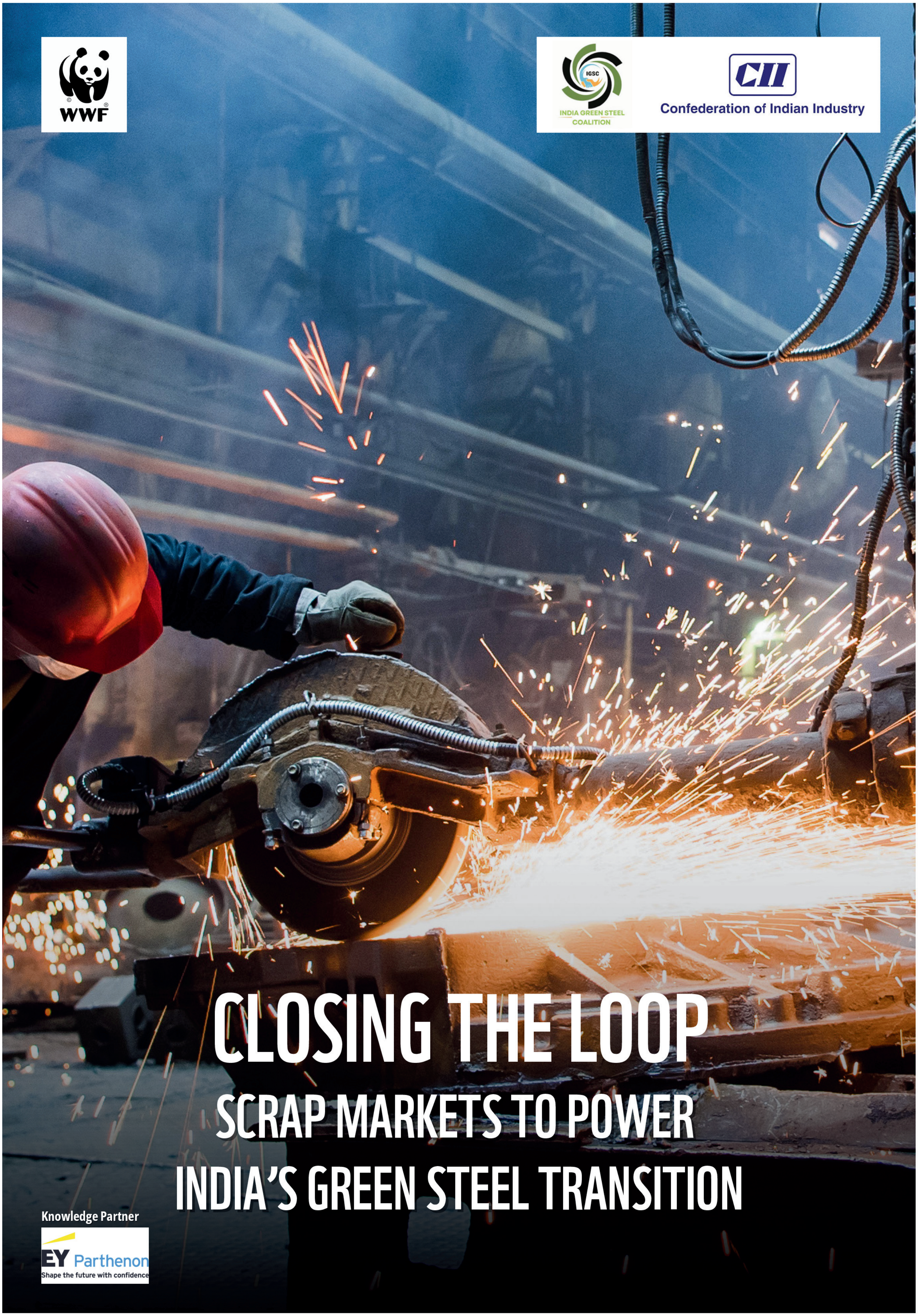

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INDIA GREEN STEEL COALITION

Confederation of Indian Industry

CLOSING THE LOOP

SCRAP MARKETS TO POWER INDIA'S GREEN STEEL TRANSITION

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Acknowledgement

The transition towards green steel has become one of the major topics in the steel industry. The whitepaper "***Closing the Loop: Scrap Markets to Power India's Green Steel Transition***" has been prepared by Ernst & Young (EY)-Parthenon in collaboration with WWF-India & CII-Green Business Centre (GBC). Bernt Nordman, Head of Climate Program of WWF Finland, is an advisor to the project. We are thankful to Mr. Rajiv Mangal, Chairman - India Green Steel Coalition (IGSC) for his inputs and to the IGSC steering committee members for their inputs. We are extremely thankful to all stakeholders who supported the development of this whitepaper, and for providing valuable feedback that helped shape the contents and finalize the recommendations. Finally, we would like to thank all the members of the team who were involved in the development process at various stages of the initiative. The report is produced under a project funded by WWF Finland. The report does not necessarily reflect the views of the funder.

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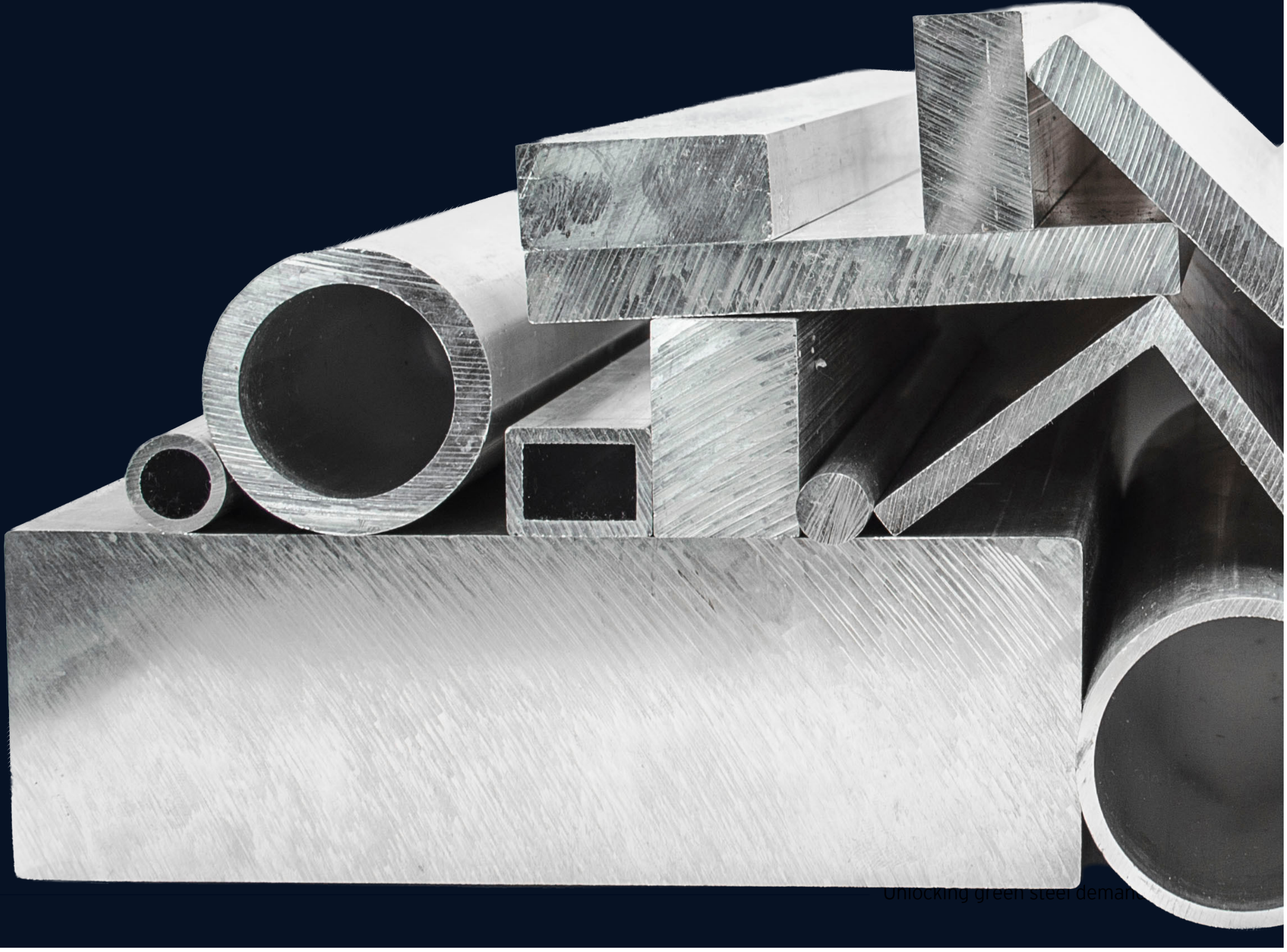

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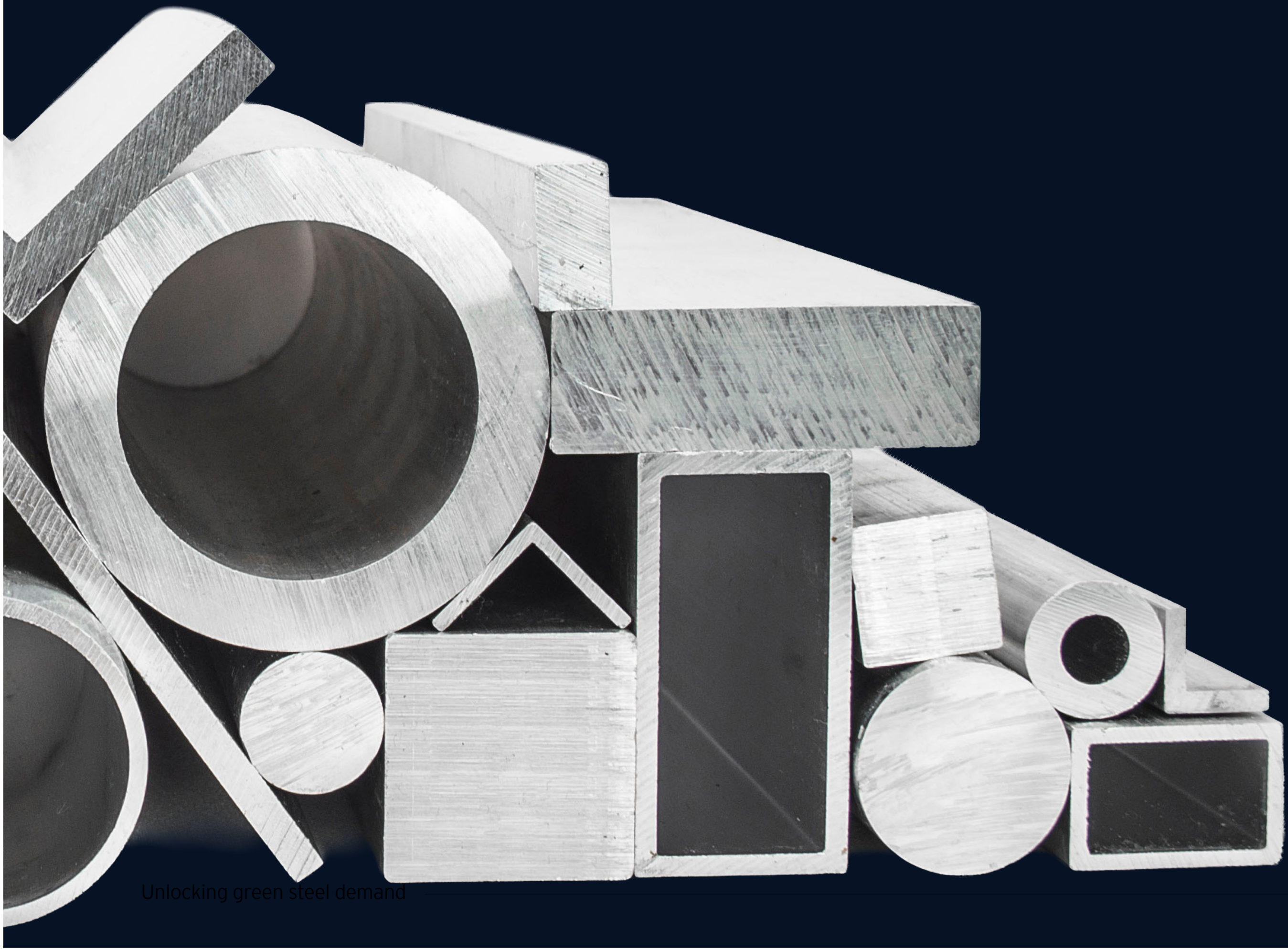

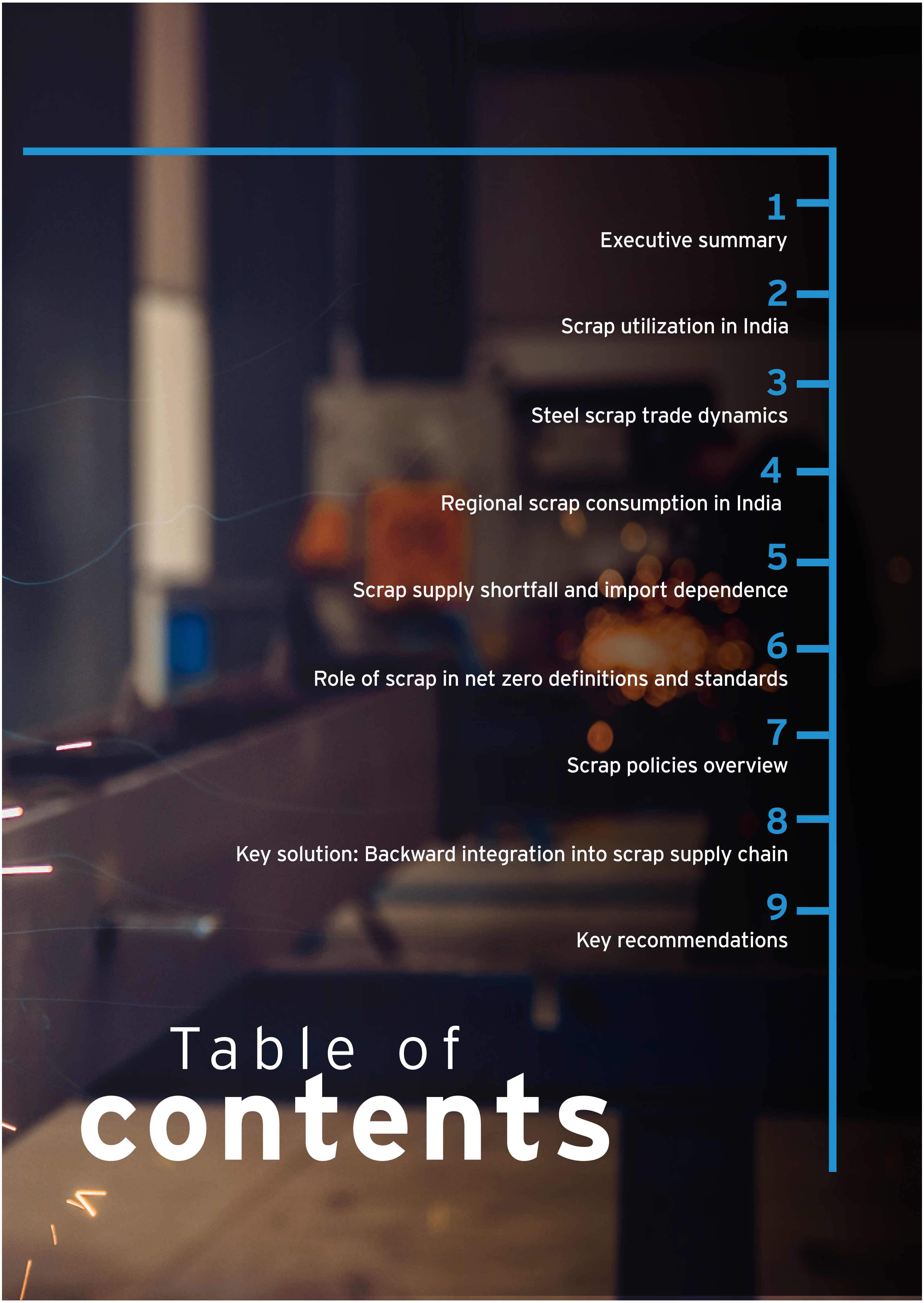

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List of common abbreviations

Abbreviation	Definition
AED	Arab Emirates Dirham
ATS	Automated Testing Station
BF	Blast Furnace
BOF	Basic Oxygen Furnace
CBAM	Carbon Border Adjustment Mechanism
CISA	China Iron & Steel Association
DRI	Direct Reduced Iron
EAF	Electric Arc Furnace
EU	European Union
ELV	End-of-life Vehicles
EOL	End of Life
EPD	Environmental Product Declaration
EPR	Extended Producer Responsibility
ESG	Environmental, Social and Governance
GHG	Greenhouse Gas
GOI	Government of India
GST	Goods and Services Tax
GVW	Gross Vehicle Weight
HS Code	Harmonized Systems Code
IEA	International Energy Agency
IF	Induction Furnace

Abbreviation	Definition
LDT	Light Displacement Tonnage
MMT	Million Metric Ton
MMTPA	Million metric tons per annum
MnT	Million Tons
MoRTH	Ministry of Road Transport & Highways
NOC	No Objection Certificate
NSW	New South Wales
OECD	Organisation for Economic Co operation and Developmen
OEM	Original Equipment Manufacturer
PCF	Product Carbon Footprint
RVSFs	Registered Vehicles Scrapping Facilities
SA	South Australia
SAIL	Steel Authority of India Limited
SBTi	Science Based Targets initiative
SDA	Sectoral Decarbonization Approach
UAE	United Arab Emirates
USD	US Dollars
TMT	Thermo-Mechanically Treated
VSF	Vehicle Scrapping Facilities

Executive summary

Ferrous scrap has emerged as a strategically critical input for India's steel sector, primarily as an immediate and scalable decarbonization lever that reduces reliance on coking coal-based ironmaking and lowers exposure to energy, trade, and price risks associated with imported primary raw materials. Currently, India consumes about 41 MMT of ferrous scrap, of which nearly 85% is utilized in steelmaking, while the remaining share is used in metal casting and foundry applications. Induction furnaces lead usage at 21 MMT of ferrous scrap, followed by electric arc furnaces at 7.5 MMT and basic oxygen furnaces at 6 MMT. Foundries consume an additional 6.5 MMT. While scrap plays a central role in India's steel ecosystem, its utilization remains uneven across technologies and significantly below global benchmarks, highlighting both structural constraints and untapped potential.

India's overall scrap utilization rate stands at around 23% of crude steel production, well below the global average of 32% and far behind advanced economies where scrap-based steelmaking accounts for 60% to 70% of output. Advanced economies such as the EU, UK and US generate higher volumes of end-of-life scrap due to decades of extensive steel use, with average product life spans of 30 to 40 years. India's lower scrap share reflects its more recent phase of steel consumption growth, reinforced by the dominance of the BF-BOF route, limited scrap-based EAF penetration, and an underdeveloped scrap collection and processing ecosystem. However, recent investments in scrap-based EAF capacity indicate a gradual shift toward higher scrap utilization aligned with long-term decarbonization objectives.

India is the world's second-largest importer of steel scrap after Turkey, reflecting a persistent domestic supply shortfall. Scrap imports declined by 18% year-on-year in FY25 to ~9 MMT from ~11MMT in FY24 due to higher domestic recovery, substitution with ore-based metallics, and geopolitical and logistics disruptions. Despite this moderation, import dependence remains structurally embedded, as domestic scrap generation is unable to keep pace with rapidly growing demand. As per EY-Parthenon analysis, a supply deficit of 40–50 MMT is projected by 2050, considering the Government of India's target of achieving a 50% ferrous scrap share in charge mix for steelmaking by 2047, even under optimistic scenarios. This dependence is further challenged by tightening global scrap availability, as major exporting regions impose restrictions to prioritize domestic use and meet net-zero commitments.

Regionally, ferrous scrap consumption is concentrated in Punjab in the north, Maharashtra (Jalna) in the west, and Tamil Nadu (Chennai) in the south, together accounting for 35% of national consumption. These regions exhibit high scrap-to-DRI charge ratios, underscoring the importance of scrap-based electric steelmaking. Capacity expansions in these states have driven double-digit growth in scrap demand, reinforcing the urgency of securing reliable domestic supply.

Most GHG emissions from steel production arise during iron making, where iron ore is reduced using fossil fuels. Using scrap directly substitutes this process and avoids a large share of these emissions. In conventional BF-BOF operations, increasing scrap use from around 15% to 25% can reduce emissions intensity by approximately 11%. These reductions are achievable using mature technologies and limited capital investment, although higher scrap utilization requires operational measures such as scrap preheating, improved bath mixing and stronger quality control.

India has laid a strong policy foundation through the National Steel Scrap Recycling Policy (2019), Vehicle Scrappage Policy (2021), and the Recycling of Ships Act (2019). These policies have improved formalization, environmental compliance and scrap generation. The next phase must focus on domestic utilization rather than generation alone. Policy priorities include regulating scrap exports, establishing uniform national scrap quality standards, incentivizing certified recycling facilities, integrating scrap flows across vehicles, ships, and industrial waste, and strengthening digital traceability and formal transactions.

A key strategic solution lies in backward integration across the scrap value chain. By integrating collection, aggregation, dismantling and processing, steelmakers can secure supply, reduce cost volatility, improve traceability, and capture margins of 14% to 16% currently retained by intermediaries. Backward integration also supports emissions reduction, portfolio diversification, long-term resource security and job creation, while mitigating risks associated with import dependence and global supply tightening.

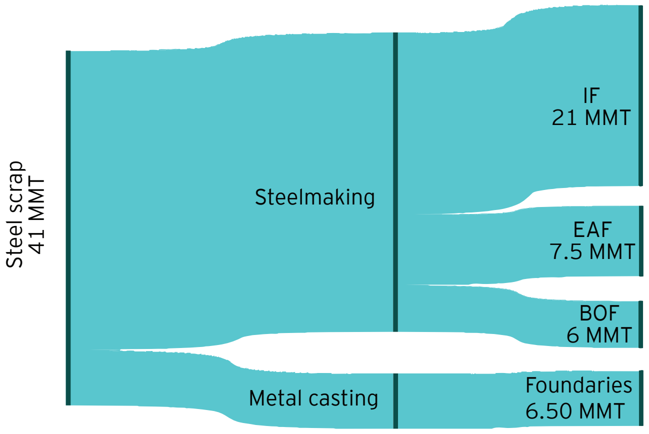
In conclusion, ferrous scrap represents a strategic raw material for India's steel sector—economically, environmentally, and geopolitically. Unlocking its full potential will require coordinated policy action, accelerated formalization, technological adaptation, and active participation by steel producers in developing integrated, domestic scrap ecosystems. This transition is essential for achieving competitive, low-carbon and resilient steelmaking in India's path toward net zero.

02

Scrap utilization in India

Ferrous scrap consumption in India is concentrated primarily within steelmaking, with the balance used in metal casting and foundry applications. The distribution of scrap use across different production routes reflects the structure of India's steel sector, prevailing technology choices and the availability of consistent quality scrap.

Figure 1: Route-wise ferrous scrap consumption in India



Source: EY Parthenon analysis

Induction furnaces have emerged as the leading route for scrap consumption owing to their extensive presence and operational reliance on scrap as a secondary raw material. However, within the IF route, rotary kiln-based Direct Reduced Iron (DRI) continues to be the preferred raw material, with scrap used as a supplementary feedstock. In contrast, Electric Arc Furnaces in India pre-dominantly consume hot metal and DRI as feed materials, and their scrap utilization remains significantly below global practice, where EAFs are designed to operate with 100% scrap. Basic Oxygen Furnaces use scrap primarily as a coolant to manage process temperatures, and increasing the share of scrap in their charge mix can contribute to reducing dependence on hot metal as a raw material input.

Foundries represent another key consumer segment for ferrous scrap, where scrap serves as the principal feedstock for metal casting. The establishment of regional scrap hubs could play a vital role in supporting smaller casting units by ensuring a steady and localized supply of raw material. Overall, the current pattern of scrap utilization highlights both the critical role of scrap in India's steel production landscape and the opportunity for process optimization across furnace types to enhance material efficiency and reduce reliance on primary resources.

India's scrap utilization in a global context

Building on the route-wise distribution of ferrous scrap utilization in India, it becomes evident that while domestic demand for scrap is high, the overall rate of scrap usage in steelmaking remains significantly lower than global benchmarks. India's current scrap utilization rate stands at approximately 23%, which is considerably below the global average. This limited utilization is primarily due to constraints in the availability of ferrous scrap and the continued dominance of traditional steelmaking technologies such as the BF-BOF route, which relies predominantly on virgin raw materials like iron ore rather than secondary inputs such as scrap.

In contrast to advanced economies such as North America and the European Union, where 60% to 70% of crude steel production is derived from scrap-based processes, India's share remains significantly lower. This difference primarily reflects the long history of steel use in these economies, where decades of steel consumption have resulted in large volumes of end-of-life scrap. As finished steel consumption has expanded rapidly in India over recent decades, the availability of end-of-life scrap is now increasing, creating an opportunity to progressively transform the steel sector to utilize a growing domestic scrap base. The situation is further constrained by an underdeveloped domestic scrap supply chain, lacking organized systems for collection, segregation, and processing. In addition, India's dependence on abundant and cost-effective iron ore reserves discourages large-scale adoption of secondary raw materials, thereby restricting the growth of scrap-based steelmaking.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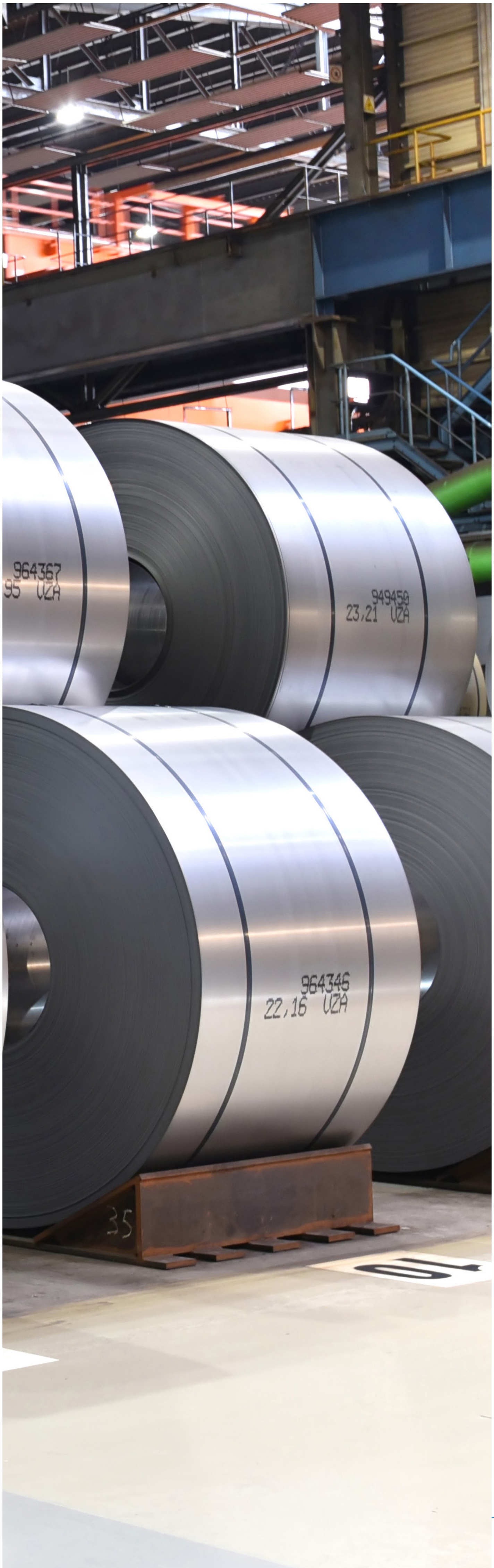
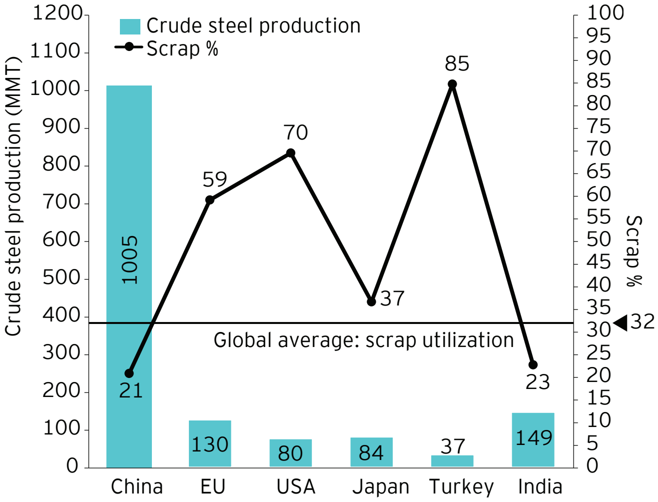


Figure 2: Ferrous scrap consumption in crude steel production



Source: EY Parthenon analysis based on S&P Global and BIR database

As illustrated in Fig. 2, India produced approximately 149 MMT to 150 MMT of crude steel in 2024, with only 23% derived from scrap, placing it below the global average of 32%. In contrast, Turkey leads with 85%, followed by the US at 70%, the European Union at 59%, Japan at 37%, and China at 21%. This underscores the need for India to strengthen its circular steel value chain and expand scrap-based production.

Major Indian steel producers are beginning to recognize the importance of circularity and the use of secondary resources as part of their long-term decarbonization strategies. Companies such as Tata Steel and JSW Steel have initiated steps toward expanding their EAF-based capacity, with Tata Steel setting up a 0.75 MMT facility in Punjab designed to operate entirely on scrap feedstock, and JSW planning a new 3 MMT EAF plant in Andhra Pradesh. These developments indicate a gradual but important shift toward integrating scrap-based production within India's steel industry, aligning future capacity additions with global trends in sustainable and circular steelmaking.

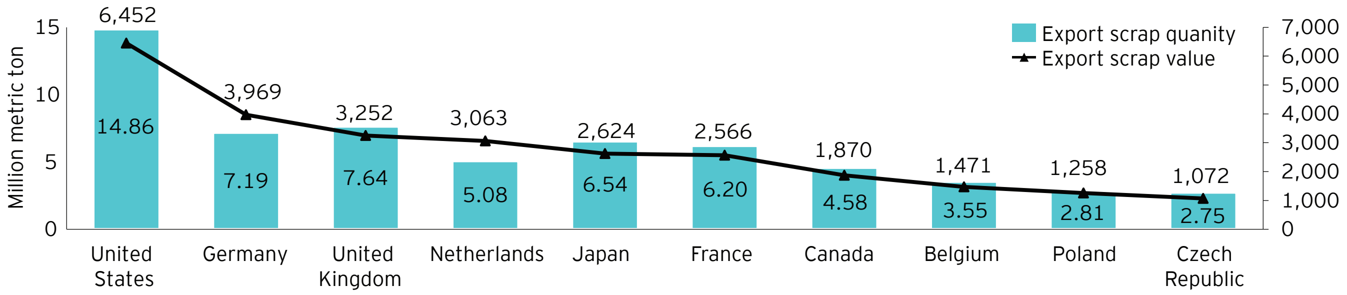
03

Steel scrap trade dynamics

Global overview

The global steel scrap trade is led by the US, which is the top exporting country with 14.86 million metric tons (MMT) of exports valued at US$6,452 million in 2024. It is followed by Germany with 7.19 MMT, the UK with 7.64 MMT, and the Netherlands with 5.08 MMT. Other key exporters include Japan (6.54 MMT), France (6.20 MMT), Canada (4.58 MMT), Belgium (3.55 MMT), Poland (2.81 MMT), and the Czech Republic (2.75 MMT). Together, these countries account for most of the world's steel scrap exports, with the US maintaining a clear lead in both export quantity and value.

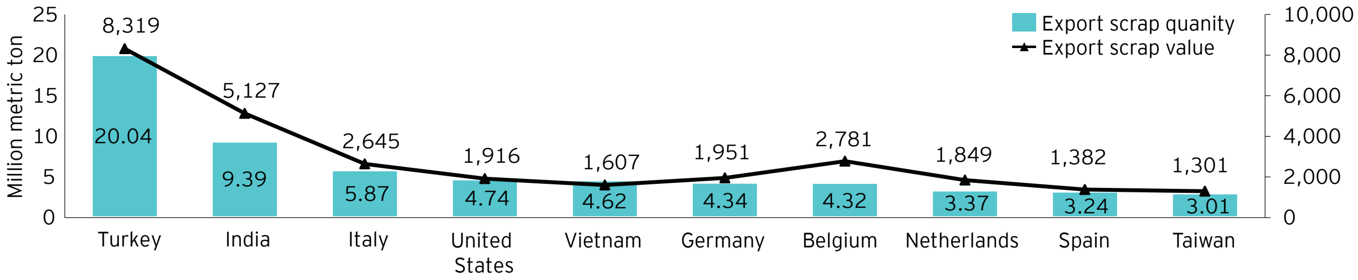
Figure 3: Top 10 countries dominating ferrous scrap exports (CY24 in US$ Million)



Source: EY Parthenon analysis based on Global Scrap Monitor database

On the import side, Turkey dominates the global market with imports of 20.04 MMT valued at US$8,319 million, followed by India at 9.39 MMT valued at US$5,127 million. Italy (5.87 MMT), the US (4.74 MMT), and Vietnam (4.62 MMT) also feature prominently among top importers. Other major importing countries include Germany (4.34 MMT), Belgium (4.32 MMT), the Netherlands (3.37 MMT), Spain (3.24 MMT) and Taiwan (3.01 MMT).

Figure 4: Top 10 countries dominating ferrous scrap imports (CY24 in US$ Million)



Source: EY Parthenon analysis based on Global Scrap Monitor database

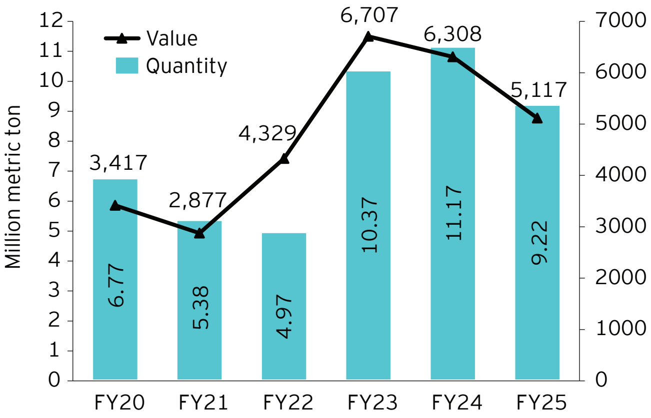
The data clearly indicates that while the US is the leading exporter of ferrous scrap, Turkey and India rank among the largest importers. Historically, scrap exports from the US and European countries have largely reflected surplus material not absorbed by domestic steel production rather than an explicit role in supplying global demand. As domestic scrap requirements rise in these economies in line with their own decarbonization objectives, the availability of exportable surplus may decline. For steel producing countries such as Turkey and India, this underscores the structural nature of import dependence and highlights the growing exposure to tightening global scrap availability as crude steel output continues to expand.

India overview

Following global trade patterns where the US dominates exports and countries such as Turkey and India lead in imports, India stands as the world's second-largest steel scrap importer. In recent years, the country has relied significantly on imported ferrous scrap to meet the growing demand from its steelmaking sector, particularly from induction and electric arc furnaces. However, despite sustained growth in crude steel production, India's ferrous scrap imports recorded a notable year-on-year decline in FY25. The total import volume dropped by 21.1% to 9.22 million metric tons (MMT) from 11.17 MMT in FY24, with the import value decreasing from US$6,308 million to US$5,117 million during the same period.

This contraction in import volume was primarily associated with higher domestic scrap recovery and partial substitution of imported scrap with domestically available ore-based metallics. Cost considerations and easier domestic availability contributed to this shift. The data shows that India's scrap imports have fluctuated in recent years—from 6.77 MMT in FY20 and 5.38 MMT in FY21 to a sharp rise of 10.37 MMT in FY23—before peaking at 11.17 MMT in FY24 and then contracting again in FY25. These variations underline the sensitivity of India's scrap import trends to both domestic supply conditions and external trade dynamics.

Figure 5: India's import trend of ferrous scrap across financial years (in US$ Million)



Source: EY Parthenon analysis based on Ministry of Commerce and Industry database

Geopolitical uncertainties further influenced India's scrap import volumes in FY25. Freight rate surges, coupled with constrained scrap exports from key supplier countries, added to the challenges of maintaining consistent inflows. As a result, despite being a major global importer, India's scrap import performance in FY25 reflected a cautious market adjustment in response to external supply pressures and logistical constraints.

Quantity in million metric ton

H S Code	Description	FY20	FY21	FY22	FY23	FY24	FY25
720410	Cast iron scrap	0.12	0.15	0.13	0.16	0.20	0.21
720421	Stainless steel scrap	1.32	1.20	1.37	1.30	1.33	1.29
720429	Alloy steel scrap	0.10	0.08	0.10	0.14	0.21	0.18
720430	Tinned steel scrap	0.01	0.03	0.00	0.00	0.00	0.00
720441	Tunings, shavings, chips, milling waste	0.15	0.10	0.07	0.12	0.18	0.17
720449	Other waste and scrap	5.06	3.82	3.30	8.66	9.24	7.37

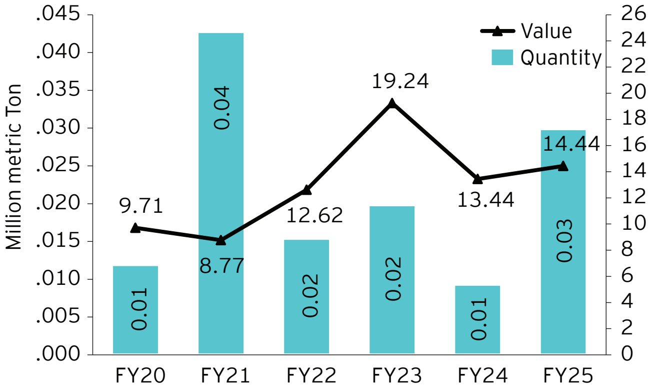
A breakdown of scrap categories imported into India highlights the composition of this inflow. In FY25, the majority of imports comprised "other waste and scrap," accounting for 7.37 MMT, followed by stainless steel scrap at 1.29 MMT, cast iron scrap at 0.20 MMT, and smaller volumes of alloy, tinned and turning scrap. Overall, India and Turkey together represented nearly half of total global scrap imports in 2024, reaffirming their central role in global ferrous scrap demand.

India's scrap export trends

While India ranks as the world's second-largest importer of steel scrap, its contribution to global scrap exports remains minimal. In FY21 and FY25, the country's steel scrap exports accounted for less than 0.5% of its domestic scrap generation, underscoring its marginal presence in the international market. India's export volume in FY24 stood at 0.01 million metric tons (MMT), which rose slightly to 0.03 MMT in FY25, with a corresponding export value of US$14.44 million. Despite fluctuations over the years, overall export quantities have remained significantly lower than import volumes, reaffirming India's role as a net importer of steel scrap.

The data shows that India's steel scrap exports have varied modestly across years, peaking at 0.04 MMT in FY21 and later declining to 0.01 MMT in FY24 before recovering slightly in FY25. Export values also fluctuated, rising from US$8.77 million in FY21 to a high of US$19.24 million in FY23, and then settling at US$14.44 million in FY25. This indicates that India's scrap exports are largely intermittent, responding to short-term market movements rather than sustained trade patterns.

Figure 6: India's export trends of ferrous scrap across financial years (in US$ Million)



Source: EY Parthenon analysis based on Ministry of Commerce and Industry database

A closer look at the composition of exported scrap reveals that cast iron scrap consistently accounted for the largest share, decreasing from 6.42 kilotons in FY20 to 4.63 kilotons in FY25. Smaller quantities were recorded for stainless steel scrap, alloy steel scrap, tinned steel scrap, and turnings or shavings. Overall, India's limited export activity suggests that domestic demand for scrap remains high, and export volumes only rise when local consumption slows or when export

Quantity in kilo ton

H S Code	Description	FY20	FY21	FY22	FY23	FY24	FY25
720410	Cast iron scrap	6.42	4.12	2.35	3.89	2.73	4.63
720421	Stainless steel scrap	3.21	2.01	2.81	3.07	2.84	2.11
720429	Alloy steel scrap	0.17	0.75	1.21	1.40	0.77	0.53
720430	Tinned steel scrap	0.11	0.00	0.03	0.00	0.04	0.14
720441	Tunings, shavings, chips, milling waste	0.10	34.32	7.96	10.47	1.94	21.88
720449	Other waste and scrap	1.90	1.53	1.01	0.99	0.98	0.61
720450	Steel remelting scrap ingots	0.00	0.00	0.01	0.00	0.01	0.00

Turnings, shavings, chips and milling waste represent a relatively high-quality category of ferrous scrap, as they are generated directly from controlled manufacturing processes and typically exhibit low contamination and consistent chemistry. These materials are particularly well-suited for domestic recycling in steelmaking and foundry applications. Exporting such scrap does not align with a long-term resource efficiency strategy, especially in the context of growing domestic demand and import dependence for other scrap categories. Prioritizing domestic utilization of high-quality manufacturing scrap can support material efficiency, reduce reliance on imported metallics, and strengthen the resilience of India's scrap-based steel ecosystem.

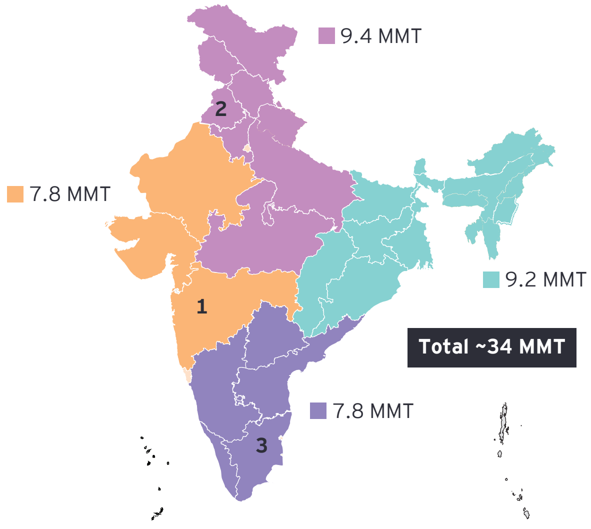
04

Regional scrap consumption in India

India's ferrous scrap consumption in steelmaking rose by 10% year-on-year in 2024, reaching above 34 MMT. This growth was supported by a 6% increase in domestic crude steel production, which reached 136 MMT between January and November 2024. The rise in scrap utilization indicates a stronger dependence on secondary steelmaking processes, primarily through the electric route, across several regions of the country.

In 2024, India's total ferrous scrap consumption stood at 34.2 million tons. The north region recorded the highest consumption at 9.4 MMT, followed by the east at 9.2 MMT, the south at 7.8 MMT, and the west at 7.8 MMT[1].

Figure 7: India's major ferrous scrap consuming states, CY24



Source: EY Parthenon analysis based on Bigmint database

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[1] Bigmint, January 2025, How did India's domestic scrap consumption trend in 2024? Supply deficit on the cards?

Region	Scrap consumption in EAF and IF (MMT)	Scrap consumption in BOF (MMT)	Total
North	9.4	-	9.4
East	5.7	3.5	9.2
South	5.8	2	7.8
West	7.3	0.5	7.8
Total	~28	6	~34

In 2024, three states - Maharashtra (4.8 MMT), Punjab (4.5 MMT), and Tamil Nadu (2.8 MMT) - collectively accounted for around 35% of India's total scrap consumption for scrap-based steelmaking. Growth in crude steelmaking capacity further supported the increase in scrap demand. In 2024, Punjab recorded a 38 % rise in steel capacity, followed by 18 % in Maharashtra and 7 % in Tamil Nadu. This capacity expansion fueled a 10 % year-on-year increase in scrap consumption across these key states, positioning them as major contributors to India's overall scrap utilization.

Within these states, consumption was further clustered around established secondary steel hubs, notably Jalna in Maharashtra, Mandi Gobindgarh in Punjab, and Chennai in Tamil Nadu.

The charge mix data for these states revealed high levels of scrap utilization. Punjab used 85 % scrap and 15 % Direct Reduced Iron (DRI) in its production mix, while Jalna operated with a combination of 70 % scrap and 30 % DRI. Chennai recorded the highest scrap dependence, with a mix of 90 % scrap and 10 % DRI. These ratios indicate the prominence of scrap-based electric steelmaking in these regions.

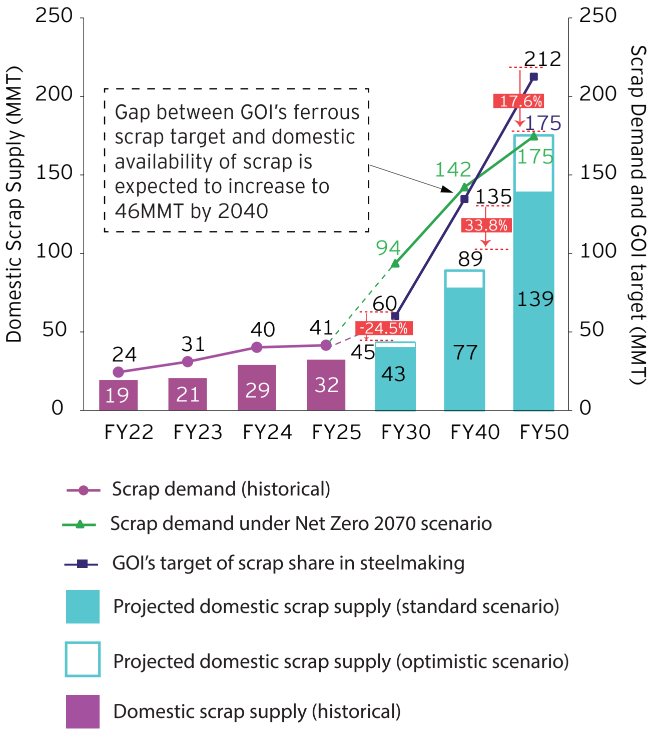
05

Scrap supply shortfall and import dependence

While scrap consumption across key states such as Maharashtra, Punjab and Tamil Nadu continues to grow, domestic scrap supply remains insufficient to meet the rising demand. India's domestic availability of ferrous scrap for its utilization in steelmaking and foundries is projected to increase to over 170 million metric tons (MMT) by 2050; however, it is expected to fall short of Government of India's (GOI) target by 40-50 MMT. As per our analysis, under the net zero 2070 scenario, the gap in supply and demand of ferrous scrap shall remain till 2040, and closing by 2050. However, as per the GOI's target, this persistent supply-demand gap will continue to drive dependence on imports to meet the requirements of the expanding steelmaking sector by 2050.

The chart depicts the widening gap between India's domestic scrap supply to the iron and steel industry, scrap demand and GOI's target over time. Historical data shows that domestic scrap generation increased from 19 MMT in FY22 to 32 MMT in FY25, while scrap demand rose from 24 MMT to 41 MMT during the same period. Under future projections, demand under the 2070 net zero scenario is expected to reach 94 MMT in FY30, 142 MMT in FY40, and 175 MMT in FY50. Whereas, as per the government's target of utilizing 50% scrap in total steel production by 2047, the ferrous scrap requirement is likely to reach 60 MMT, 135 MMT and 212 MMT in the same timeframe. Against this, projected domestic supply under the standard scenario is 43 MMT in FY30, 77 MMT in FY40, and 139 MMT in FY50, while under the optimistic scenario it is 45 MMT, 89 MMT, and 175 MMT respectively. This results in a widening gap between GOI's target and supply—about 15 MMT in FY30, 46 MMT in FY40, and 37 MMT in FY50—indicating that despite growth in domestic supply, it may continue to fall short of meeting future demand.

Figure 8: India's widening supply-demand gap of ferrous scrap



Source: EY Parthenon analysis based on Bigmint database

Key notes in the analysis:

- Ferrous scrap requirement projections under GOI's scenario are based on the Government of India's target to achieve a 50% share of scrap and 50% iron ore in total steelmaking feedstock by 2047
- Scrap demand projections under net zero 2070 scenario considers 25%, 40%, 20% and 100% scrap as a charge mix in BF-BOFs, DRI- EAFs/IFs, GH2 DRI-EAFs and scrap-EAFs, respectively
- Domestic scrap supply to grow at a CAGR of 6% and 8% under standard and optimistic scenario

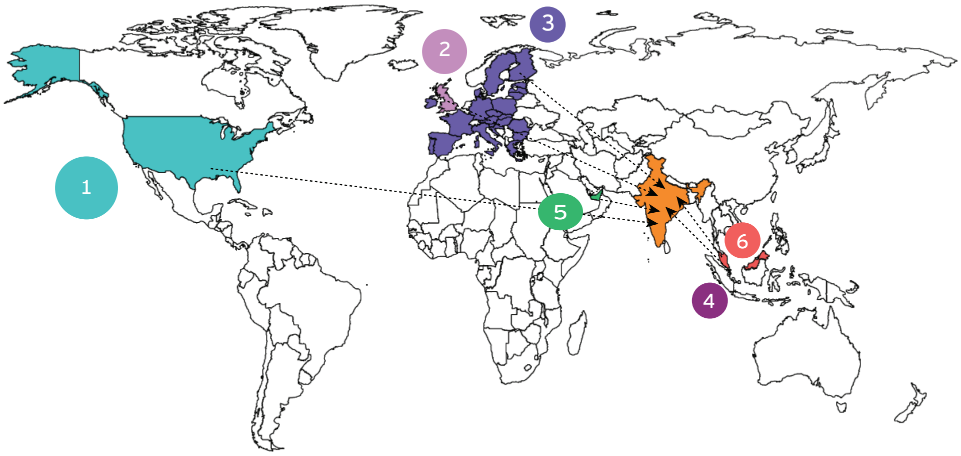
Domestic scrap supply is anticipated to grow at a rate of 6–8 % annually, supported by policies such as the Vehicle Scrappage Policy (2022) and the Steel Scrap Recycling Policy (2019) aimed at strengthening collection and recycling infrastructure. Increased manufacturing activity, particularly in the capital goods sector, is expected to raise production scrap levels at around 12 % growth per year until FY27. Additional contributions will come from end-of-life (EOL) scrap generated by construction, ship breaking, and vehicle recycling. The ship breaking industry is projected to expand by approximately 10 % from FY26-28, while vehicle recycling could grow by around 13 % between FY24–30.

Despite these supportive developments, domestic supply will still fall short of meeting the steep rise in demand. With the current trajectory, India will continue to depend heavily on imports to fill this gap. Scrap imports have already doubled from about 5 MMT in FY22 to nearly 10 MMT in FY24, and this trend is expected to persist as the demand gap widens, reinforcing India's dependence on major global scrap exporters.

Global scrap supply shortfall

Following global trade patterns where the US dominates With India's domestic scrap availability projected to fall short of demand, continued reliance on imports will be challenged by tightening global supply conditions. Exports from major scrap-supplying regions are expected to decline significantly by 2030, driven by increasing domestic demand and export restrictions. The US, which exported 0.9 MMT of scrap to India in the first half of CY25, is projected to reduce its exports by 39% by 2030, reaching only 1.1 MMT. Similarly, the European Union's exports to India, recorded at 0.43 MMT in H1 FY25, are expected to fall by 23% to 0.66 MMT by 2030. The UK, exporting 0.47 MMT to India, is projected to experience a 16% decline, while Malaysia's exports of 0.22 MMT are expected to shrink by 18% over the same period.

Figure 9: Scrap import volume and expected shrink by 2030



1 United States

Exports to India in YTD H1 25: 0.9 MT
Projected scrap exports in 2030 : 1.1 MT
Exports expected to shrink by 39% by 2030

2 United Kingdom

Exports to India in YTD H1 25: 0.47 MT
Projected scrap exports in 2030: 0.79 MT
Exports expected to shrink by 16% by 2030

3 European Union

Exports to India in YTD H1 25: 0.43 MT
Projected scrap exports in 2030: 0.66 MT
Exports expected to shrink by 23% by 2030

4 Singapore

Exports to India in YTD H1 25: 0.33 MT
Government considering curbs on exports to meet Net zero goals

5 United Arab Emirates

Exports to India in YTD H1 25: 0.25 MT
UAE has imposed an export duty of 109 USD/ tonne on scrap exports starting Jan'24

6 Malaysia

Exports to India YTD H1 25 : 0.22 MT
Exports expected to shrink by 18% by 2030

Source: EY Parthenon analysis based on Global Scrap Monitor database

Other major suppliers are also imposing new restrictions. The UAE, which exported 0.25 MMT of scrap to India in H1 FY25, introduced an export duty of US$109 per ton in January 2024[2] . Singapore, exporting 0.33 MMT to India, is considering curbs on exports to align with its net zero goals. These developments indicate a tightening global scrap trade, with over 60 countries banning or restricting ferrous scrap exports to prioritize domestic consumption. As global scrap trade is projected to shrink by 15% by 2030, India will need to focus on strengthening domestic scrap aggregation and processing, ensuring greater formalization within the supply chain to harness locally generated scrap and meet its growing steel sector demand.

[2] SteelOrbis, January 2024, UAE removes ban on scrap exports but imposes duty

06

Role of scrap in net zero: Definitions and standards

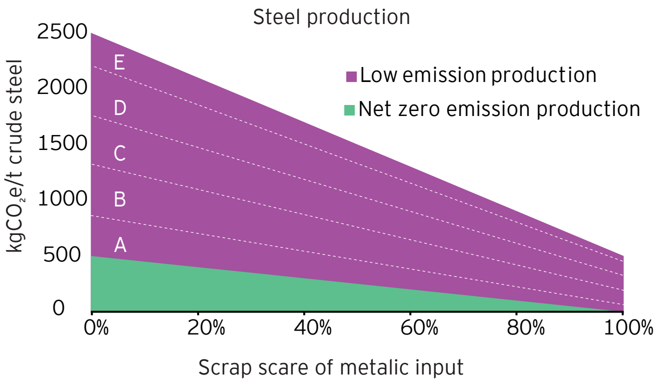
IEA "sliding scale" methodology

The International Energy Agency (IEA) defines the near zero emission threshold for steel production through a sliding scale that links permissible carbon intensity to the proportion of scrap used in production. The threshold for crude steel made without any scrap input is set at 400 kg CO_2e per ton, while production using 100% scrap must remain below 50 kg CO_2e per ton. Between these two limits, the allowable emission intensity progressively decreases in proportion to the share of scrap used, ranging from 50 kg CO_2e/t to 400 kg CO_2e/t.

This approach, developed under the IEA's Net Zero by 2050 Roadmap (2021), establishes a quantitative framework to define "near zero emissions production." The methodology provides a continuous scale rather than a single value, allowing for differentiation based on scrap input levels. Under this structure, crude steel producers are assessed against emission thresholds aligned with the decarbonization pathways outlined in the IEA's scenario analyses.

To encourage gradual progress toward near zero production, the IEA also identifies a tiered performance framework that recognizes incremental emission reductions. Steel producers are classified into five performance categories (Class A to E) based on their emissions intensity. The upper threshold for low-emissions steel is defined at six times the near-zero benchmark, corresponding to a 10% to 20% reduction in emissions compared to conventional steelmaking routes.

Figure 10: IEA's sliding scale mechanism for steel emission intensity



Through this system, the IEA provides both a benchmark for defining "near zero" steel production and a structured pathway for intermediate progress, ensuring that emission reductions are measured relative to the share of scrap utilized in the production process.

ResponsibleSteel "sliding scale" methodology

ResponsibleSteel provides a comprehensive global framework for responsible steel production by combining environmental, social, and governance standards with measurable decarbonization performance. It is an international, non-profit, multi-stakeholder organization that promotes responsible sourcing, production, and recycling of steel. Its certification system is built around thirteen core principles, which include GHG emissions reduction, responsible raw material sourcing, labor and human rights protections, and compliance with social and environmental standards. Together, these principles form a unified standard for steelmakers to align operational practices with sustainability objectives.

Certification under ResponsibleSteel is available through two distinct pathways—Core Site Certification and Steel Certification. Core Site Certification focuses on overall ESG management and governance at the facility level, while Steel Certification assesses a site's progress toward decarbonization and responsible sourcing. Within this framework, emission performance is measured using a cradle-to-crude boundary, and steelmaking sites are classified across four progress levels, ranging from Level 1 (better than the industry average) to Level 4 (near-zero emissions). To market a steel product as ResponsibleSteel certified, the product must also carry a Product Carbon Footprint (PCF) or Environmental Product Declaration (EPD) that reports its global warming potential through a cradle-to-gate boundary.

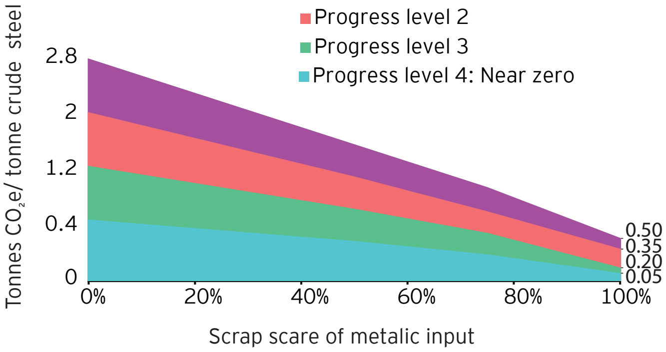


Figure 11: ResponsibleSteel's sliding scale mechanism

In alignment with the IEA's sliding scale approach, ResponsibleSteel has established a four-tier GHG performance structure that directly links emissions intensity to the share of scrap used in steelmaking. The Level 1 Basic Threshold begins at 2.8 tons of COe per ton of crude steel when no scrap is used and declines to 0.5 tons COe/t when 100% scrap is utilized. Higher levels (Levels 2–4) progressively reduce the allowable emissions, with the Level 4 threshold—the most stringent—ranging from 400 kg COe/t for 0% scrap to 50 kg COe/t for 100% scrap steel production, fully consistent with the IEA's near-zero emissions definition.

SBTi in the iron and steel sector: Company targets with a scrap-input-dependent pathway

The iron and steel sector presents diverse technological configurations and varying levels of vertical integration, which can make emissions accounting inconsistent. To address this, the SBTi has introduced a standardized iron and steel core boundary, ensuring uniform accounting for both integrated and non-integrated steelmakers. This boundary aligns the sector's target-setting approach with the global carbon budget, creating a level field for all producers.

The SBTi provides a structured, four-step process for companies to set science-based targets. The steps include: (i) reviewing the SBTi criteria to determine boundaries, scopes, and methods relevant to the company's operations; (ii) calculating base-year and most recent emissions inventories following the GHG Protocol; (iii) constructing targets using the Steel Science-Based Target-Setting Tool, with flexibility to model additional emissions not covered under the iron and steel Sectoral Decarbonisation Approach (SDA); and (iv) submitting the completed target form to the SBTi for validation.

Through this approach, the SBTi enables companies in the iron and steel value chain to set transparent, science-aligned decarbonization goals. By defining a scrap-input-dependent methodology and applying consistent accounting principles across production systems, the initiative ensures that emission reduction targets remain credible, measurable, and compatible with global net-zero objectives.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07

Scrap policies

National Steel Scrap Recycling Policy, 2019

Introduced by the Ministry of Steel in 2019, the Steel Scrap Recycling Policy seeks to promote a circular economy in India's steel sector by formalizing the collection, dismantling, and recycling of scrap materials. The policy is rooted in the 6Rs principles—Reduce, Reuse, Recycle, Recover, Redesign, and Remanufacture—and provides a structured framework for safe, scientific, and environmentally sound management of ferrous scrap. It aims to reduce India's dependence on imported scrap by encouraging domestic recycling through an organized network of scrapping centers, while ensuring compliance with the Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016.

Figure 12: Objectives of the National Steel Scrap Recycling Policy, 2019

01 **Promote circular economy**
To promote circular economy in the steel sector

02 **Formal and scientific scrap management**
To promote a formal and scientific collection, dismantling and processing of end-of-life products that are sources of recyclable (ferrous, non-ferrous and other non-metallic) scraps

03 **Organized and safe recycling**
Processing and recycling of products in an organized, safe, and environment-friendly manner

04 **Ecosystem and high-quality scrap**
To evolve a responsive ecosystem by involving all stakeholders, and to produce high-quality ferrous scrap for quality steel production, minimizing dependency on imports

05 **Promote 6Rs principles**
6Rs–Reduce, Reuse, Recycle, Recover, Redesign, and Remanufacture–through scientific handling, processing, and disposal of all recyclable scraps including non-ferrous scraps via authorized centers/facilities

The policy envisions a responsive ecosystem built on collaboration between key stakeholders, including aggregators, manufacturers (OEMs), dismantlers and government agencies. This shared responsibility model supports the creation of collection, dismantling, and scrap processing centers through joint ventures or independent facilities. Roles and responsibilities are clearly defined—manufacturers are responsible for recovering materials from end-of-life vehicles (ELVs) and white goods, dismantling centers oversee depollution and shredding using the best available technologies, and scrap processors ensure radioactive detection, segregation, and proper waste disposal. Together, these actors form the backbone of a formal recycling system that supports sustainable raw material sourcing for steelmaking.

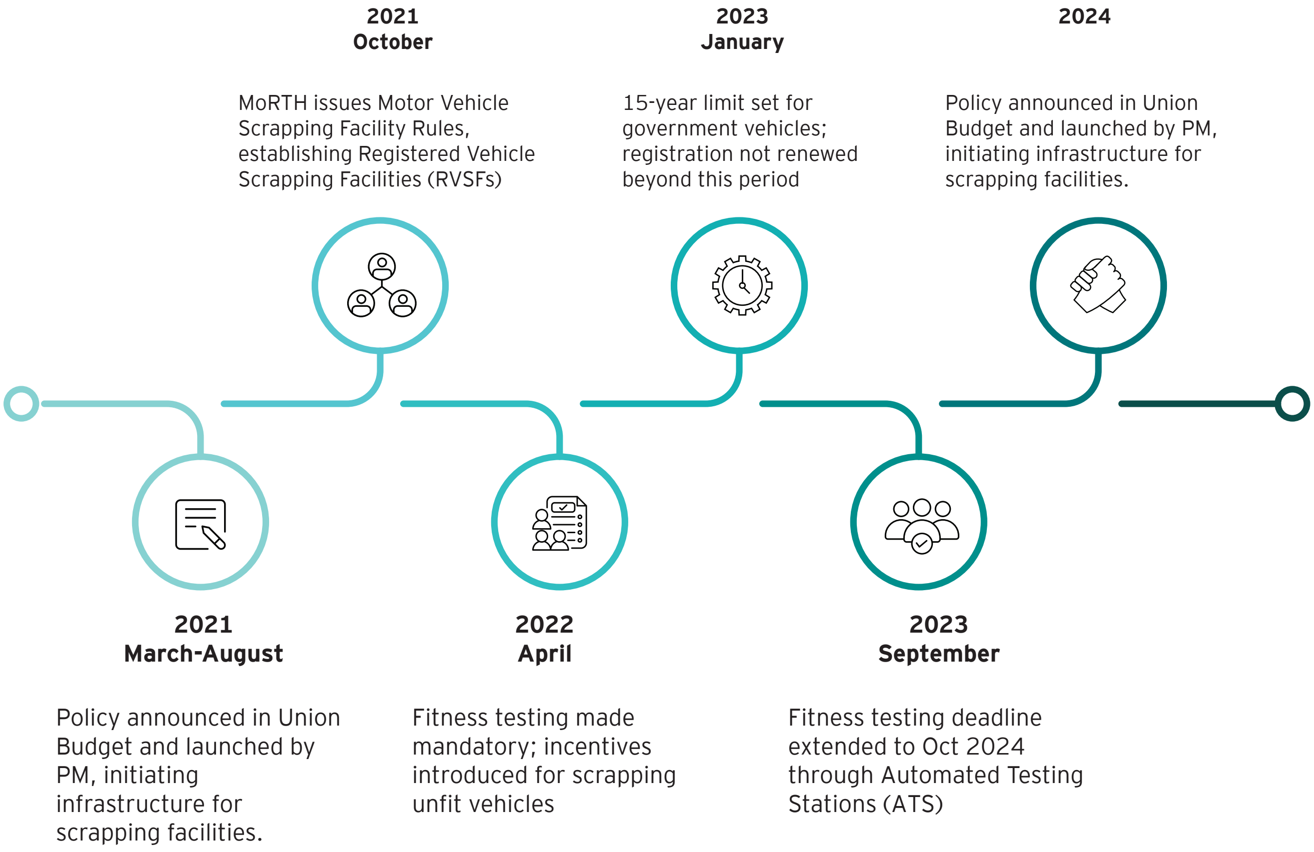
Recognizing that increased vehicle production and consumer durables have led to a growing stock of end-of-life products, the policy focuses on streamlining India's recycling infrastructure. It mandates that dismantling and collection centers operate either independently or in association with scrap processing units, handing over depolluted scrap and ELVs to authorized recyclers. To strengthen the supply chain, it also calls for the development of logistics infrastructure aligned with the National Logistics Policy, ensuring cost-effective transportation of both unprocessed and processed scrap. Locating scrapping centers near highways, railway sidings, and Sagarmala-linked multimodal hubs is expected to improve efficiency and prevent material losses during transit.

At its core, the policy positions ferrous scrap as a critical input for India's EAF/IF-based steel production. By adopting environmentally friendly technologies and encouraging scientific recycling, it seeks to transform the largely informal scrap sector into a well-regulated and economically viable industry. The policy not only aims to conserve resources and reduce energy use but also to decongest urban areas through the reuse of scrap from ELVs. Ultimately, it establishes a comprehensive framework that supports safe, standardized recycling operations while advancing India's vision for a sustainable and globally competitive steel industry.

Vehicle Scrappage Policy, India (2021)

Introduced in 2021, the Vehicle Scrappage Policy is a government-funded initiative aimed at phasing out old, unfit, and polluting vehicles to promote the use of modern, fuel-efficient, and environment-friendly alternatives. The policy seeks to reduce carbon emissions and improve road safety by ensuring that unfit vehicles are systematically removed from circulation. Vehicles—both private and commercial—are required to undergo a mandatory fitness test once they reach a specified age: 15 years for private vehicles and 15 years for commercial vehicles. The tests, conducted at automated centers, assess key parameters such as emission levels, safety standards, and overall vehicle condition.

Figure 13: Timelines of Vehicle Scrappage Policy in India



2021
March-August

Policy announced in Union Budget and launched by PM, initiating infrastructure for scrapping facilities.

2021
October

MoRTH issues Motor Vehicle Scrapping Facility Rules, establishing Registered Vehicle Scrapping Facilities (RVSFs)

2022
April

Fitness testing made mandatory; incentives introduced for scrapping unfit vehicles

2023
January

15-year limit set for government vehicles; registration not renewed beyond this period

2023
September

Fitness testing deadline extended to Oct 2024 through Automated Testing Stations (ATS)

2024

Policy announced in Union Budget and launched by PM, initiating infrastructure for scrapping facilities.

Source: Vehicle Scrappage Policy in India

The policy also sets out the following timelines for implementation milestones:

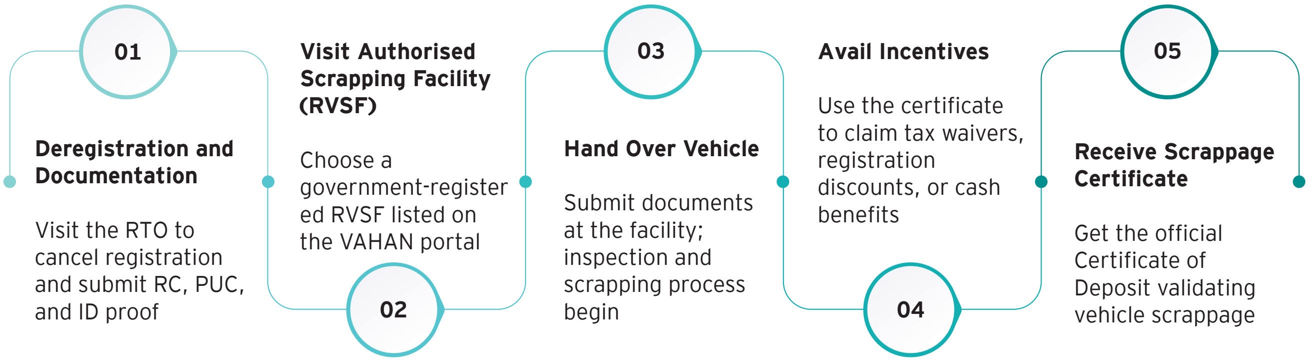
- 2015: The Government of India began discussions on the need for a structured scrappage policy.
- March 2021: The official announcement of the policy in the Union Budget marked a national push to phase out old and inefficient vehicles.
- August 2021: The Prime Minister launched the policy during the Investor Summit in Gujarat, initiating infrastructure development for Registered Vehicle Scrapping Facilities (RVSFs).
- October 2021: The Motor Vehicles (Registration and Functions of Vehicle Scrapping Facility) Rules, 2021, came into effect, outlining procedures for RVSF establishment.
- January 2023: New rules clarified that government-owned vehicles will not have their registration renewed after 15 years.
- September 2023: The mandatory fitness testing timeline was extended to October 2024 through Automated Testing Stations (ATS).
- 2024 onwards: Expansion of the ATS and RVSF network across India was planned to increase testing and scrapping capacity.

Under the policy, vehicles are categorized into four groups—government, commercial, private, and vintage—each with distinct guidelines:

- Government vehicles: Owned by central, state, and union territory governments; mandated to be scrapped after 15 years.
- Commercial vehicles, such as buses and trucks; must undergo a fitness test after 15 years and are scrapped if they fail.
- Private vehicles: Used for daily commuting; subjected to a 15-year fitness test, failing which they are deregistered and scrapped. Owners receive incentives based on the scrappage value.
- Vintage vehicles: Over 50 years old and well-maintained; exempt from mandatory testing, preserved as historical artefacts.

The scrapping process involves a structured five-step procedure to ensure transparency and environmental safety.

Figure 14: Vehicle scrapping procedure in India



Incentives play a central role in encouraging participation in the program:

Concession on registration fees for new vehicles. Up to 25% discount on road tax for non-transport vehicles and 15% for transport vehicles. 5% discount on new vehicle purchase price when presenting a valid scrappage certificate. Waiver of pending liabilities such as fines or penalties in certain states.

By combining environmental goals with economic incentives, the Vehicle Scrappage Policy aims to accelerate the transition toward a cleaner and safer transport ecosystem, while creating a formalized market for scrapping and recycling within India's growing automotive sector.

Despite offering multiple incentives, the uptake under India's Vehicle Scrappage Policy remains limited, with only 3% of eligible vehicles scrapped as of July 2025. Several leading manufacturers—including Honda, Toyota, Mahindra, Tata Motors, and Volvo—have extended additional incentives ranging from 1.5 to 3% of the ex-showroom price, alongside trade-specific rebates for both passenger and commercial vehicles.

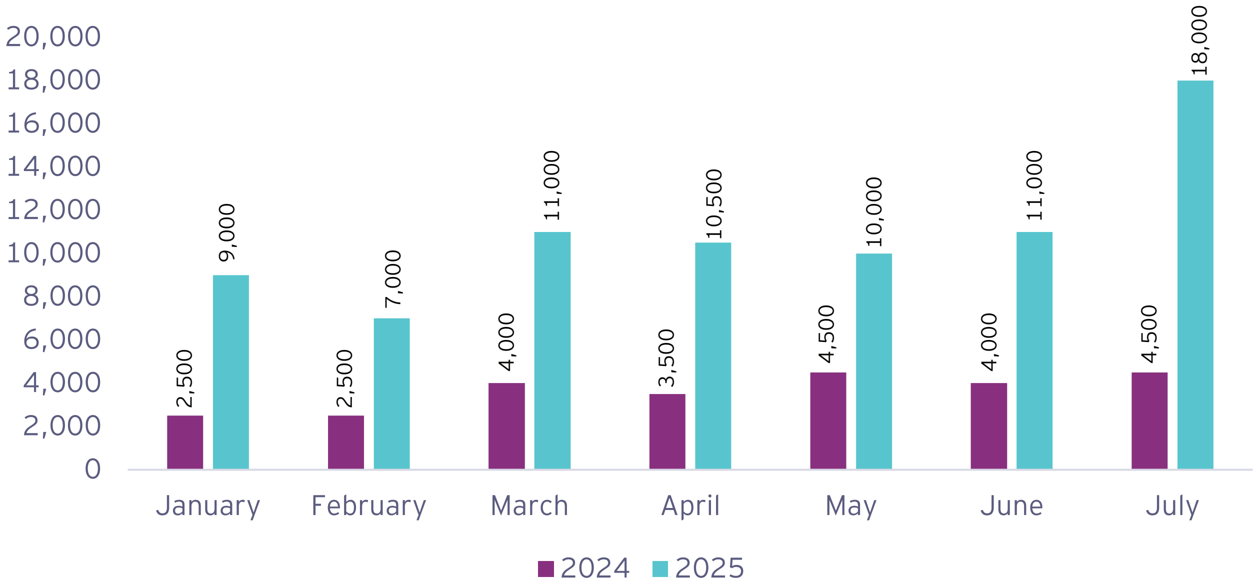
Passenger vehicles

- 1.5% of ex-showroom price or INR20,000 (whichever is less) for vehicles scrapped within six months
- Scrapped vehicle details linked to VAHAN system
- Additional model-based discounts possible
- Applicable only for scrappage, not exchange

Commercial vehicles

- 3% of ex-showroom price for cargo vehicles >3.5 tons GVW scrapped within six months
- 1.5% for vehicles <3.5 tons GVW scrapped within 6 months
- 2.75% against traded certificate for >3.5 tons GVW
- 1.25% against traded certificate for <3.5 tons GVW
- Includes buses and vans

Figure 15: Scrapped vehicles in India with certificates of deposit



Source: S&P Global

However, data indicates that progress has been modest. Between 1 August 2022, and 31 July 2025, only 350,500 vehicles were scrapped at authorized Registered Vehicle Scrapping Facilities (RVSFs). This includes 65,173 private, 46,028 commercial, 12,001 government, and 59,203 defense vehicles. The government's target of scrapping over 500,000 vehicles annually by 2026 remains unmet, with just a fraction achieved. Out of an estimated 12 million vehicles eligible for scrappage—comprising 4.5 million medium and heavy commercial vehicles and 7.5 million light vehicles—the current figures highlight a slow adoption rate despite the attractive incentive framework.

The Recycling of Ships Act, 2019

India's ship recycling industry holds a significant position in the global maritime recycling landscape, managing approximately 30% of global scrapped tonnage. Concentrated largely in Alang, Gujarat, the sector has a capacity of 4.5 million Light Displacement Tonnage (LDT) spread across 153 yards, contributing around 0.5% to India's total steel production. The composition of scrapped vessels primarily includes 75% to 80% structural steel scrap and 5% to 10% heavy machinery, along with non-ferrous metals, oils, and furniture. India, alongside Pakistan and Bangladesh, accounts for nearly 90% of global ship recycling[3]. Under the ship recycling ecosystem in Alang, Gujarat, the recovered materials are utilized in multiple forms—50% goes to fabrication units, 25% to re-rolling mills for TMT bars under 6 mm, and the remaining 25% to mini steel plants producing billets and ingots through induction furnaces.[4]

The Recycling of Ships Act, 2019, provides a regulatory foundation for the industry, aligning India's practices with Hong Kong Convention standards. It ensures environmentally responsible and safe ship dismantling, mandates Ready for Recycling Certificates, and requires continuous monitoring of compliance. The act bans hazardous materials in new ships, with a five-year compliance window, while exempting warships and non-commercial vessels. These measures formalized India's ship recycling sector, which has seen periodic fluctuations—from processing 3.85 million LDT in 2012 (415 ships) to less than 1 million tons of steel in FY24. However, the industry continues to play a vital role in upcycling 75% of recovered steel into value-added products.

Looking ahead, India's maritime policies—particularly the Maritime India Vision 2030 and the Maritime Amrit Kaal Vision 2047—aim to expand this capacity and global competitiveness. The targets include doubling ship recycling capacity to 9.5 MMTA by 2030, increasing shipyards from 153 to 198, and developing 70 new scrapping centers under an eco-friendly and tech-driven framework. The Ship Breaking Code, 2013, complements these efforts by treating scrap as a valuable secondary resource, while the Gujarat Maritime Board spearheads infrastructure expansion at Alang-Sosiya. Collectively, these initiatives are expected to position India as a global leader in green and sustainable ship recycling, potentially reducing 19.8 million tons of CO annually by 2040.

Global scrap policies

Globally, scrap trade and recycling are increasingly being shaped by evolving regulatory frameworks aimed at promoting circularity and reducing environmental impact. In the European Union, the EU Waste Shipment Regulation (effective May 2027) prohibits exports of both hazardous and non-hazardous scrap to non-OECD countries unless strict environmental standards are met. The regulation introduces digital traceability for "green-listed" waste and mandates environmental audits for exporters to curb waste dumping. Complementing this, the Steel and Metals Action Plan (2025) seeks to safeguard the EU's metal industries from overcapacity and carbon leakage while recognizing steel scrap as a strategic raw material. It tightens import safeguards, expands the Carbon Border Adjustment Mechanism (CBAM) to downstream products, and prioritizes fair trade and energy competitiveness to advance a green steel transition.

Similar reforms are being implemented across major economies. China is revising its Ferrous Scrap Standards (2023-25) to broaden acceptable scrap grades, ease import restrictions, and relax impurity limits, addressing its domestic supply gap of around 550,000 tons annually. The country also maintains a 40% export tariff on scrap to retain domestic availability, with additional incentives proposed for recycling and low-carbon steelmaking. In Australia, federal and state governments regulate the scrap metal trade to curb theft and encourage circular practices through strict dealer registration and digital payment systems, achieving annual CO savings of around 2.5 million tons. Meanwhile, the UAE has imposed a metal scrap export duty of AED400 per ton (US$109) to support domestic steelmakers and regulate export flows, while South Africa continues to enforce export restrictions on ferrous and red metal scrap, aiming to limit theft, strengthen traceability, and reduce global scrap demand.

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[3] bccResearch, August 2025, Global ship recycling market to reach $13 billion by end of 2030

[4] Climate Catalyst, December 2024, Turning the tide: Ship recycling as a source of green steel in India

Figure 16: Evolving scrap regulations and trade controls at global level

European Union

Policies

EU Waste shipment regulation

- Bans exports of hazardous and non-hazardous scrap to non-OECD countries from May 2027, unless they meet strict environmental standards
- Intra-EU Trade: Prior consent required for hazardous scrap; "green-listed" waste subject to traceable digital documentation
- Exporter Duties: Companies must audit overseas facilities for environmental compliance
- Goal: Prevent waste dumping abroad, strengthen traceability, and advance a circular economy within the EU

Steel and Metals action plan (2025)

- Aims to protect EU steel & metals from global overcapacity and carbon leakage.
- Tightens import safeguards and expands CBAM to downstream products.
- Recognizes steel scrap as a strategic raw material; exploring export duties to retain supply.
- Focus on fair trade, energy competitiveness, and green steel transition.

China

Policies

Ferrous scrap standards revision (2023-25)

- China is revising national standards (GB/T 39733-2020) to broaden accepted scrap types, ease import restrictions, and relax impurity limits to boost domestic scrap supply.
- Imports currently average ~550,000 tonnes/year, far below demand; revisions aim to attract more high-quality scrap inflows by end-2025.

Strategic resource and export controls

- Steel scrap remains under a 40% export tariff (2024-25) to retain domestic supply.
- The China Iron & Steel Association (CISA) has proposed classifying scrap as a "strategic resource" under the next 5-year plan, with tax incentives and processing system reforms to industrialize recycling and support low-carbon steelmaking.

Source: Metal Scrap Export Duty, Recycling Today, Australian Steel Institute

Australia

Policies

Scrap metal regulations

- Regulated at federal and state levels to curb theft and promote circular economy.
- National Waste Policy drives local recycling and limits scrap exports.
- NSW, Victoria, and SA mandate dealer registration, ID checks, and cash bans.
- Payments allowed only via bank or verified digital transfers.
- Strong enforcement with fines and seizures; recycling saves ~2.5 Mt CO_2 annually.

UAE

Policies

Metal scrap export duty

- Introduced metal scrap export duty of AED 400 ($109)/ton in January 2024 to reshape global scrap trade.
- Export and re-export allowed only with NOC from Ministry of Finance & Industry (as per Decree 262/4 of 2004).
- Duty applies to ferrous and copper scrap (HS 7204 & 7404 series).
- Aims to support domestic steel mills with affordable raw material and regulate export flows.
- Replaces earlier 2020 export ban, shifting to a fee-based control regime.
- Higher export cost makes UAE scrap less competitive internationally.

South Africa

Policies

Scrap export restrictions

- Export restrictions on ferrous and red metal scrap extended till mid-December 2023.
- Ban covers ferrous scrap, remelting scrap ingots, and copper waste, but exempts stainless steel.
- Restrictions first introduced in November 2022 to combat metal theft from transport and telecom networks.
- Measures aim to reduce global scrap demand and disrupt criminal logistics networks.
- Additional controls: cashless scrap transactions and export limited to specific ports.

Source: Metal Scrap Export Duty, Recycling Today, Australian Steel Institute

08

Key solution: Backward integration into scrap supply chain

As highlighted in earlier sections, scrap availability is emerging as a structural constraint rather than a cyclical challenge. Global scrap trade flows are expected to tighten as major economies increasingly prioritize domestic scrap retention to support their own decarbonization pathways and circular economy objectives. For India, this implies a gradual but sustained decline in scrap imports over the medium to long term, even as demand accelerates with the scaling up of electric arc furnaces and net zero aligned steelmaking. As the steelmakers align towards the national decarbonization targets, ferrous scrap might shift from being a traded commodity to a strategic resource. In this context, early movers that secure long term scrap access through upstream aggregation, recycling infrastructure and international partnerships will enjoy a durable cost and carbon advantage, positioning themselves ahead of peers in a constrained and increasingly competitive market.

India's scrap ecosystem spans multiple stages—from generation to processing—and offers a clear opportunity for steel manufacturers to strengthen competitiveness through backward integration. Scrap generation broadly occurs through two streams. Production scrap, also referred to as new scrap, is generated during manufacturing and fabrication processes such as cutting, machining, stamping and shaping of steel products. This material is produced before the steel enters consumer use and is typically clean, homogeneous and easy to recycle. End of life scrap, also referred to as old scrap, is generated when steel containing products such as vehicles, buildings, machinery and ships reach the end of their useful life and are dismantled for material recovery. Currently, 53% of total scrap originates as new scrap from production wastage, while 47% arises from end-of-life (EoL) products. Among new scrap sources, automobile manufacturing contributes 15%-20%, heavy machinery (including turbines, rails, pumps, defense and white goods) accounts for 30%-40%, and local workshops and service centers add 5%-10%. The end-of-life scrap stems from plant, ship, and building dismantling (20%-25%), EoL automobiles (10%-15%) and domestic scrap (10%).[5]

The value chain integrates several actors across collection, aggregation, dismantling, sorting and processing. Collection begins with local ragpickers , small-scale collectors and digital platforms which channel materials to local scrap yards and aggregators. From there, the scrap moves to intermediate aggregators and dismantling centers, where sorting and segregation are carried out before being transferred to large-scale processors or vehicle scrapping facilities (VSFs). Major processors and recyclers handle shredding, baling and processing, supplying the recovered material to downstream BOF, IF and EAF steel manufacturers.[6]

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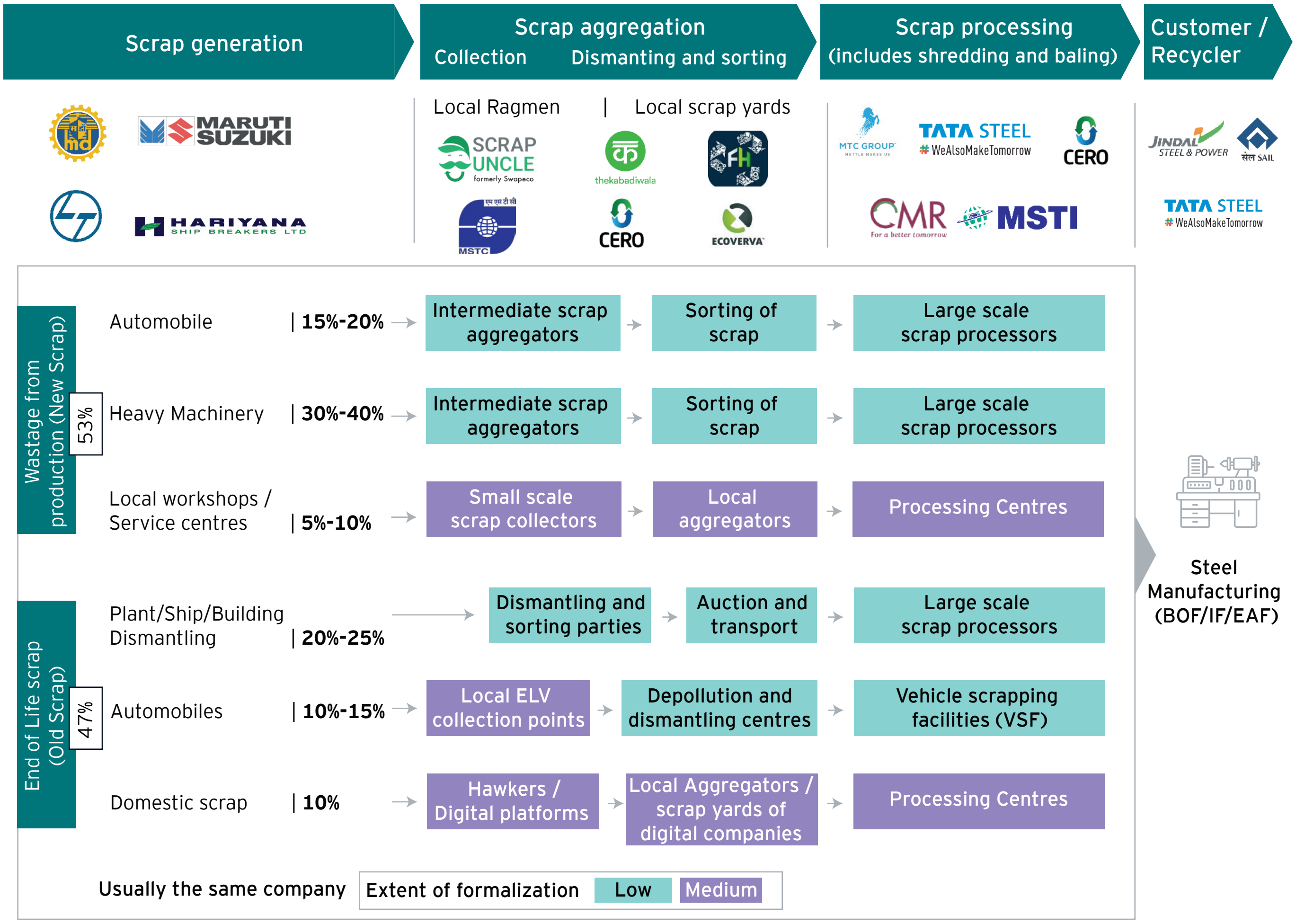
[5] Analysis is based on primary interaction with stakeholders and dataset from Bigmint

[6] Companies indicated in Fig. 17 are non-exhaustive and information is sourced from public domain and websites

Figure 17: Overview of ferrous scrap processing value chain

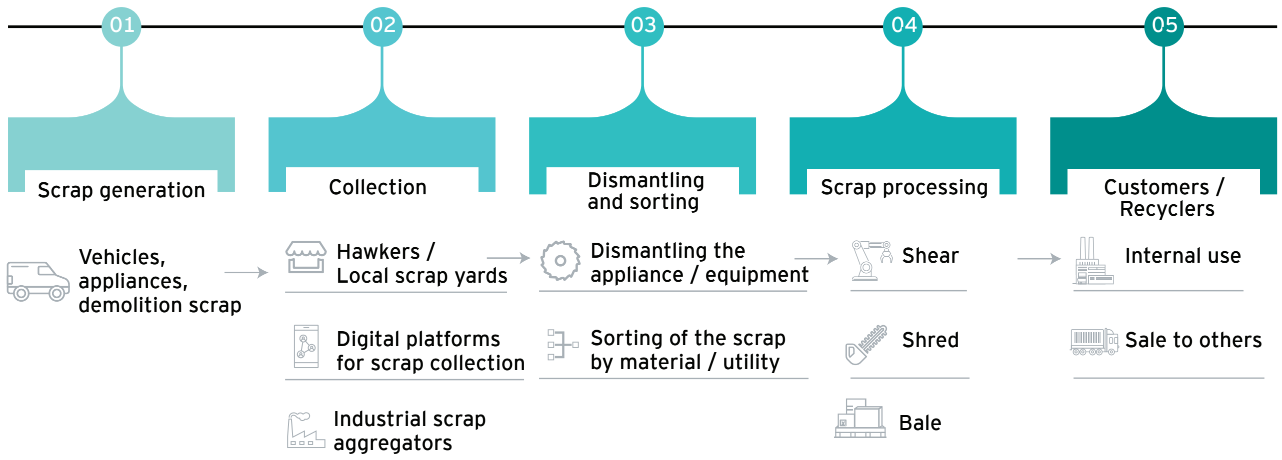


The extent of formalization varies across nodes—being low at the collection level, moderate at aggregation and dismantling, and higher at large-scale processing. By developing a robust and formal ecosystem that connects these stages, steel producers can strengthen material traceability, enable steady scrap supply, and capture greater market share in the recycling value chain. Integrating informal networks with organized scrap processors and recyclers would not only improve operational efficiency but also enable circularity in steel production through consistent, high-quality ferrous feedstock.

Control over scrap supply ecosystem

Integration across the scrap value chain offers steel manufacturers a strategic opportunity to gain competitive advantage through improved control, cost savings and reduced emissions. The process involves establishing backward linkages across scrap generation, aggregation, processing and steel manufacturing. By integrating these functions, companies can directly collect, dismantle and process scrap sourced from various industries before feeding it into IF, EAF or BOF steelmaking routes. This integration not only strengthens supply security but also enables firms to manage scrap flow efficiently, reduce dependence on intermediaries, and improve value recovery at each stage.

Figure 18: Ferrous scrap processing value chain



Source: EY Parthenon analysis

Given the projected rise in domestic scrap generation, expected to increase fivefold by 2050, and growing demand for recycled feedstock, controlling the supply chain at the source can provide distinct advantages. Backward integration allows steel manufacturers to secure scrap inputs, resulting in better supply chain control and measurable bottom-line impact through direct cost savings. Additionally, it supports emission reduction, with potential for significant declines in carbon intensity, and encourages portfolio diversification, allowing companies to expand into new business segments where competitors are already investing.

Figure 19: Indicative value add in scrap supply chain

	Value chain	Cost per Ton (INR)	Remarks
1	Point of generation	INR19,000 - INR21,000	Raw, unsorted, obsolete scrap purchased directly at the source.
2	Scrap collection and transport to local processing yards for dismantling and sorting	INR22,000 - INR23,500	Includes minor sorting and aggregator profit margin; Includes transport costs (INR500/ton - INR1,000/ton)
3	Dismantling, weighing and sorting	INR24,000 - INR26,500	Labor intensive due to manual sorting
4	Processing (includes shredding and baling)	INR28,500 - INR30,000	Includes machinery, electricity, and maintenance costs. Adds INR2,000/ton- INR3,000/ton
	Scrap market price	INR32,000 - INR35,000	Margins of the processor INR4,000/ton - INR5,000/ton

Margins → **Scrap market price (3rd party vendor)** − **In-house supply chain and scrap processing facility costs** = **INR3500 - INR5000/ton of scrap**

Source: EY Parthenon analysis based on primary interaction

A breakdown of the value chain indicates clear value addition across each stage. At the point of generation, raw and unsorted scrap is typically priced between INR19,000 and INR21,000 per ton. Once collected and transported for local processing, including minor sorting and transport, costs rise to INR22,000–INR23,500 per ton. The dismantling, weighing, and sorting stage, which is labor-intensive, further adds up the costs to INR24,000–INR26,500 per ton. During processing, which includes shredding, baling, and mechanical handling, expenses increase to INR28,000–INR30,000 per ton, incorporating machinery and maintenance costs of INR2,000–INR3,000 per ton.

The scrap market price ultimately ranges from INR32,000–INR35,000 per ton, yielding processor margins of INR3,500–INR5,000 per ton. This equates to nearly 14%–16% margins in scrap procurement, achievable through in-house supply chain and processing efficiencies. Thus, backward integration across the scrap ecosystem, from generation to processing, provides steel manufacturers both economic and environmental benefits while ensuring long-term supply stability.

Building on the emphasis of strengthening backward integration, it is equally important to recognize the systemic barriers that exist across India's scrap value chain. Despite the growing potential for organized aggregation and processing, each stage faces distinct challenges that hinder efficiency and scalability. At the scrap generation level, regulatory and tax impediments, such as high GST rates and complex clearance procedures, increase transaction costs. The limited number of authorized demolition centers restricts the dismantling of vehicles and infrastructure, while uncollected industrial waste and fragmented scrap sources further complicate aggregation and planning. Moving downstream, informal sector dominance and uncoordinated collection networks reduce traceability, while vehicle scrapping delays and a lack of financial incentives discourage formal participation in scrap recovery.

The dismantling and sorting segment also experiences operational inefficiencies, including technology and infrastructure gaps, mixed-grade scrap batches, high contamination (tramp elements like Copper), and an absence of standardized dismantling protocols. These factors collectively lower scrap quality and recycling efficiency. In processing, issues such as inconsistent material quality, poor logistics and handling, and thin profit margins deter technology investments, while high power consumption and pollution compliance costs add further strain. At the consumption end, price volatility, irregular feedstock quality and frequent policy changes create uncertainty for recyclers and manufacturers, compounded by supply chain and logistics bottlenecks that disrupt steady scrap inflows.

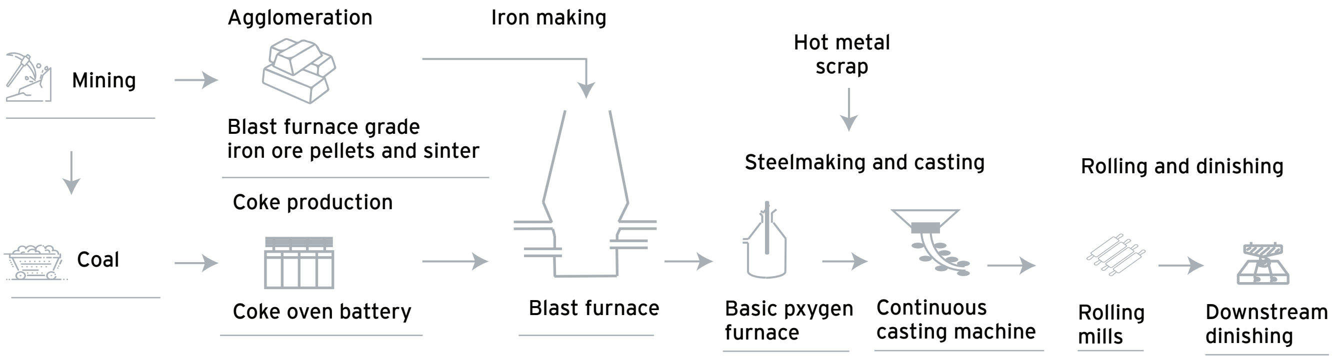
Addressing these gaps requires a cohesive enabling framework. India's National Scrap and Decarbonization Policies—including the 2019 Steel Scrap Recycling Policy, the 2021 Vehicle Scrappage Policy, and the forthcoming EPR-based End-of-Life Vehicle Rules (2025)—set a clear direction for formalization and traceability. Complementary measures such as circular economy integration, technological modernization through RVSFs and automated testing, and reduced import duties are enhancing the ecosystem's efficiency. Equally critical are efforts to skill and include the informal workforce, alongside a growing market for recycled components in the auto sector, which together can bridge policy intent with operational outcomes and strengthen India's pathway towards a circular steel economy.

Reduced emissions in steelmaking

In India, BF-BOF continues to dominate the steelmaking landscape, responsible for more than 70% of energy use and emissions in integrated steel plants. Therefore, strategic interventions in this specific route can significantly influence national and corporate emission trajectories.

Increasing the share of steel scrap in BF-BOF operations presents a technically mature and economically attractive lever for reducing both greenhouse gas emissions and energy intensity. Scrap-based metallics, when charged directly into the Basic Oxygen Furnace, partially displace virgin ore-based iron production in the blast furnace. This substitution leads to substantial upstream emission savings because scrap recycling bypasses the agglomeration, coke production, and hot metal generation stages, each a major contributor to energy consumption and CO_2 release.

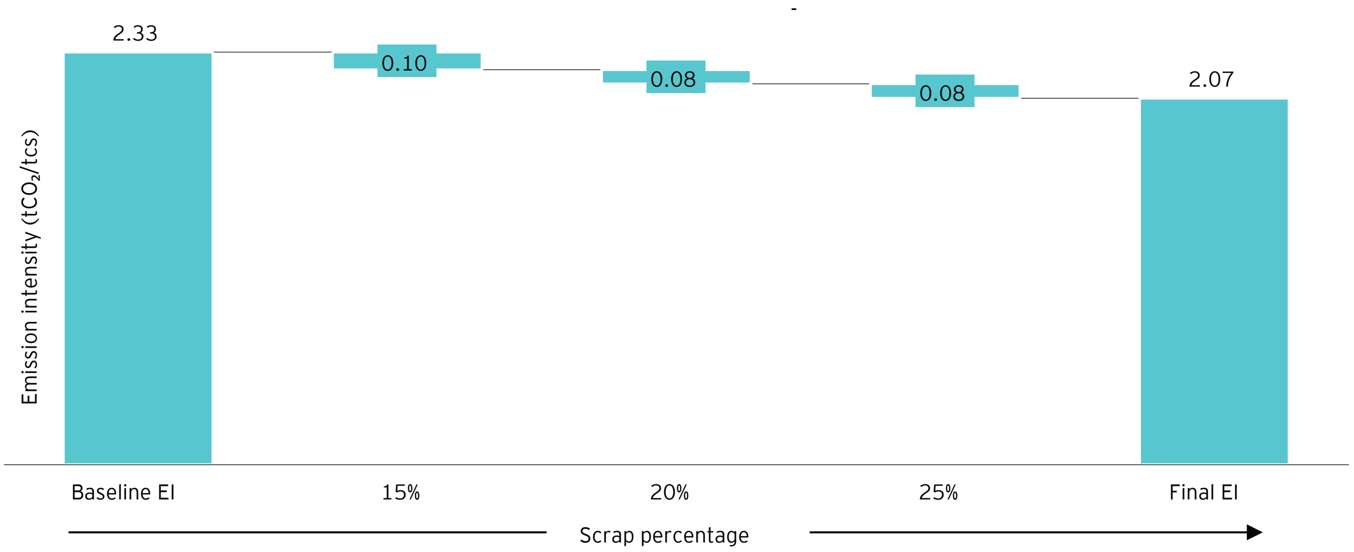
Figure 20: Overview of BF-BOF steelmaking process



Source: EY Parthenon analysis

Quantitatively, the environmental benefit is compelling. Every ton of scrap used in place of iron ore eliminates the need for roughly 1,400 kg of iron ore, 740 kg of metallurgical coal, and 120 kg of limestone in the ironmaking process. These avoided inputs translate into reduced fossil fuel combustion, lower process emissions from ore reduction, and diminished calcination emissions from limestone use. As illustrated in the below figure, enhancing scrap utilization from currently low levels (~15%) to a more competitive benchmark of ~25% can drop CO_2 emission intensity from 2.33 tCO_2/tCS to 2.07 tCO_2/tCS–representing a reduction of ~11%. This shift not only aligns India more closely with international best practices but also offers immediate returns with no requirement for breakthrough technologies or major plant retrofits

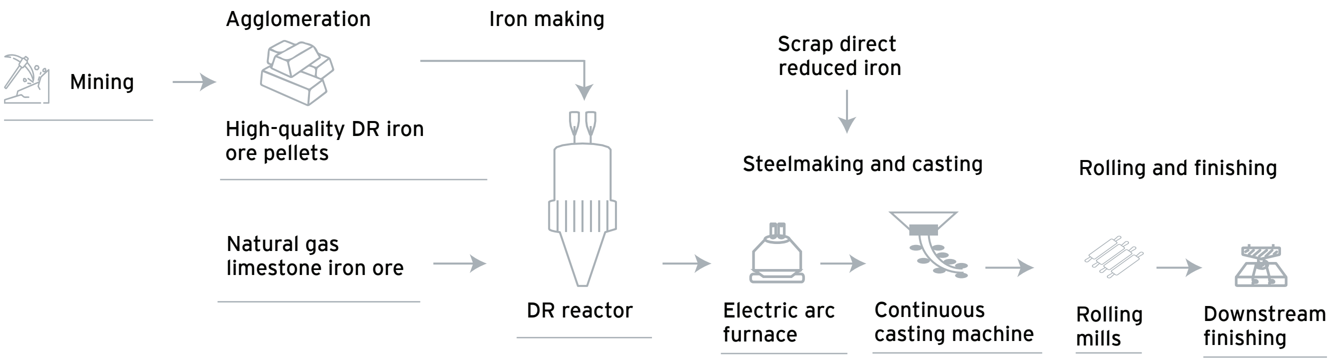
Figure 21: Reduction in emission intensity in BF-BOF steelmaking through scrap addition



Source: EY Parthenon analysis

The Direct Reduced Iron–Electric Arc Furnace (DRI–EAF) route has emerged as a lower-emission alternative to conventional BF–BOF steelmaking, particularly in regions such as India where natural gas-based DRI production is expanding. Unlike the BF-BOF process, NG DRI-EAF eliminates reliance on coke and sintering, thereby significantly reducing associated carbon and energy footprints. However, even within this comparatively clean route, further decarbonization opportunities exist, with increased steel scrap utilization being among the most cost-efficient and impactful pathways.

Figure 22: Overview of NG DRI-EAF steelmaking process

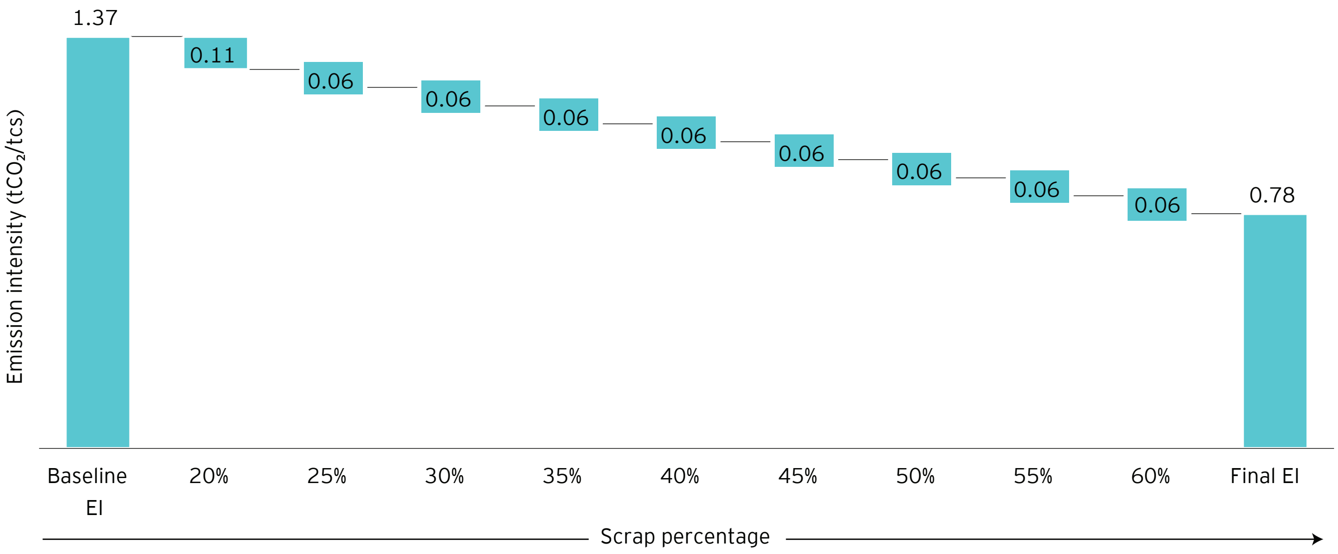


Source: EY Parthenon analysis

Scrap integration directly offsets the need for freshly produced DRI, which is still carbon-intensive due to natural gas consumption and upstream mining and pelletization activities. By replacing a portion of metallic input with recycled scrap, steelmakers can avoid a large share of embedded emissions while simultaneously lowering energy demand inside the EAF. Each incremental rise in scrap share leads to a measurable reduction in CO_2 intensity, as highlighted in the slide: an additional 5% increase in scrap proportion results in approximately 0.06 tCO_2/tCS of emission savings. This demonstrates the strong marginal benefit associated with every step toward higher circularity in the metallic charge mix.

Quantitatively, the impact is compelling. Increasing scrap input from the current baseline of ~20% to 60% has the potential to reduce overall CO_2 emissions from 1.37 tCO_2/tCS down to 0.78 tCO_2/tCS, equivalent to a ~43% reduction. This scale of improvement represents a transformative shift in steelmaking sustainability, helping companies align with global decarbonization trajectories and future regulatory expectations. With India's evolving climate commitments and increasing investor emphasis on ESG performance, such reductions not only deliver operational efficiencies but also future-proof competitiveness.

Figure 23: Reduction in emission intensity in NG DRI-EAF steelmaking through scrap addition



Source: EY Parthenon analysis

However, increasing scrap share in BOFs and EAFs would require technological adaptations, as listed below:

BF-BOF

- A higher scrap rate faces physical and logistical limits such as scrap chute volume and crane utilization; using a second chute increases charging time and affects process efficiency
- With higher scrap share, sensible heat and reaction heat from hot metal decrease, lowering post-combustion and CO_2 generation. Additional energy is required to melt the scrap, though total steel output remains unchanged; slag and off-gas volumes slightly decrease
- Proper bath mixing becomes essential to prevent temperature gradients and cold spots; strong bottom stirring is required throughout the vessel campaign
- Scrap preheating helps increase the scrap rate and material flexibility. Preheating inside the vessel avoids heat loss and dust generation, and BOF off-gas heat can be effectively used for this purpose
- The most efficient preheating method is a burner lance installed in place of one of the top oxygen lances
- Switching from a standard top-blown BOF to a combined blowing converter (top and bottom oxygen) can overcome limitations in processing higher scrap rates

NG-DRI EAF

- Scrap quality directly influences slag volume, raw material cost, energy use, and productivity; high-oxide or tramp-element scrap increases cost and often requires dilution with higher-grade material.
- In ultra-high power-charged EAFs, the absence of a scrap pile results in lower arc length and voltage, reducing energy-transfer efficiency to the molten steel.
- Electrical energy forms the majority of total energy use in EAF steelmaking, typically accounting for 40%–66% of total energy consumption.
- Energy efficiency can be improved through air-tight furnace systems, scrap preheating, stirring, burners, hot charging (e.g., hot DRI), aluminum electrode arms, post-combustion, higher DRI metallization and carbon content, reduced DRI share in the charge, and foamy-slag practice.

To conclude, backward integration into scrap supply becomes essential to unlock this opportunity at scale. Current constraints in India include limited availability of high-quality scrap, informal collection systems, weak end-of-life vehicle disposal infrastructure, and a high dependency on scrap imports. These structural barriers create volatility in scrap pricing and undermine stable charge planning for EAF steelmakers. By investing in organized scrap procurement channels such as auto and white-goods recycling ecosystems, shredding and sorting facilities, and localized scrap processing hubs, companies can secure sustainable and cost-competitive scrap supply while fostering circular economy growth across the steel value chain.

Enhancing scrap utilization also contributes to resource security, minimizing reliance on imported DRI-grade pellets and natural gas. Additionally, it enables immediate decarbonization progress without the long-lead-time technological dependencies associated with future pathways like green hydrogen-based DRI. This positions scrap integration as a near-term, high-impact transition lever that can reduce emissions at pace while retaining flexibility to adapt to emerging technologies.

Case study

Project rationale

TATA Steel has announced net zero targets by 2045. As part of their "wealsomaketomorrow" initiative, TATA has commissioned 0.5 MMTPA scrap processing plant in Rohtak, Haryana

Project partner

The plant has been set up in collaboration with M/s Aarti Green Tech Ltd, as a Build, Own, Operate (BOO) partner

Plant description

- Mechanized equipment like balers, shredders, and material handlers
- Scrap is processed from end-of-life vehicles, obsolete households, construction demolition, industrial etc

Scrap sourcing

- Use of FerroHaat® digital application to source scrap from various scrapyards
- More than 180 suppliers have registered on the app

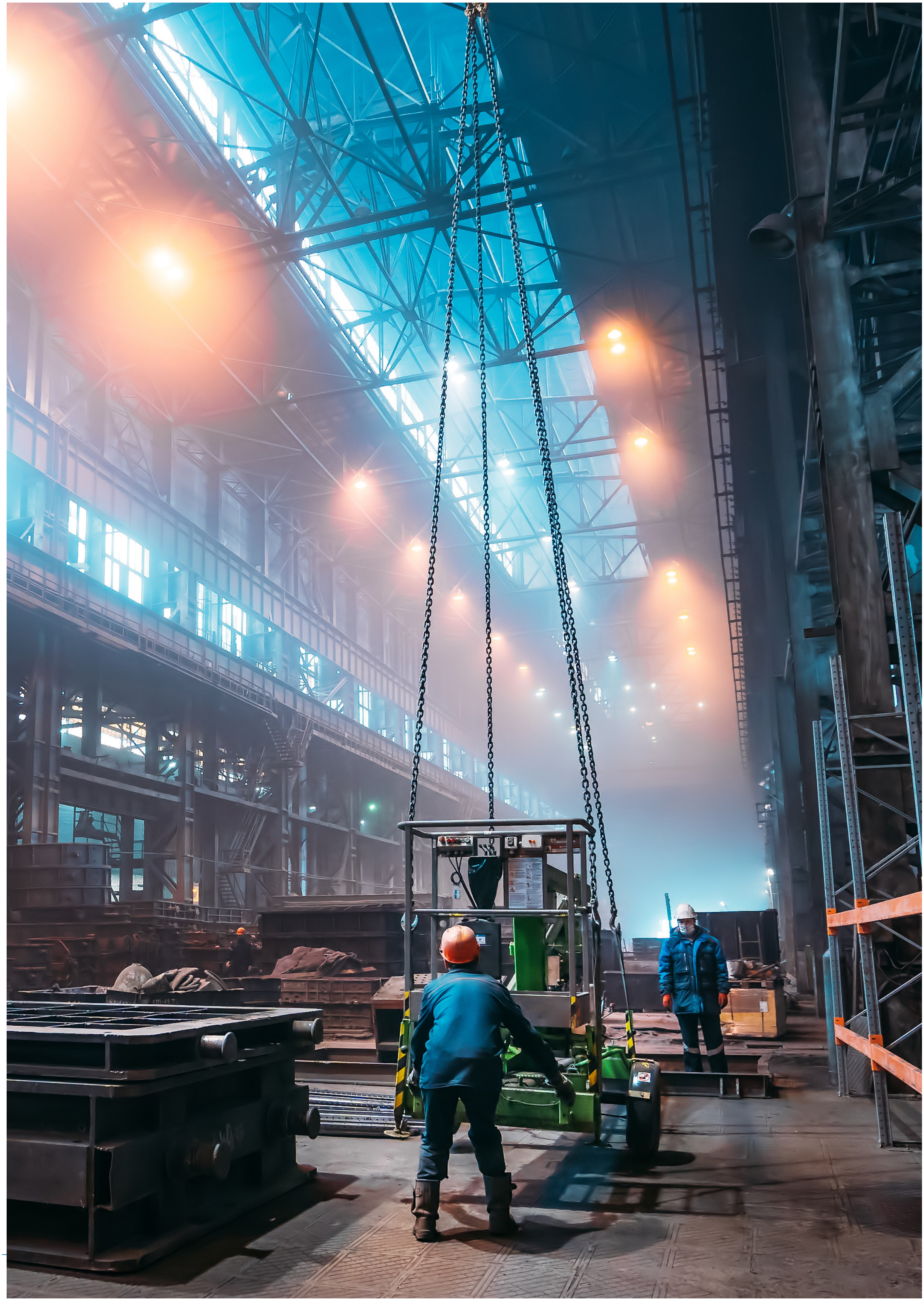
Products

TATA FERROBALED
BALED FERROUS SCRAP

TATA FERROSHRED
SHREDDED FERROUS SCRAP

Key takeaways

- Strong supply chain
- Efficient market access
- High cleanliness
- Low contamination
- High bulk density
- Lower tramp elements
- No radioactivity



09

Key recommendations

Recommendations in Whitepaper: "Unlocking the scrap supply chain for India's steel decarbonization"

Recommendation 1

Recognize ferrous scrap as a strategic domestic resource within India's steel value chain

Problem

Scrap demand can be met only under the projected optimistic domestic generation scenario, which assumes scrap availability grows at an 8% CAGR. Even under this scenario, a deficit of 40-50 MMT is expected, given the government's ambitious target of increasing scrap share to 50% in steelmaking by 2047, as highlighted in the report (Fig. 8: India's widening ferrous scrap supply-demand gap).

Furthermore, scrap is not yet formally treated as a strategic industrial input, which limits coordinated planning across policy, logistics, external trade, and steelmaking. This challenge is compounded by tightening global scrap markets: more than 60 countries have imposed export restrictions, and major supplier nations are projected to reduce exports by 2030.

Rationale

India is already the world's second-largest importer of scrap, and domestic availability is structurally constrained even under optimistic projections. As electric-route steelmaking expands and global exporters retain scrap for their own decarbonization pathways, import reliability will decline. Scrap is transitioning from a traded commodity to a strategic secondary raw material. Without formal recognition at the national resource-planning level, India risks exposure to supply shocks, price volatility, and carbon competitiveness risks under emerging international standards.

Way forward

Ferrous scrap should be formally designated as a strategic secondary raw material under national steel and resource planning frameworks. This should trigger:

- Cross-ministerial coordination between the Ministries of Steel, Commerce, External Affairs, Finance, and Environment.
- Bilateral agreements and long-term supply arrangements with key exporting countries to secure stable scrap inflows.
- Rationalization of duties, GST treatment, and logistics incentives to facilitate both domestic circulation and strategic imports.
- Integration of scrap planning into national industrial and trade policy.

This approach ensures scrap security is addressed as a matter of industrial resilience, not merely waste management.

Recommendation 2

Strengthen execution of the existing policies around scrap generation to unlock end-of-life scrap supply

Problem

Despite incentives and regulatory clarity, implementation of the existing policies remains weak. Only ~350,500 vehicles have been scrapped between August 2022 and July 2025, far below the annual target of 500,000 vehicles. This execution gap materially constrains domestic scrap availability. Additionally, while India is one of the world's leading ship recycling destinations under the Ship Recycling Act, integration of recovered steel into domestic secondary steelmaking remains sub-optimal. Coordination between maritime dismantling and steel value chains requires strengthening.

Rationale

Given the historic rise in steel consumption from 6.5 MMT in 1968 to ~150 MMT in 2025, large scrap volumes will emerge over the coming decades across mobility, maritime, infrastructure, and industrial sectors. Without robust enforcement, dismantling capacity, and integration into formal steel supply chains, this future scrap stream will remain under-realized.

Way forward

- Materially expand domestic scrap generation across sectors:
  - Enhance scrap recovery from construction and infrastructure through mandatory deconstruction norms and material recovery audits. These sectors accounted for ~68% of India's more than 600 MMT steel consumption in the last five years (~410 MMT). As assets with multi-decade lifespans begin reaching end of life due to renovation and redevelopment, a significant scrap stream will emerge.
  - Accelerate vehicle scrappage implementation. Only ~3% of ~12 million eligible vehicles have been scrapped. With ~55 MMT of steel consumed in automobiles over the last five years and a 15-year lifecycle, improved execution could unlock ~11 MMT per year of scrap during 2036-2041.
- Expand Automated Testing Stations and RVSFs through viability gap funding.
- Enable co-investment by steelmakers in scrappage facilities.
- Improve financial incentives and ease of participation for asset owners.

The objective is disciplined execution and integration at scale.

Recommendation 3

Establish uniform national scrap quality standards supported by digital traceability

Problem

Inconsistent scrap quality, contamination (tramp elements such as copper), and limited traceability constrain higher scrap charge ratios. Variability in grading and absence of standardized certification create operational inefficiencies for EAF and IF operators and reduce confidence in increasing scrap share.

Rationale

Scrap quality directly influences furnace performance, steel chemistry, and downstream product suitability. Elevated tramp elements such as copper and tin can accumulate in the melt, limiting the ability to produce high-grade flat products and specialty steels. Poor segregation increases slag formation, raises energy consumption, affects refractory life, and reduces yield.

Without predictable and certified quality, producers are compelled to dilute scrap with virgin iron units, lowering achievable scrap ratios. A uniform, transparent quality regime is therefore essential to unlock higher scrap utilization while maintaining product standards required by automotive, construction, and infrastructure sectors.

Way forward

India should introduce:

- National scrap grading standards aligned with EAF and IF technical requirements.
- Mandatory testing and certification protocols for chemical composition and contamination levels.
- Digital traceability systems linking scrap origin, processor certification, and furnace-level usage.

A standardized and transparent quality ecosystem will improve furnace stability, enable higher scrap charge ratios, reduce process losses, and strengthen confidence across the steel value chain.

Recommendation 4

Develop regional scrap processing hubs aligned with secondary steel clusters

Problem

Scrap consumption is concentrated in Punjab, Maharashtra (Jalna), and Tamil Nadu (Chennai), yet processing infrastructure remains fragmented. This leads to logistics inefficiencies, inconsistent quality, and value leakage

Rationale

These regions already operate with high scrap-to-DRI ratios (70–90%). Localized processing hubs can reduce transport costs, improve material quality, and enable higher scrap charge rates. Without cluster-based infrastructure, incremental generation will not convert into efficient utilization.

Way forward

Develop integrated regional scrap processing hubs near major steel clusters through public-private partnerships. These hubs should include

- Shredding and sorting lines
- Contamination testing and grading facilities
- Baling and densification units
- Digital tracking systems

This strengthens local circularity and reduces systemic inefficiencies across the value chain.

Recommendation 5

Encourage backward integration by steelmakers across the scrap value chain

Problem:

Steelmakers remain exposed to scrap price volatility, supply uncertainty, and quality variability. Intermediaries capture 14–16% margins in aggregation and processing stages, while global markets tighten.

Rationale:

Backward integration improves supply security, stabilizes costs, enhances traceability, and enables higher scrap utilization. Early movers will gain durable cost and carbon advantages. However, integration must expand total scrap availability rather than merely reallocating limited flows.

Way forward

Steel producers should:

- Invest in collection, dismantling, and processing infrastructure.
- Form joint ventures with end-of-life steel recyclers.
- Integrate informal networks into formal systems

Backward integration should be positioned as a supply-expansion strategy, not a competitive hoarding mechanism.

Recommendation 6

Dual policy focus on effective ferrous scrap utilization in the near term, alongside scaling green hydrogen-based DRI steelmaking as a long-term lever

Problem:

Steelmakers remain exposed to scrap price volatility, supply uncertainty, and quality variability. Intermediaries capture 14–16% margins in aggregation and processing stages, while global markets tighten.

Rationale:

Increasing scrap share in NG-DRI-EAF from 20% to 60% can reduce emissions intensity by ~43% and raising scrap share in BF-BOF from 15% to 25% can reduce intensity by ~11%. These gains require no breakthrough technologies. Therefore, focus should be on unlocking more scrap for effective utilization in steelmaking.

However, scrap availability is likely to remain structurally constrained. Scrap should therefore be positioned as a critical transition lever, but not the sole foundation of long-term decarbonization. Parallel investments in green hydrogen-based DRI deployment remain essential.

Way forward

Enable higher scrap utilization through technology support, including:

- Long-term offtake arrangements between certified processors and EAF/IF units.
- Incentives for scrap preheating, furnace upgrades, and quality-enhancing processing.
- Targeted support mechanisms for early commercial deployment of green hydrogen-based DRI integrated with electric steelmaking

Scrap policy must therefore be embedded within a broader decarbonization roadmap that simultaneously improves scrap circularity and scales green hydrogen-based ironmaking capacity.

Notes

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About India Green Steel Coalition

The India Green Steel Coalition (IGSC) is a joint initiative of WWF-India and the Confederation of Indian Industry (CII) to accelerate the transition to green steel manufacturing and consumption in India. IGSC aims to reduce the emissions intensity of India's steel production by 30% compared to 2023 levels by 2030.

As a multi-stakeholder platform representing ~70% of India's crude steel production, IGSC brings together primary and secondary producers, alongside demand-side players to drive sustainable transformation in this hard to abate sector. IGSC supports industry dialogue through technical reports, capacity building sessions, actions groups on key topics like: renewable energy cluster development for steel sector, and Carbon, Capture & Utilization (CCU); and international expert involvement through WWF network offices.

By addressing key transition challenges and fostering industry-wide collaboration, IGSC will actively engage with policymakers to shape an enabling environment for decarbonization while supporting India's goal of increasing domestic steel production sustainably.

About WWF-India

WWF-India is a science-based organization which addresses issues such as the conservation of species and its habitats, climate change, water and ecological footprint. Over the years, its perspective has broadened to reflect a more holistic understanding of the various conservation issues facing the country and seeks to proactively encourage environmental conservation by working with different stakeholders - Governments, NGOs, corporates and other relevant stakeholders. WWF-India acknowledges the strong linkages of industry's ecological footprint and its impact on nature and biodiversity. Hence, we collaborate with industry partners to addressing such challenges and working on solutions that promote carbon mitigation and adaptation solution. On the similar lines, WWF-India conceptualized India Green Steel Coalition under its ''Decarbonization of Steel Sector in India' program that supports Indian Steel Industry to adapt to changing international regulations and standards.

About WWF Finland

WWF Finland is part of the global WWF network that has offices in about 50 countries and operations in over one hundred countries. WWF Finland was established in 1972 and is now the most recognized environmental NGO in Finland. Alongside domestic conservation projects, WWF Finland is working with WWF partners in Asia, Africa and South America. WWF Finland is hosting the WWF global Steel Decarbonisation Workstream.

About CII- GBC

The CII – Sohrabji Godrej Green Business Centre (CII – GBC) is CII's Developmental Institute for Green Practices and Businesses, focused on offering world-class advisory services dedicated to the conservaBAMtion of natural resources. Its mission is to help India emerge as a global leader in green business by 2030.

The Centre promotes sustainable practices and supports businesses through a comprehensive range of services, including Green Buildings, Energy Management Initiatives, Energy Efficiency Initiatives, GreenPro Certification, GreenCo Rating System, Green Entrepreneurship Council (GEC), Solar Vendor Rating Program (VRP) etc.

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