



SUSTAINABLE STEEL FOR SUSTAINABLE STATE

**A Status Report on West Bengal's Steel Industry
& Green Steel Initiative**

March 2025

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Founded in 2008, the **Environment Conservation Society (ECS)**, also known as SwitchON Foundation, actively offers **sustainable solutions** for the vulnerable Indian population. With a commitment to **clean and renewable energy**, climate-resilient agriculture, and **sustainable cities**, ECS is working towards creating opportunities for 10 million people by 2030, promoting equitable growth through innovative business models and technologies.

Recognizing the crucial role of the steel industry in India's green transition, ECS is dedicated to fostering sustainable steel production and consumption. Our work focuses on integrating renewable energy solutions, resource efficiency, and circular economy principles into steel manufacturing. By engaging with industry leaders, policymakers, and research institutions, we aim to drive innovation, reduce emissions, and promote responsible sourcing of raw materials.

Through **evidence-based research** and stakeholder engagement, ECS advocates for policies that encourage low-carbon steel production and responsible mining practices. Our efforts also include capacity-building initiatives to ensure that industries, workers, and communities are equipped to participate in this transition towards sustainable industrialization.

ECS's commitment to sustainability extends to fostering collaborations for green infrastructure and decarbonizing hard-to-abate sectors. This audit report, **Sustainable Steel for Sustainable India**, critically examines the current landscape of green steel in India and West Bengal as well, identifying challenges and opportunities to align the sector with national and global climate commitments.



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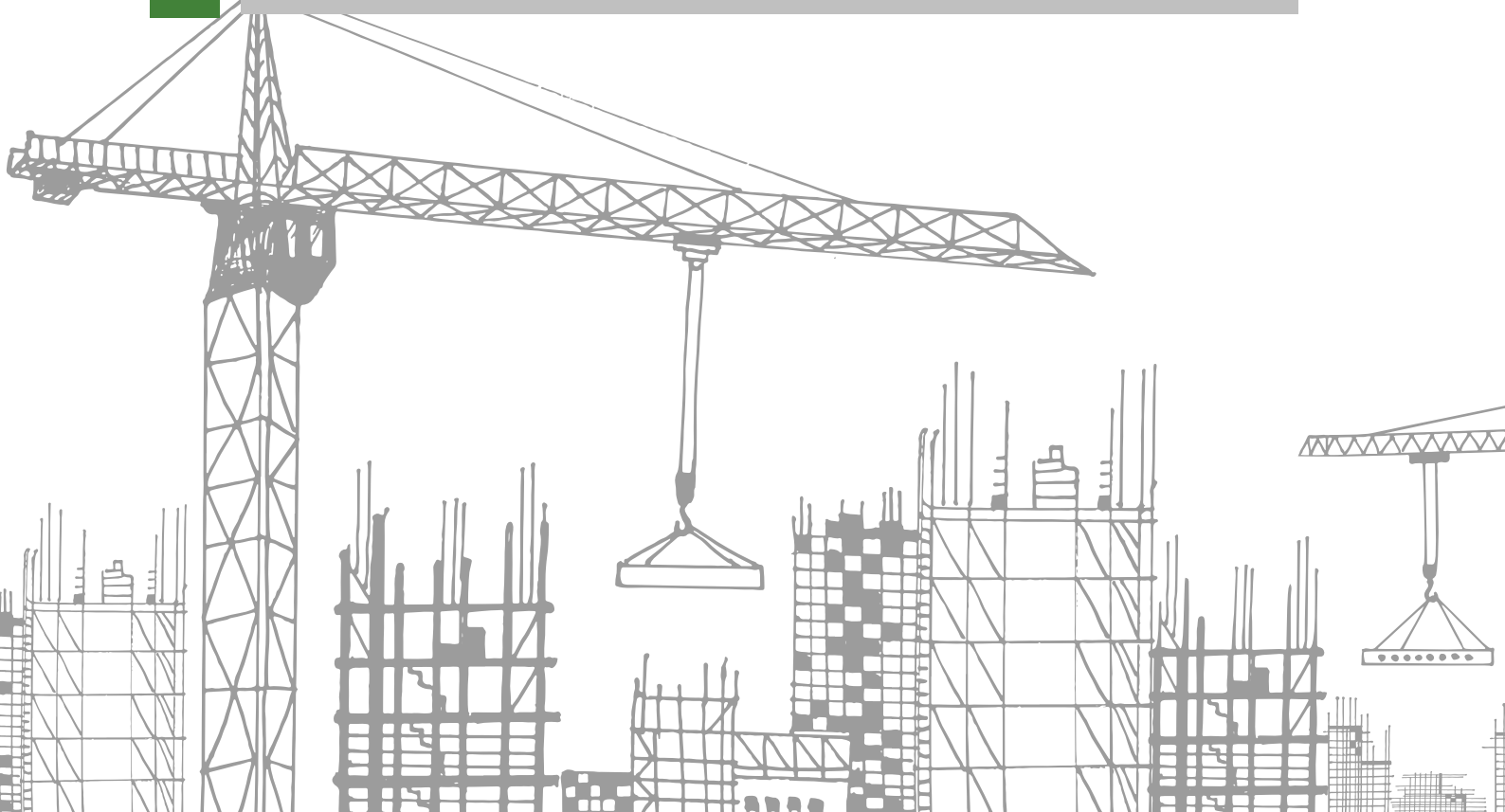
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TABLE OF CONTENTS

1.	A. Introduction	1
2.	B. Green Steel in West Bengal	2
3.	C. Green Steel in India	5
4.	D. Recommendations	7
5.	E. Conclusion & Way Forward	9
6.	F. References	10



Executive Summary

• 1. Introduction

The steel industry is a major contributor to carbon emissions, responsible for 7–9% of global CO₂ emissions. India, the second-largest steel producer, emits around **242 million tons of CO₂ annually** from this sector. With a national commitment to **net-zero emissions by 2070**, the transition to **green steel**—produced using hydrogen-based reduction, electric arc furnaces, and renewable energy—is imperative. West Bengal, with its well-established steel industry, plays a crucial role in this transformation. This report assesses the **current landscape of green steel in West Bengal**, analyzing key players, industry interventions, challenges, and policy recommendations.

• 2. Current State of Steel Industry in West Bengal

West Bengal is a key steel-producing state, accounting for approximately **10% of India's total steel output**. The **major steel hubs** include **Durgapur, Asansol, and Burnpur**, with leading manufacturers such as **IISCO (SAIL), Shyam Steel, Rashmi Group, Tata Metaliks, and Jindal Steel**. The state's steel industry is actively incorporating **energy efficiency measures, waste heat recovery, and circular economy practices** to reduce emissions. However, coal-based **Blast Furnace–Basic Oxygen Furnace (BF–BOF) technology** remains dominant, necessitating urgent adoption of **low-carbon alternatives**.

• 3. Key Industry Initiatives towards Green Steel

Several steel manufacturers in West Bengal have begun adopting green technologies:

- **Hydrogen-Based Reduction:** **Rashmi Group** is piloting **H₂-DRI technology** to reduce reliance on coal.
- **Energy Efficiency Measures:** **Shyam Steel and IISCO** have implemented **waste heat recovery systems (WHRS) and solar-powered auxiliary systems**, reducing energy consumption by **18%**.
- **Circular Economy Approaches:** The industry is aiming to increase **scrap steel-based production to 30% by 2030**, aligning with India's **National Steel Policy**.
- **Low-Emission Furnace Technologies:** Companies are investing in **oxygen injection systems and hybrid electric arc furnaces** to reduce CO₂ emissions by **40%** compared to conventional furnaces.

• 4. Policy and Institutional Interventions

Industry bodies and government agencies are supporting green steel initiatives:

- **Bengal Chamber of Commerce & Industry (BCC&I):** Advocating for **ESG compliance, renewable energy integration, and green hydrogen adoption**.
- **West Bengal Industrial Development Corporation (WBIDC):** Developing **industrial parks and steel clusters** to promote sustainable production.
- **Confederation of Indian Industry (CII):** Facilitating **GreenPro certification** for steel manufacturers and partnering with **WWF–India** for emission reduction strategies.
- **Government of India's Green Steel Mission:** Allocating **₹15,000 crore** for green steel development, including a **PLI scheme for green steel, renewable energy incentives, and green procurement mandates**.

• 5. Challenges in Green Steel Adoption

Despite progress, the industry faces significant challenges:

- **High Investment Costs:** Transitioning to green hydrogen and CCUS technologies requires substantial capital investment.
- **Technological Barriers:** Hydrogen-based reduction and renewable energy integration remain in the early stages of commercial viability.
- **Policy and Market Uncertainty:** Lack of clear carbon pricing mechanisms and green steel certification frameworks slows adoption.
- **Energy Supply Limitations:** Industries in West Bengal face renewable energy supply limitations due to inadequate grid infrastructure, high costs, weather-dependent generation, regulatory complexities, lack of awareness, and reliance on fossil fuels, despite strong solar and wind potential.

• 6. Recommendations and the Way Forward

To accelerate the transition to green steel, the following actions are recommended:

For Industry

- **Invest in modernizing steel plants** with electric arc furnaces and hybrid furnaces.
- **Scale up scrap steel utilization** to improve raw material efficiency.
- **Adopt Carbon Capture, Utilization, and Storage (CCUS) technologies** to reduce emissions.
- **Develop partnerships for hydrogen-based steel production** to establish regional hydrogen hubs.

For Government

- **Introduce a dedicated West Bengal Green Steel Policy** to align with national decarbonization goals.
- **Provide financial incentives**, including low-interest loans, green bonds, and PLI schemes for sustainable steelmaking.
- **Create Green Industrial Zones in Durgapur and Asansol** with renewable energy access and hydrogen infrastructure.
- **Mandate minimum green steel usage in public procurement** to drive market demand.

For Research and Academia

- **Advance research in low-cost hydrogen production and CCUS technologies** in collaboration with IIT Kharagpur and NML.
- **Develop workforce training programs** focused on green metallurgy and sustainable steel production.
- **Enhance circular economy practices** by improving scrap sorting and alloy recovery techniques.

7. Conclusion

West Bengal has a significant opportunity to emerge as a leader in India's green steel transition. While early initiatives in energy efficiency, waste heat recovery, and hydrogen-based steelmaking are promising, scaling up sustainable production requires stronger policy support, financial incentives, and technological advancements. By leveraging national policies like the Green Hydrogen Mission and aligning with global Carbon Border Adjustment Mechanisms (CBAM), Bengal can ensure its steel industry remains competitive while contributing to India's climate goals. A collaborative approach involving government, industry, and research institutions will be key to achieving a low-carbon, sustainable steel sector in the state.



Key methods used in green steel production include :

- **Hydrogen-based Direct Reduced Iron (H₂-DRI):** Uses green hydrogen instead of coal to reduce iron ore.
- **Electric Arc Furnace (EAF) Technology:** Uses recycled scrap steel and renewable energy.
- **Carbon Capture, Utilization, and Storage (CCUS):** Captures CO₂ emissions from steel plants, preventing them from entering the atmosphere.

Green hydrogen-based steelmaking alone has the potential to reduce emissions by **30–50% by 2050** , making it a game-changer in the industry ([IEEFA & JMK Research, 2024](#)).

• A.3. What This Report is Looking Into

This report provides an in-depth analysis of the state of green steel in **West Bengal**, focusing on:

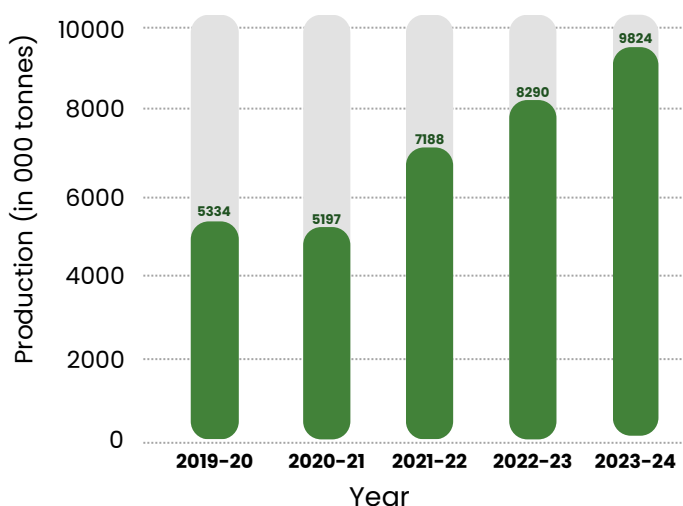
- The current state of steel production and emissions in West Bengal.
- Key industry players and their green initiatives.
- Government and industry association interventions.
- Challenges in green steel adoption.
- Opportunities for research, investment, and policy interventions.
- Comparison with national green steel strategies.
- Policy and industrial recommendations to facilitate the green transition.

B. Green Steel in West Bengal

• B.1. West Bengal Steel Industries

West Bengal, **India's sixth-largest economy**, had a GSDP of ₹14.44 lakh crore (US\$206.64 billion) in 2020-21, growing at 12.6% since 2015-16. Over 75% of its GVA comes from industries, manufacturing, and services. The state is a major hub for sectors like iron and steel, tea, leather, jute, and FMCG. **Steel production, concentrated in the mineral-rich western region, has grown significantly.** With the push for green steel and net-zero carbon emissions by 2070, an audit report explores the state's steel production landscape and sustainability efforts.

**Finished Steel production – West Bengal
(FY 2020 – FY 2024)**



• B.1.1. Major Organizations in the Steel Industry of Bengal

West Bengal is home to some of India's largest steel plants, with **Durgapur, Asansol, and Burnpur** being key industrial hubs. The state produces approximately **10% of India's total steel output**, making it a crucial player in the nation's transition to green steel (**Ministry of Steel, 2024**).

Key manufacturing organizations include - Tata Metaliks West Bengal, Jindal Steel and Power, Concast Steel & Power Ltd, Bengal Steel Industries Limited

- **IISCO Steel Plant (ISP), Burnpur** : A unit of SAIL, one of India's largest steel producers. ISP has been modernizing its production processes and incorporating **energy-efficient blast furnace operations** (**SAIL, 2023**).
- **Shyam Steel** : A major private sector player, achieving **GreenPro certification** for its sustainable practices. The company has been incorporating **energy-efficient rolling mills and waste heat recovery systems** (**Shyam Steel, 2025**).
- **Rashmi Group** : Actively researching **green hydrogen applications in steelmaking** and collaborating with various research institutions to explore **hydrogen-based DRI** (**WBPCB, 2022**).

• B.1.2. What is the Steel Industry Doing to Adopt Green Steel?

The steel manufacturers in West Bengal are implementing various measures to transition towards green steel production. These initiatives include adopting **hydrogen-based reduction technologies**, improving **energy efficiency**, and embracing **circular economy principles**.

Key manufacturing organizations include - Tata Metaliks West Bengal, Jindal Steel and Power, Concast Steel & Power Ltd, Bengal Steel Industries Limited

- **Hydrogen-Based Reduction** : Rashmi Group is at the forefront of implementing **hydrogen-based direct reduced iron (H₂-DRI)** processes, reducing reliance on **coal-based blast furnaces**. With West Bengal's **Green Hydrogen Policy 2023**, steel manufacturers are exploring partnerships to develop **hydrogen hubs** that can support the transition to green steel (**WB Power, 2023**).
- **Energy Efficiency Measures** : Companies like **Shyam Steel** and **IISCO Steel Plant** are integrating **waste heat recovery systems (WHRS)** and **solar-powered auxiliary systems** to improve energy efficiency. **Shyam Steel's recent investments in energy-efficient rolling mills** have resulted in an **18% reduction in overall energy consumption**, a significant step toward sustainability (**Shyam Steel, 2024**).
- **Circular Economy Approaches** : The **use of scrap steel** is becoming a key focus for reducing emissions. West Bengal-based steel plants are working to **increase the share of scrap-based production to 30% by 2030**, aligning with India's national strategy to enhance **electric arc furnace (EAF) usage**. **IISCO Steel Plant** has committed to using **recycled steel for at least 25% of its production by 2026**, significantly lowering its carbon footprint (**Ministry of Steel, 2024**).

- **Investment in Low-Emission Furnace Technologies : Shyam Steel and Rashmi Group** are actively modernizing their furnaces by introducing **oxygen injection systems and hybrid electric arc furnaces**, which can **reduce CO₂ emissions by 40% compared to conventional coal-fired furnaces**. These innovations are expected to set the stage for large-scale adoption of **green steel technologies** in the state ([Garg et al. 2023](#)).

By adopting these measures, West Bengal's steel manufacturers are moving toward sustainable production, ensuring compliance with national and international environmental goals. However, the widespread adoption of green steel still requires **policy support, financial incentives, and technological advancements** to become fully viable in the long term.

• B.2. Industry Associations Interventions

• B.2.1. Bengal Chamber of Commerce

The Bengal Chamber of Commerce and Industry ([BCC&I](#)) promotes ecological sustainability, decarbonization, and renewable energy in West Bengal's steel industry. It focuses on ESG, renewable energy, and green hydrogen (BCC&I, 2024). BCC&I facilitates policy advocacy, outreach programs, and industry discussions while supporting green startups through the WEBEL-BCC&I Tech Incubation Centre. Its Blue Carbon Credit project aims to plant 14 million mangroves in the Sunderbans. Events like the Sustainability Summit foster industrial sustainability, while SAIL contributes through ESG compliance, waste management, and climate initiatives.

• B.2.2. WBIDC (West Bengal Industrial Development Corporation)

West Bengal Industrial Development Corporation (WBIDC) supports industrial infrastructure and green steel initiatives in the state. It has developed industrial parks like the 432.29-acre Plasto Steel Park in Bankura and a 1,458-acre park in Panagarh for steel and plastic industries ([WBIDC, 2024](#)). **Iron and Steel Parks are being established in Kharagpur and Guptamoni to enhance green steel production (WBIDC, 2024)**. WBIDC promotes energy efficiency, **increased scrap utilization**, and green product standards to support net-zero emissions by 2070. It encourages investments in sustainable steelmaking through infrastructure, renewable energy integration, and policy incentives (WBIDC, 2024). Additionally, WBIDC facilitates collaborations between steel companies and technology providers to accelerate the adoption of cleaner production processes. With West Bengal's strategic location near ports and raw material sources, WBIDC also focuses on skill development to support green steel manufacturing.

• B.2.3. CII (Confederation of Indian Industry)

The Confederation of Indian Industry ([CII](#)) supports green steel initiatives in West Bengal through **GreenPro certification**, promoting environmentally responsible production. Shyam Steel's Angadpur and Mejia plants have received this certification. CII collaborates with WWF-India in the India Green Steel Coalition to promote renewable energy in steelmaking. It also advocates for energy-efficient technologies and partners with producers like Tata Steel. The **Steel Summit 2024** fostered industry discussions on sustainability, while efforts with WWF aim to cut steel's carbon intensity by 30% by 2030.

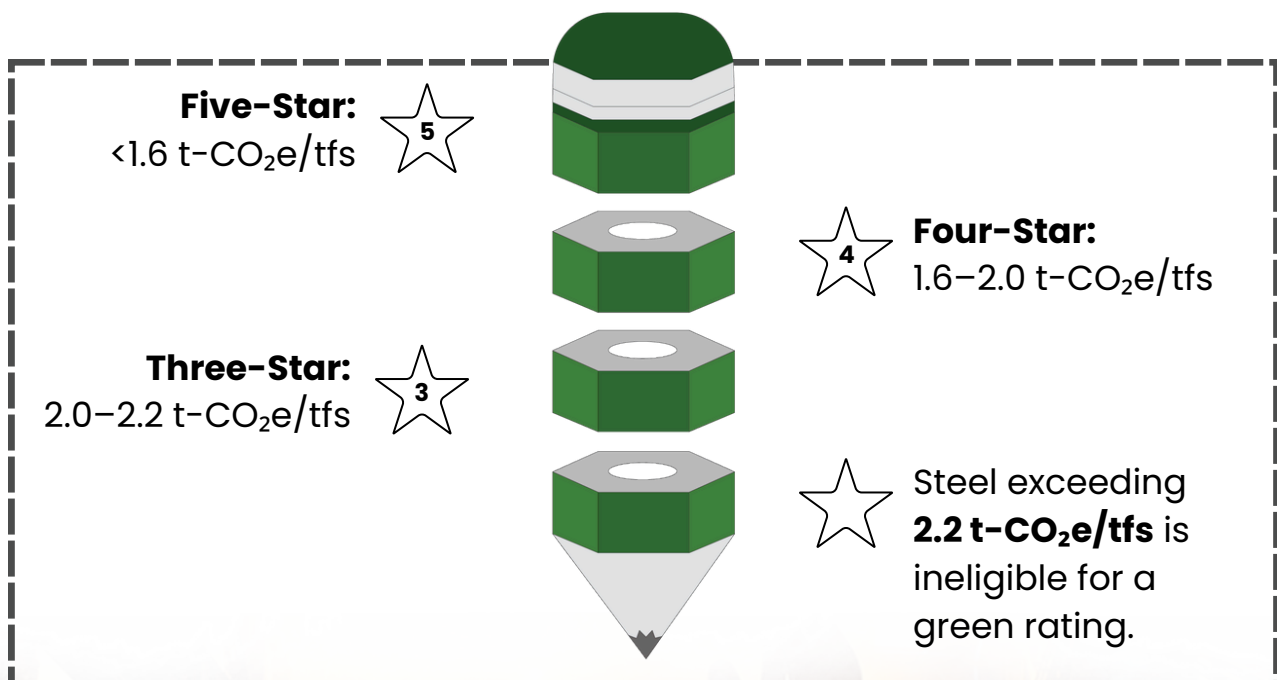
C. Green Steel in India

• C.1. Green Steel Taxonomy

India released its Green Steel Taxonomy on December 12, 2024 (PIB Delhi, 2024c), aligning with its net-zero emission intensity target by 2070. The taxonomy defines "Green Steel" based on emission intensity and assigns star ratings to promote low-emission steel production.

• Definition and Rating System

- Green Steel is defined as steel produced with CO₂ equivalent emissions below **2.2 tonnes per tonne of finished steel (tfs)**.
- The "**greenness**" is expressed as a percentage, reflecting how much emissions fall below the threshold.
- Star ratings are assigned based on emission intensity:



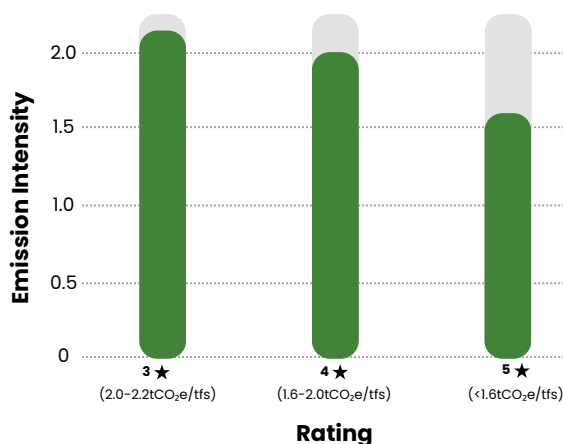


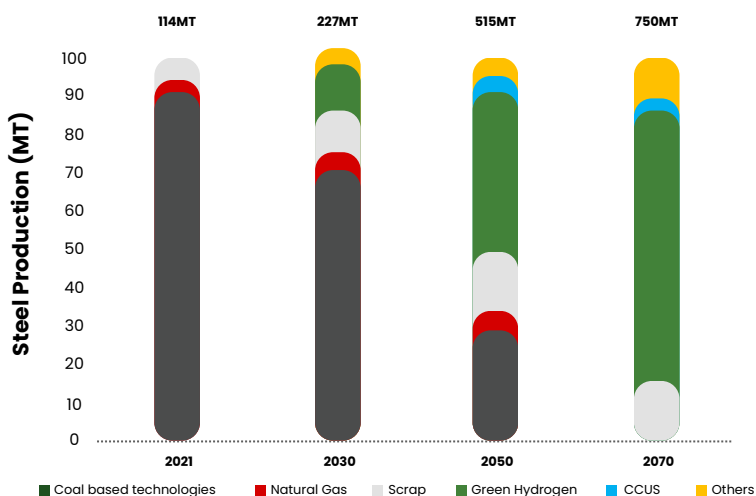
Figure: Green Steel Taxonomy
Source: Gulati, 2024

➤ Thresholds will be reviewed every three years.

C.2. Green Steel Mission

The Government of India is advancing steel sector decarbonisation through the **Green Steel Mission**, with an estimated budget of ₹15,000 crore. This mission includes a **PLI Scheme for Green Steel**, renewable energy incentives, and mandates for government agencies to procure green steel. The **National Green Hydrogen Mission**, led by MNRE, integrates the steel sector, with ₹455 crore allocated for pilot projects until FY 2029–30. Key projects include producing Direct Reduced Iron (DRI) using 100% hydrogen and hydrogen injection in blast furnaces to reduce coal consumption.

A **Steel Scrap Recycling Policy** enhances resource efficiency, while the **Taxonomy of Green Steel** (released on December 12, 2024) defines standards for low-emission steel and establishes green star ratings. The taxonomy supports green steel production, market creation, and financial assistance. The **"Greening the Steel Sector in India"** roadmap, based on recommendations from 14 task forces, was released on September 10, 2024, outlining actionable decarbonisation strategies.



Source : Industry Reports, JMK Research

Note : Coal Based Technologies include EAF, BF and BO, Others can include Molten Oxide Electrolysis, Electrowinning etc.

Figure: Percentage Share of Different Technologies in Steel Production by 2070

Source: IEEFA & JMK Research (2024)

D. Recommendations

• D.1. For the Industry

India released its Green Steel Taxonomy on December 12, 2024 (PIB Delhi, 2024c), aligning with its net-zero emission intensity target by 2070. The taxonomy defines "Green Steel" based on emission intensity and assigns star ratings to promote low-emission steel production.

- a. **Transition to Low-Carbon Steelmaking Techniques** : Steel industries, especially small industries, can start their green steel journey as pilots by establishing hydrogen-based DRI plants, partnering with hydrogen supply companies and collaborating with other steel-making organisations.
- b. **Modernisation of old steel plants**: By investing in electric arc furnaces, the stalwart manufacturers of Bengal can modernise and reduce their carbon imprint.
- c. **Recycle Scrap Steel** : This is one of the best options for the steel industry of Bengal to reduce its carbon footprint. The supply of scrap steel is very much evident in the industrial zones of Howrah and Durgapur. Through this enhancing circular economy and raw material efficiency can be achieved. A mandatory scrap usage target can be set up.
- d. **Carbon Capture, Utilization, and Storage (CCUS)** : Steel industries, especially small industries, can start their green steel journey as pilots by establishing hydrogen-based DRI plants, partnering with hydrogen supply companies and collaborating with other steel-making organisations.
- e. **Renewable energy integration in the steel plants** : from solar to wind, waste heat recovery systems to combined heat and power systems can be implemented in the steel mills of Bengal based on their location, size and accessibility of energy sources and demand.

• D.2. For the Government

- a. **Policy and Regulations** : The government can think about mandating low-carbon steel production through Green Hydrogen subsidies, a Hydrogen Purchase Obligation (HPO), and a Green Steel Procurement Policy. A state-level Green Steel Policy in West Bengal in line with the central policy can drive regional adoption, while carbon trading mechanisms can provide financial incentives.
- b. **Financial Support** : There is a need for a PLI scheme, green bonds, and low-interest loans to support hydrogen-based DRI, EAF, and CCUS technologies in the green steel sector. West Bengal can offer electricity tariff subsidies and tax breaks for industries investing in green steel. Establishing a Green Industrial Zone in Durgapur and Asansol will attract investments.
- c. **Infrastructure and Renewable Energy** : Developing hydrogen hubs, storage systems, and solar-wind hybrid parks will ensure a clean energy supply. In West Bengal, a Green Hydrogen Cluster in Durgapur and floating solar projects on the Damodar River can provide direct power to steel plants.

- d. **R&D and Workforce Development** : A Green Steel Innovation Fund should support research in hydrogen steelmaking and energy-efficient processes. Collaborations with IITs and the National Metallurgical Laboratory (NML) can drive innovation. A Centre of Excellence for Green Steel at prominent research institutes and technical training in Durgapur and Asansol will build a skilled workforce.
- e. **Market and Competitiveness** : A Green Steel Certification System and alignment with Europe's Carbon Border Adjustment Mechanism (CBAM) will enhance global trade. Incentives for MSMEs in West Bengal's engineering sector will promote domestic adoption and international competitiveness.

• D.3. For the Researchers

- a. **Breakthrough Technologies for Green Steel** : Researchers should focus on next-generation steelmaking techniques, including hydrogen-based Direct Reduced Iron (DRI), plasma reduction, and molten oxide electrolysis. Innovations in biomass-derived reducing agents and ammonia-based hydrogen carriers could revolutionize fossil-free steel production. Developing advanced catalysts for more efficient hydrogen reduction will also be crucial.
- b. **Material Circularity and Scrap Utilization** : With India's scrap steel market set to grow, researchers must explore AI-driven scrap sorting, alloy recovery, and secondary steel purification. Developing ultra-low-emission scrap melting techniques using solar thermal energy or microwave-assisted metallurgy could offer energy-efficient alternatives.
- c. **Green Hydrogen Infrastructure and Storage** : Green hydrogen's cost remains a challenge—research should prioritize breakthrough electrolyzer designs, solid-state hydrogen storage, and synthetic gas blends for hybrid fuel use. Cryogenic hydrogen transport and ammonia cracking technologies could make hydrogen-based steelmaking more viable for India.
- d. **Geospatial Research and Industrial Planning** : Identifying ideal green steel production zones in West Bengal, such as Durgapur, Asansol, and Burnpur, based on the availability of industrial ecosystems and low cost open access to renewable energy, is essential. CCUS feasibility studies, mining waste repurposing, and land-use optimization for solar-wind hybrid parks should guide sustainable steel clusters.
- e. **AI, IoT, and Smart Manufacturing** : Industry 4.0 solutions can redefine green steel production. Researchers should work on AI-powered process control, real-time carbon footprint tracking, and digital twins for energy optimization in steel plants. Predictive maintenance using machine learning can also extend the lifespan of green steel infrastructure.
- f. **Economic Models and Policy Research** : Developing cost-reduction pathways for green steel adoption, such as carbon credit mechanisms, impact bonds, and dynamic pricing models, is crucial. Researchers should also explore trade competitiveness under CBAM, policy incentives, and financing structures for first movers in green steel.
- g. **Skill Development and Knowledge Transfer** : Universities should create specialized curricula in green metallurgy, hydrogen technology, and sustainable industrial design. Collaborations between IIT Kharagpur, NML, and global research hubs can accelerate innovation. Hands-on training with green steel pilot plants will ensure the next generation of metallurgists is industry-ready.



E. Conclusion & Way Forward

The transition to green steel is a critical step toward sustainable industrialization and India's long-term decarbonization strategy. As one of the highest carbon-emitting sectors, steel production must shift to low-carbon alternatives to align with India's net-zero target by 2070. West Bengal, with its strong steel manufacturing base, has the potential to become a leader in this transformation.

The state's major steel producers, including IISCO, Shyam Steel, and Rashmi Group, are adopting cleaner technologies such as **hydrogen-based Direct Reduced Iron (H₂-DRI)**, **Electric Arc Furnace (EAF)**, and **waste heat recovery systems** to lower emissions. Industry bodies like BCC&I, WBIDC, and CII are driving policy support, financial incentives, and market facilitation. However, challenges such as **high capital investment**, **technological gaps**, and **regulatory limitations** must be addressed for large-scale adoption.

A sustainable green steel ecosystem requires a multi-stakeholder approach, integrating **renewable energy**, **circular economy principles**, and **national policies like the Green Hydrogen Mission**. By fostering collaboration between industry, government, and research institutions, West Bengal can emerge as a **hub for low-carbon steel production**, strengthening economic resilience while contributing to national and global climate goals.

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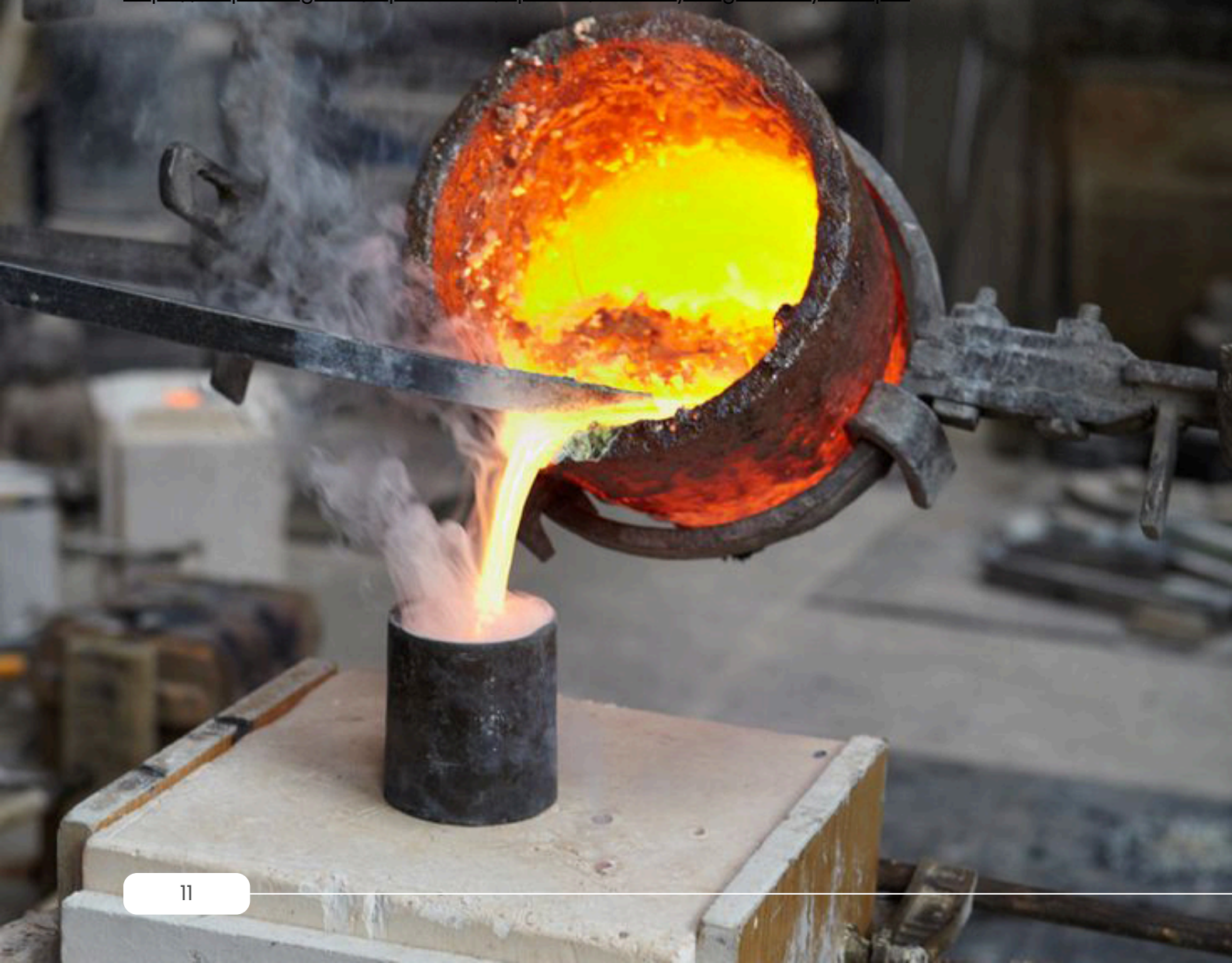
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