ferrous scrap, which today is constrained by fragmented collection networks, informal dismantling operations, and limited traceability.

- **Develop a national network of urban scrap aggregation hubs (USAHS):** Establish urban scrap aggregation hubs (USAHs) as decentralised facilities to collect and pre-process scrap from Construction and Demolition (C&D) waste, end-of-life vehicles (ELVs), white goods, and consumer durables.



These hubs will prepare high-quality scrap feedstock for CEPs. QR code-based digital tracking will also be a critical link to scrap data to VAHAN (vehicle registration database) and municipal C&D waste systems. Dedicated dismantling zones for micro-enterprises and environmental controls compliant with Central Pollution Control Board (CPCB) norms for stormwater drainage, fire safety, and hazardous waste containment will ensure safe, standardised, and auditable scrap flows.

- **Deployment and scaling of high-efficiency scrap processing technologies:** Pilots of advanced scrap processing systems have demonstrated how automated sorting, shredding, and traceability technologies can deliver high-purity, BIS-compliant feedstock for low-emission steelmaking. The next step is to transition from pilot projects to widespread, cluster-scale deployment of these systems, enabling consistent feedstock quality and supply for induction and EAFs across the country.

- **Scaling priorities:**
  - **Cluster-based expansion:** Focus on scrap-intensive regions such as Jalna, Talegaon (Maharashtra) and Ludhiana, Mandi Gobindgarh (Punjab), where pilot facilities already exist, material flows are concentrated, and downstream rerolling and steelmaking units can rapidly absorb high-quality feedstock.
  - **Technology partnerships and localisation:** Accelerate partnerships with technology providers (e.g., Danieli, Advance Hydrau-Tech) to scale automated shredding, alloy detection, and traceability systems, while localising equipment manufacturing to reduce costs and build domestic capability.
  - **Integrated digital traceability:** Link processing systems with digital platforms to enable real-time material flow monitoring and chain-of-custody tracking from scrap source to steel product, supporting ESG compliance and procurement confidence.
  - **Financing and incentives:** Mobilise concessional finance through SIDBI and infrastructure investors, combined with state industrial incentives, to support smaller scrap processors in upgrading to advanced systems.

- **Recognise and upskill the informal workforce:** Formalise the informal scrap workforce, which currently handles over 50% of urban scrap recovery. This can be done through structured training and certification programs delivered under the National Urban Livelihoods Mission (NULM), National Skill Development Corporation (NSDC), and PM Vishwakarma Yojana, with technical input from the National Institute of Secondary Steel Technology (NISST).

Training will cover alloy identification, safe dismantling, fire and emissions safety, and digital inventory management. Workers should also be provided with personal protective equipment (PPE), health insurance, and access to microfinance to ensure safety, social inclusion, and smooth integration into urban scrap aggregation hubs (USAHs) and CEP supply chains.

### Integrating definitive scrap recovery and utilisation targets into the Steel Scrap Recycling Policy, 2019

The Steel Scrap Recycling Policy (SSRP), 2019, signalled India's intent to promote scientific scrap processing, reduce import dependence, and expand scrap-based steelmaking. Although it provides a national framework and projects scrap consumption of 70–80 MTPA by 2030, the policy stops short of setting binding utilisation targets, defining regional infrastructure needs, or establishing mechanisms to ensure consistent routing of scrap into EAF and IF steelmaking.[60]

## Integrating Circularity into Steel Scrap Recycling Policy

### The challenge

High-circularity producers such as EAFs and IFs, which typically operate with 40%–80 % scrap and achieve 30%–40% lower carbon intensity than the BF-BOF route, remain outside India's formal incentive architecture. The current SSRP primarily addresses the formalisation of scrap flows but lacks explicit utilisation thresholds, robust traceability mechanisms, and product-level recognition of low-carbon, scrap-based steel. As a result, the sector's potential contribution to decarbonisation and circularity remains underleveraged.

### Proposed actions

- **Define circularity performance thresholds in policy instruments:** India's SSRP should evolve beyond generic recognition of scrap use to explicit performance thresholds for different steelmaking routes, even in green steel taxonomy. These thresholds would build upon current utilisation patterns and set clear benchmarks for high scrap utilisation production: E.g., >= 60% scrap charge for EAF and IF units, at least 15% scrap blending for BF-BOF operations, and an emissions intensity ceiling of 1.5 $tCO_2$/t TMT for qualifying 5-star green steel.

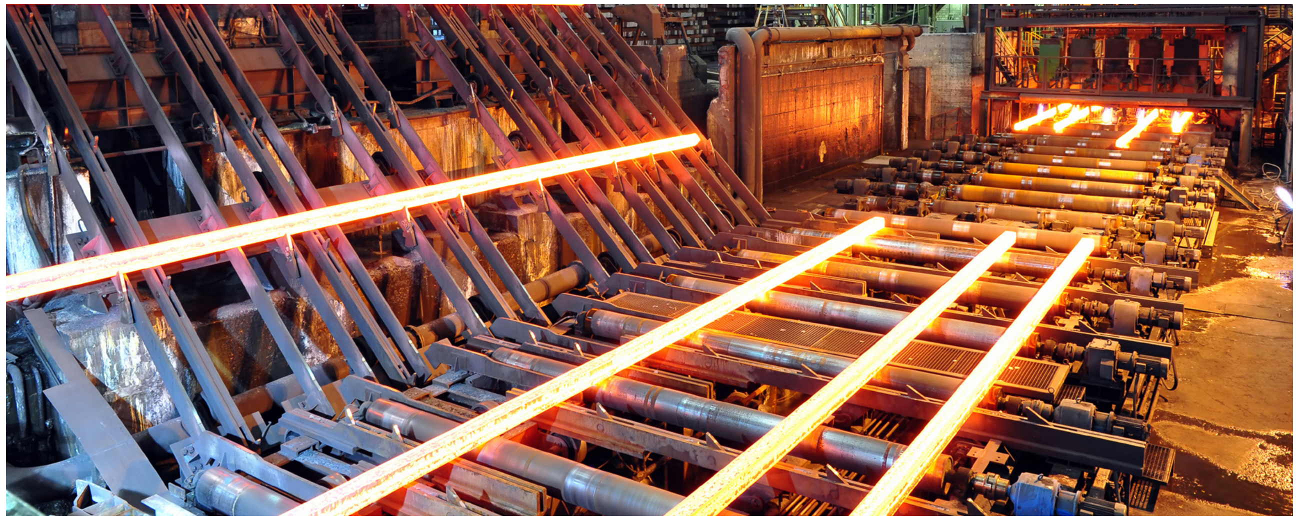
  To operationalise this:

  - Link eligibility for green or circular steel recognition to BIS scrap quality standards (IS:2549), ensuring that certified input quality and traceability are integral to circularity claims.
  - Mandate transparent reporting of scrap input share and route-specific emissions intensity for producers seeking green certification, incentives, or preferential procurement.

- **Operationalise SSRP as a regional infrastructure planning tool:** The SSRP provides a national framework for scientific scrap mobilisation. However, its current form lacks mechanisms to translate national targets into spatially distributed, investment-ready infrastructure plans. As CEPs and Urban Scrap Aggregation Hubs (USAHs) scale up, the SSRP must evolve into a regional planning instrument that integrates scrap generation hotspots, processing capacity, and logistics corridors into a coherent national network.

### Key actions

- Develop a regional scrap flow and infrastructure atlas to map high-generation scrap clusters, dismantling and shredding capacity, and logistics corridors.
- Set cluster-specific capacity targets tied to projected scrap generation and regional steel demand, ensuring feedstock security for secondary producers and BF-BOF blending operations.
- Issue state-level infrastructure guidelines covering hub and park planning, land allocation, environmental clearance, logistics integration, and fiscal incentives, aligned with industrial corridors and urban waste systems.



## Framework for Accelerating the Uptake of Green Rebar

Although steel producers invest in efficiency upgrades, enhanced scrap utilisation, and renewable electricity integration are reshaping the steel industry, these efforts will remain constrained without strong market demand. Developers and other bulk buyers hold the critical leverage needed to transform this market. India needs a market transformation framework to unlock scale that aligns stakeholders across the value chain through strategic market interventions.

Creating a sustainable market for low-emission rebar requires coordinated action across three progressive stages, each building foundations for the next:

STAGE 1

### Establishing performance specifications

Market transformation begins with standardised performance criteria that define low-emission steel. Large developers and bulk buyers must lead by embedding emissions performance specifications directly into procurement processes. These specifications should focus on measurable, achievable metrics: scrap content percentages, renewable energy usage, and carbon intensity thresholds aligned with India's green steel taxonomy.

Large developers and government entities possess the influence to set procurement standards that influence industry practices. Unlike small buyers, they aggregate substantial volumes, maintain established supplier relationships, and set procurement standards that smaller players follow. The key is making emissions disclosure and compliance a qualifying criterion in the tendering process. When bulk buyers consistently demand emissions data and set performance thresholds, they create market standards that drive industry-wide adoption.



## Procurement Specification Guidance

Buyers must transition from a basic cost–quality compliance to cost-quality and carbon-based procurement. This requires clear specifications that go beyond price, embedding carbon considerations into every stage of sourcing:

### 1. Establish a carbon baseline and a reduction target

- Begin with an assessment of the current embodied carbon footprint. Currently, the embodied carbon footprint for RCC construction in India is about 400–800 $kgCO_2/m^2$, and steel rebar contributes to about 15%–20% of it.
- Use the baseline to set realistic, material-specific reduction targets aligned with project goals or corporate sustainability commitments. These targets will inform the procurement strategy rather than just mandating compliance.

### 2. Mandate emission intensity thresholds

- Integrate $tCO_2e$ per ton of finished steel (tfs) thresholds into procurement documents.
- Align these thresholds with life cycle assessments. These benchmarks will guide suppliers and ensure alignment with project-level carbon reduction objectives.

### 3. Require verified carbon disclosures

Establish robust supplier prequalification criteria based on emissions disclosure and compliance with recognised standards:

- **Product-level disclosures:** EPDs, ISO (14025)/EN (15804), life cycle assessments (LCAs, ISO 14040/44), and other recognised methodological references.
- **Corporate/facility-level disclosures:** Corporate Carbon Footprints (GHG Protocol, ISO 14064), World Steel Association $CO_2$ data collection, science-based targets initiative (SBTi) targets.
- **Certifications and ecolabels:** NISST green steel certification, ResponsibleSteel™, CII GreenPro and other such recognitions under green building and rating systems (IGBC, GRIHA, and LEED), where credits are linked to the use of green materials.

### 4. Disclose material and energy inputs

- **Charge mix:** Request for breakdown of scrap versus DRI in electric furnace steel. Incentivise high-scrap, low-carbon DRI routes.

- **Energy source:** Request for share of renewable electricity in steelmaking, whether grid-sourced or captive. Preferential procurement of rebar produced with a minimum renewable share (e.g., >30%–50%) can drive both demand for RE integration in the steel sector and emissions reductions in purchased materials.

### 5. Preserve structural integrity

- Ensure strict compliance with IS 1786, which specifies the mechanical properties of reinforcement bars, including yield strength, elongation, and ductility, along with permissible tolerances and rolling margins.

- Mandate adherence to the relevant IS code for chemical analysis of steel (such as IS 228 series), ensuring that the composition of the rebars consistently meets prescribed limits for elements like carbon, sulphur, and phosphorus.

### 6. Supply chain proximity

- Include distance from manufacturing facility to project site in procurement evaluation.
- Prioritise local or regional suppliers to cut transport emissions, improve reliability, and reduce costs.

Although the disclosure and certification landscape is extensive, buyers should avoid treating it as a mere checklist. Instead, they should specify the disclosure instrument most relevant to their intended use case and require suppliers to support it with the corresponding monitoring, reporting, and verification (MRV) evidence. This approach ensures that the data collected is both credible and fit for purpose, streamlining supplier engagement and ultimately making carbon information actionable in procurement and design decisions.




STAGE 2

## Aggregate demand through buyers' platforms

Individual commitments, while valuable, lack the scale needed to drive producer investments. Collective action multiplies this impact. The next stage requires demand aggregation that creates volume certainty sufficient to justify investments in scrap-based furnaces, renewable energy infrastructure, and advanced process technologies.

Buyers' platforms serve this aggregation function by pooling demand across multiple stakeholders. This creates visibility and volume certainty for producers to justify investments in scrap-based furnaces, renewable energy infrastructure, and advanced process technologies. These platforms also standardise procurement terms and enable risk sharing. Government bodies, private developers, and tech firms can create demand signals strong enough to trigger investment in low-carbon steelmaking capacity. Joint procurement announcements by leading developers or participation in buyers' platforms can significantly reduce producer uncertainty while sharing risk among participants.

India's existing steel procurement platforms focus primarily on inventory management and transaction efficiency, with little emphasis on emissions intensity metrics at the production or consumption level. New aggregation mechanisms, such as RMI's Sustainable Steel Buyers' Platform in the United States, enable multiple developers, technology giants, and climate-conscious companies to pool volumes, mitigate price exposure, and strengthen negotiating positions while maintaining focus on emissions reduction.

## Green Rebar Buyers Platform- Driving Demand Aggregation

### The challenge

**Fragmented demand, lack of procurement standards, and limited traceability**

India's transition to circular and low-emission steel is slowed by demand fragmentation and the absence of a standardised procurement ecosystem:

- **Uncoordinated demand signals:** Despite ESG and SBTi-linked commitments by developers, EPC contractors, and OEMs, most tenders do not specify recycled content thresholds, embodied carbon limits, or emissions verification requirements. This weak demand signal limits suppliers' ability to make investment decisions in scrap-based or near-zero steel production.

- **No standardised procurement pathways:** India lacks a coordinated mechanism — like a buyers' platform or joint procurement rounds — to aggregate demand, discover transparent green premiums, or standardise contract terms. As a result, buyers often act individually, delaying market creation for low-emission products.

- **Traceability and verification gaps:** No established national protocol for product-level emissions reporting or recycled content verification exists. EPDs — the globally recognised tool for life cycle-based emissions disclosure — are rarely used in Indian steel procurement. Without verifiable emissions and circularity data, claims of "green" or "low-carbon" steel cannot be reliably compared or audited.

- **First-cost barrier:** Early-stage low-emission steel carries a 3%-5% premium, which buyers often reject due to the absence of long-term collaborative procurement models that distribute cost and risk.

- **India's building codes and green rating systems (IGBC, GRIHA, ENS)** do not mandate embodied carbon thresholds.

### Proposed actions

The **Green Rebar Buyers Platform (GRBP)** is a demand-aggregation and market-enabling mechanism designed to accelerate India's low-emission steel transition through collaborative procurement and market action. It will be the first-of-its-kind initiative in India, enabling buyers to send strong market signals jointly, facilitate supplier investment, and meet corporate and public sector supply chain decarbonisation goals.



The GRBP will:

- Drive demand consolidation across major steel-consuming sectors.
- Define clear emissions thresholds aligned with India's green steel taxonomy.
- Launch joint procurement rounds to discover green premiums and unlock early supply.
- Establish digital traceability and life cycle emissions verification systems to ensure credibility.
- Build buyer awareness and procurement capacity for adopting low-emission steel at scale.

### 1. Aggregate demand and define emissions criteria

- Convene anchor buyers (real estate developers, infrastructure EPCs, public agencies, automotive and appliance OEMs) to commit to multi-year low-emission steel procurement.
- Define procurement specifications and criteria: Set product emissions intensity (aligned with India's green steel taxonomy), mandatory EPDs to verify cradle-to-gate emissions, aligned with ISO 14025 and EN 15804 standards.
- Harmonise evaluation criteria for all members to ensure consistent adoption of emissions-based procurement.

### 2. Launch coordinated procurement rounds

- Issue joint request for proposals (RFPs) embedding emissions criteria and EPD requirements as core evaluation parameters.
- Facilitate collective price discovery and determine the green premium through coordinated annual procurement cycles.
- Develop template contracts and verification protocols to standardise procurement across sectors and reduce transaction costs.

### 3. Mainstream procurement and digital traceability

- Deploy a standardised digital procurement interface for all platform members to manage demand aggregation, supply traceability, and emissions verification.
- Integrate MRV tools for recycled content, renewable energy attribution, and product origin data linked to EPDs.
- Embed emissions verification in national procurement frameworks (e.g., CPWD, NHAI, Metro Rail) to mainstream low-emission steel adoption.
- Expand membership and procurement volumes across sectors to accelerate market maturity for low-emission steel products.

4. **Build market awareness and buyer support**
    - Conduct technical workshops addressing performance, cost, and availability of low-emission steel, including training on EPD interpretation and life cycle emissions accounting.
    - Publish buyer toolkits covering RFP templates, specification language, emissions verification guidance, and best-practice procurement case studies.
    - Develop in-house capacity within procurement teams to evaluate suppliers based on emissions performance and integrate low-emission steel into existing sourcing workflows.

STAGE 3

## Institutionalise through various procurement mechanisms and building codes

India's public sector is a dominant consumer of construction steel, driven by flagship programs such as Pradhan Mantri Awas Yojana (PMAY), metro rail networks, and urban bridges and flyovers. Yet, most building codes, rating systems, procurement processes remain cost- and schedule-centric, without specifying emissions intensity, recycled content, or EPD-based performance.

Various countries have already embedded emissions and circularity criteria into public procurement: Sweden mandates EPD-backed, scrap-intensive steel (60%–90% scrap content) in low-carbon public building projects; Japan incorporates deconstruction planning and steel reuse scoring into public housing procurement. These policies send clear demand signals for low-emission steel production and structural steel reuse, triggering supply chain upgrades.

Integrating low-carbon steel in existing codes and rating systems, along with the green public procurement policies, represents the most powerful lever at this stage. When government infrastructure projects mandate emissions criteria, they create immediate and substantial market demand. Including low-emission steel in the schedule of rates makes green procurement financially viable across all government projects, essentially de-risking the entire market.

India has existing digital procurement systems (GeM, Central Public Procurement Portal) and a growing network of secondary steel producers (EAFs and IFs) supplying 40%–42% of domestic steel. However, the absence of EPD-backed emissions criteria, traceability systems, and reuse specifications in tendering prevents the public sector from leveraging its purchasing power to scale low-emission and recovered steel markets.



## Green Public Procurement (GPP) and Integration in Building Codes

### The challenge

**Fragmented demand, lack of procurement standards, and limited traceability**

Public procurement under programs like PMAY, metro rail expansions, and urban infrastructure projects remains focused on speed and scale, with limited or no criteria for:

1. Low-emission steel production pathways (e.g., electric arc furnaces with high-quality scrap feed or renewable-powered direct reduced iron).
2. No embodied carbon standards: Building codes and green rating systems (IGBC, GRIHA, LEED) do not require whole building life cycle assessment (WBLCA) or embodied carbon disclosure.
3. Construction tenders and specifications rarely address recycled content, reuse readiness, or end-of-life steel recovery.
4. Fragmented oversight in Construction and Demolition (C&D) Waste Management Rules, 2016, rating systems, and sustainability reporting (BRSR), which operate in silos and lack harmonised circularity metrics and verification protocols.

### Proposed actions

1. **Integrate LCAs, EPDs in the existing building codes and rating systems and define emission-linked procurement guidelines**
    - Embed emissions intensity thresholds (e.g., ≤1.4 $tCO_2$/t steel) and minimum recycled content targets (e.g., ≥50% scrap for rebar, ≥80% for structural sections) in existing building codes, rating systems, CPWD, and State PWD tender documents.
    - Provide preferential credits in rating systems such as IGBC, GRIHA, and LEED for projects using certified low-emission or recovered steel.
    - Include reuse-oriented specifications for structural elements (beams, hollow sections) in housing, bridge, and metro projects.
    - Introduce scoring criteria for bidders based on EPD disclosure and emissions performance.

2. **Mandate and digital traceability**
    - Require third-party verified EPDs aligned with ISO 14025 and EN 15804 to report life cycle emissions and recycled content.
    - Develop a digital traceability system linking EPD data with GeM/CPPP workflows, enabling real-time emissions tracking at the product level.
    - Extend BIS and QCI certification protocols to cover recycled content, emissions performance, and reuse-ready steel components.
    - Drive supplier participation and market readiness by linking EPD-based performance to green building incentives, procurement preferences, and fast-track approval pathways.
3. **Accelerate structural steel recovery and reuse**
    - Amend the Construction and Demolition (C&D) Waste Management Rules, 2016, to include mandatory pre-demolition audits identifying steel recovery potential and minimum structural steel recovery rates (≥60% by 2030).
    - Require new projects to include deconstruction and recovery plans at the design stage, embedding reuse and recycling strategies across the building life cycle.
    - Establish certified recovery hubs and logistics frameworks to streamline processing and supply chain integration of reusable structural steel.

The business case is straightforward: Building codes, rating systems, and procurement strategies aligned with decarbonisation goals can stimulate investment in low-carbon technologies, reduce embodied emissions in projects, and create competitive differentiation for forward-thinking developers. By redefining procurement specifications to include carbon performance, forming partnerships to scale demand, ensuring quality assurance, and embedding circularity, bulk buyers can decisively influence the pace and direction of India's steel decarbonisation journey.



# Conclusion: Rebar as India's Steel Decarbonisation Catalyst

India's steel sector is expanding at ~6%–7% CAGR to meet urbanisation and infrastructure needs while responding to global trade shifts and national net-zero commitments. Within this dynamic, rebar represents a ready-now opportunity for immediate and scalable decarbonisation. Although the path to a fully decarbonised steel industry may be long, scrap-based electric furnace rebar can cut emissions at scale today, not decades from now. While green hydrogen and CCUS still await cost breakthroughs, rebar offers more than incremental gains: market scale, technical readiness through established scrap-based production routes, and economic viability, with manageable cost premiums reduced through efficiency gains and renewable energy uptake. It is a chance to fundamentally reshape the carbon footprint of Indian construction.

The principal obstacle is systemic rather than technical or financial. Without robust procurement frameworks that absorb modest premiums across the construction value chain, producers lack the certainty to invest in low-emission capacity. Bulk procurers, both government and private, wield decisive influence in shaping India's green steel market. By setting carbon-intensity thresholds, requiring transparent emissions disclosure through EPDs, aggregating demand, and agreeing to absorb modest cost premiums, they can generate the demand signal necessary for low-emission steel. In doing so, developers bridge the gap between industrial readiness, policy ambition, and climate-aligned growth, while preparing India's supply chain for emerging regulatory and market instruments such as the green steel taxonomy, carbon credits, and external trade measures like the EU's CBAM.

For developers, acting on rebar decarbonisation is both a climate imperative and a strategic opportunity. It enables early compliance with emerging regulations, aligns with national priorities, and contributes meaningfully to India's net-zero goals. Those who act now will not just future-proof projects but build the literal foundations for a low-carbon built environment. By embedding carbon performance into standard procurement practices, India can transform rebar into the spearhead of sector-wide decarbonisation, creating a replicable model for other high-volume steel products and aligning construction-driven growth with climate-compatible industrial development.

# Appendices

## Appendix A: Production Process Overview in Secondary Steel Plants

This appendix documents key stages of the production process observed during site visits to secondary steel plants. The photos illustrate typical electric arc furnace and induction furnace-based rebar production workflows, including scrap handling, melting, refining, casting, rolling, quenching, and finishing operations. These visuals provide context for the technical and operational considerations discussed in the report.




## Appendix B: System Boundaries and Key Assumptions for Scenario Analysis

This appendix details the system boundaries, key assumptions, and data sources underpinning the scenario analysis assessing the potential energy and emissions reductions from higher scrap utilisation in rebar production.

- **System boundary:** Cradle-to-gate, covering raw material extraction, fuel use, on-site processing, and electricity consumption.
- **Normalisation:** Impacts evaluated per ton of TMT steel and scaled to national production volumes.
- **Grid factor assumptions:** These are derived from national projections (CEA) and reflect increasing RE share.
- **Techno-economic assessment:** does not account for captive or group-captive renewable energy, power purchase agreements (PPAs), or renewable energy certificates (RECs).

**Exhibit A1** Calorific values of fuels

| Fuel type | Calorific value | Unit |
|---|---|---|
| Coke | 26.00 | GJ/t |
| Coking coal | 23.66 | GJ/t |
| Thermal coal | 17.09 | GJ/t |
| Furnace oil | 40.40 | GJ/t |
| Pulverised coal (PCI) | 32.42 | GJ/t |
| Coke oven gas (COG) | 0.02 | GJ/Nm$^3$ |
| Blast furnace gas | 0.004 | GJ/m$^3$ |
| BOF gas | 0.01 | GJ/m$^3$ |
| Natural gas | 55.20 | GJ/t |
| Pet coke | 31.30 | GJ/t |
| Hydrogen | 120.00 | GJ/t |
| Char | 16.50 | GJ/t |

**Exhibit A2** Emission factors

| Input material or energy | Emission factor | Units | Input material or energy |
|---|---|---|---|
| **Coking coal** | 0.0937 | $tCO_2/GJ$ | Coking coal |
| **Thermal coal** | 0.0968 | $tCO_2/GJ$ | Thermal coal |
| **Furnace oil** | 0.0774 | $tCO_2/GJ$ | Furnace oil |
| **Natural gas** | 0.0562 | $tCO_2/GJ$ | Natural gas |
| **Hydrogen** | 0.0000 | $tCO_2/GJ$ | Hydrogen |
| **Electricity (grid)-2024** | 0.1325 | $tCO_2/GJ$ | Electricity (grid)-2024 |
| **Electricity (grid)-2030** | 0.0865 | $tCO_2/GJ$ (estimated) | Electricity (grid)-2030 |
| **Electricity (RE)** | 0.0000 | $tCO_2/GJ$ | Electricity (RE) |
| **Iron ore** | 0.0370 | $tCO_2/t$ | Iron ore |
| **Scrap** | 0.0100 | $tCO_2/t$ | Scrap |
| **Lime** | 0.9500 | $tCO_2/t$ | Lime |
| **Oxygen** | 0.1640 | $tCO_2/t$ | Oxygen |
| **Ferro alloys** | 1.8000 | $tCO_2/t$ | Ferro alloys |
| **Biomethane** | 0.0300 | $tCO_2/t$ | Biomethane |
| **Labour and machine (operations and maintenance)** | 0.0000 | $tCO_2/t$ | Labour and machine (operations and maintenance) |



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