PRESS RELEASE
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India's transition to green steel to be gradual amid cost and technology constraints: ICRA

Rating agency ICRA expects India's transition to low-carbon green steel to remain a gradual, long-term process as cost and technological constraints continue to hinder rapid decarbonisation. According to ICRA's estimates, Indian steelmakers' carbon emission intensity averages about 2.5 tonnes of CO_2 per tonne of steel (scope 1 and 2)[i], roughly 12% higher than the global average for the blast furnace-basic oxygen furnace (BF-BOF) route. Recent introduction of a Green Steel Taxonomy by the Government of India in December 2024 (under the National Mission on Green Steel) marks a positive step, setting graded emission thresholds[ii] to define what qualifies as "green" steel. However, most Indian primary producers are currently well above even the upper end of this green range, underscoring the significant decarbonisation gap, which needs to be bridged.

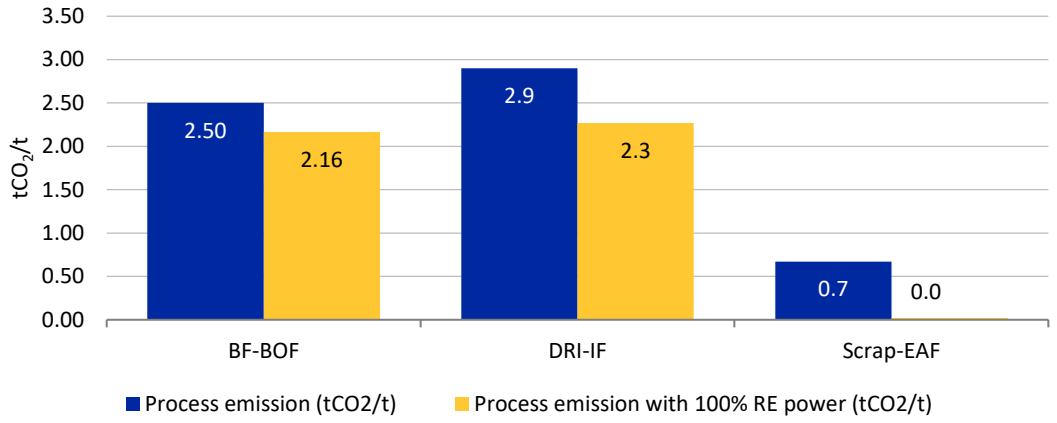
Commenting on the industry trends, **Girishkumar Kadam, Senior Vice-President & Group Head, Corporate Sector Ratings, ICRA** said*: "The planned capacity additions of about 80–85 million tonnes (mt) in India by 2030-31 are heavily skewed towards the coal-based BF-BOF[iii] route, the share of which will increase from ~45% currently to roughly 51% by 2030-31, reflecting a high carbon intensity in the medium term. Consequently, the domestic steel industry's near-term decarbonisation will mainly rely on operational efficiency gains and higher renewable energy adoption, which is expected to result in ~19% reduction in emission intensity by 2029-30 and would bring the sector average down to roughly 2.0 tCO_2 per tonne by the end of this decade. A major part of this reduction is expected from renewable energy integration and process optimisations".*

ICRA's report highlights that ~9 gigawatts (GW) of captive renewable power capacity has already been announced by domestic steel mills to replace fossil fuel-based electricity in their operations. Transitioning to green power alone is expected to cut emissions by ~13% for BF-BOF based mills and by up to 22% for DRI-based steelmaking units. Other operational levers – such as higher scrap usage in furnaces, energy efficiency measures like waste-heat recovery, and iron ore beneficiation – are expected to further lower CO_2 per tonne. However, the scrap-based EAF[iv]. capacity, which has a far lower carbon footprint, remains constrained by limited scrap availability in India.

Further, the higher green hydrogen cost remains a constraint for wider adoption of the hydrogen-based DRI[v] route in the medium term. As per ICRA estimates, the break-even cost of production via the DRI–EAF route would require green hydrogen to fall to around $1.5–1.6 per kg, versus the current estimate of over $3 per kg. This is unlikely to be achieved in the near to medium term, which means large-scale green steel capacity addition will remain constrained over the medium term.

Over the long term beyond 2030, green steel demand in India is projected to accelerate and will be driven by tightening ESG compliance norms, large end-user industries (automotive, infrastructure, capital goods, etc.) striving to decarbonise their supply chains, and policy measures. While India's green steel ambition is strategically aligned with global trends, its realisation remains a long-term aspiration rather than an imminent shift, with economics, technology readiness and policy support determining the pace and scale of adoption.

Exhibit: Potential reduction in emission intensity through 100% renewable energy usage



[i] *Scope 1 emissions are direct GHG emissions that occur from sources that are controlled or owned by an entity; Scope 2 emissions are indirect GHG emissions associated with the purchase of electricity, steam, heat, or cooling*

[ii] *Thresholds as defined in Green steel Taxonomy are:* ***Three-star green rated steel:*** *Steel with emission intensity between 2.0 and 2.2 tCO_2/tonnes per tonne of steel (tfs);* ***Four-star, green-rated steel:*** *Between 1.6 and 2.0 tCO_2/tfs and* ***Five-star green-rated steel****: Lower than 1.6 tonnes of CO_2 per tonne*

[iii] *BF-BOF: Blast Furnace – Basic Oxygen Furnace*

[iv] *EAF: Electric Arc Furnace*

[v] *DRI: Direct Reduced Iron*

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