2. Green Steel- Environment

Green steel can shape India's climate goals trajectory

India's green steel transition is a cornerstone of its updated Nationally Determined Contributions (NDC) for COP30. By notifying the Green Steel Taxonomy in December 2024, the government has established a structured roadmap to decarbonize an industry that is vital to the economy but remains a major carbon emitter.

The Strategic Importance of Steel in India

Steel is the backbone of India's industrial growth, yet it poses the most significant decarbonization challenge.

Core Economic Pillar- Steel holds a 17.92% weight in the Index of Eight Core Industries (ICI), making it vital for infrastructure and manufacturing.

The Emission Challenge- Currently, the sector accounts for ~12% of India's CO_2 emissions.

Intensity Gap- India's emission intensity stands at 2.55 tonnes CO_2 per tonne of crude steel, notably higher than the global average of 1.9 tonnes.

Future Demand- To reach its economic potential, India must scale production from ~125 million tonnes today to over 400 million tonnes by 2050, creating a risk of "carbon lock-in" if legacy coal-based technologies are used.

Defining "Green Steel"- The 2024 Taxonomy

The Ministry of Steel's December 2024 notification moved India from a vague understanding of "green steel" to a precise, outcome-based framework.

Primary Definition- Steel is officially "Green" if its emission intensity is less than 2.2 tonnes of CO_2e per tonne of finished steel (tfs).

Star Rating System- To encourage continuous improvement, the taxonomy uses a graded star system-

1. 5-Star- Intensity < 1.6 t-CO_2e/tfs.
2. 4-Star- Intensity 1.6 – 2.0 t-CO_2e/tfs.
3. 3-Star- Intensity 2.0 – 2.2 t-CO_2e/tfs.
4. *Note*- Anything above 2.2 t-CO_2e/tfs is ineligible for a green rating.

Technology Neutrality- Unlike some international models, India does not mandate a specific process (like Green Hydrogen). It allows DRI (Direct Reduced Iron), Electric Arc Furnaces (EAF), Natural Gas, and CCUS (Carbon Capture) as long as the emission threshold is met.

Review Mechanism- These thresholds are not static; they will be reviewed every three years to align with global technological progress.

Production Pathways- Conventional vs. Green Routes

Decarbonizing steel involves shifting away from coal-heavy blast furnaces toward electricity and hydrogen-driven processes.

Production Route	Primary Fuel/Reductant	CO_2 Intensity (Approx.)	Transition Status in India
BF-BOF (Traditional)	Coking Coal / Coke	2.3 – 2.6 t-CO_2/t	Current mainstay; high "lock-in" risk.
Natural Gas-DRI	Natural Gas	1.4 – 1.8 t-CO_2/t	Used as a "bridge" technology.
Scrap-based EAF	Electricity + Recycled Steel	0.5 – 0.7 t-CO_2/t	Key for secondary steel; needs formal scrap policy.
Green Hydrogen-DRI	Green Hydrogen + RE	< 0.2 t-CO_2/t	Target for 2040-50; requires lower H_2 costs.
CCUS Integration	Fossil fuels + Carbon Capture	Variable (60-70% reduction)	Pilot stage; requires sequestration infra.

Key Enablers and Benefits

The taxonomy serves as a catalyst for a broader ecosystem change-

Investment Clarity- Green steel projects require 30–50% higher CAPEX. The taxonomy provides a "green label" that helps banks offer preferential financing and lower interest rates.
Market Creation- It enables Green Public Procurement (GPP), where the government can mandate a percentage of green steel in national infrastructure projects.
Global Trade (CBAM Readiness)- The EU's Carbon Border Adjustment Mechanism (CBAM) will penalize high-carbon imports. This taxonomy helps Indian exporters certify their products to maintain global competitiveness.
Policy Synergy- It connects the National Green Hydrogen Mission with the Carbon Credit Trading Scheme (CCTS), creating a unified domestic carbon market.

Critical Barriers and Policy Needs

Despite the progress, several structural hurdles remain that require immediate intervention-
Input Constraints- High costs of green hydrogen and a lack of dedicated renewable energy for heavy industry.
Raw Material Gaps- Fragmented scrap markets and uncertain access to affordable natural gas as a transition fuel.
Implementation Needs-

1. Carbon Pricing- Establishing a price on carbon to internalize the cost of emissions (making green steel more competitive).
2. Strategic Hubs- Creating specialized industrial clusters where shared infrastructure (hydrogen pipelines, CO_2 transport) can reduce individual plant costs.
3. SME Support- Providing fiscal incentives for smaller producers who lack the capital for high-tech transitions.

Source- **https-//www.thehindu.com/opinion/lead/green-steel-can-shape-indias-climate-goals-trajectory/article70571515.ece**