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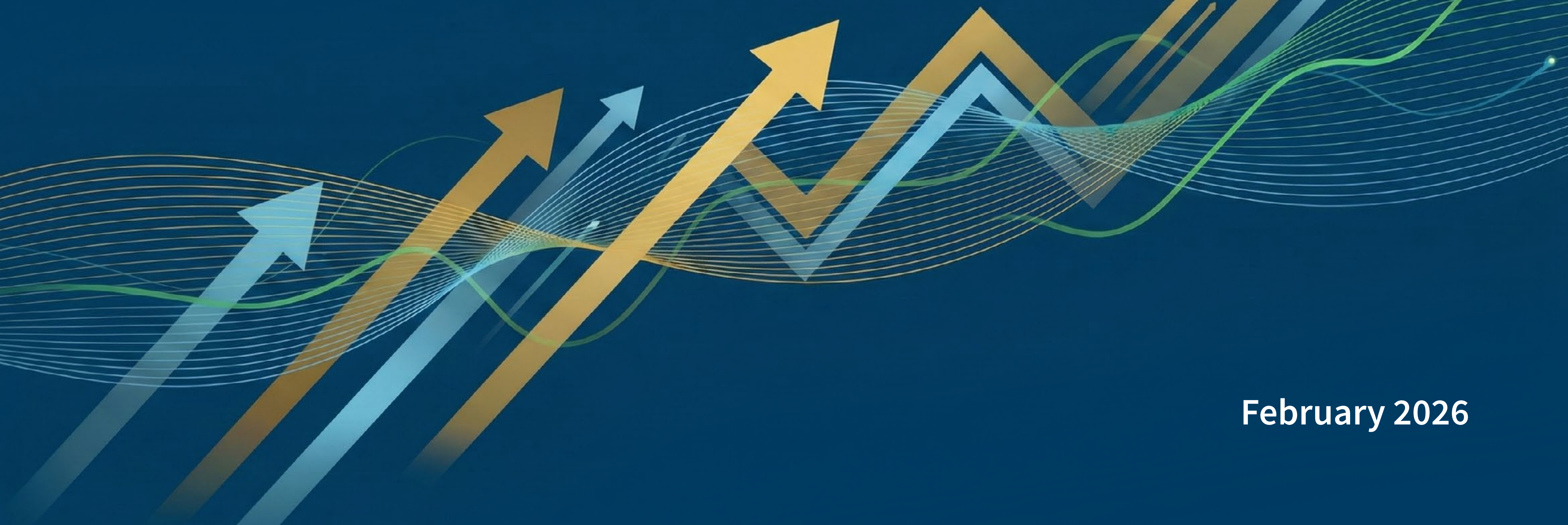
An Introduction to Corporate Transition Assessments in India

A guide for bankers to assess the transition risks and opportunities of companies



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About the Organisations

Rocky Mountain Institute, or RMI, is an independent, nonpartisan nonprofit founded in 1982 that transforms global energy systems through market-driven solutions to secure a prosperous, resilient, clean energy future for all. In collaboration with businesses, policymakers, funders, communities, and other partners, RMI drives investment to scale clean energy solutions, reduce energy waste, and boost access to affordable clean energy to enhance security, economics and improve people's livelihoods. RMI is active in over 50 countries. RMI has been supporting India's mobility and energy transformation since 2016.

Climate Policy Initiative is an analysis and advisory organization with deep expertise in finance and policy. Our mission is to help governments, businesses, and financial institutions drive economic growth while addressing climate change. CPI has seven offices around the world in Brazil, India, Indonesia, South Africa, the United Kingdom, and the United States.

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Disclaimer

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About this guide

This guide provides insight into why and how to conduct corporate transition assessments, using a case study of a leading primary steel producer

This guide has been developed jointly by RMI and the Climate Policy Initiative (CPI) India to provide bankers with an India-specific case study of how to use the corporate transition assessment (CTA) framework in India. The assessment benefits from being region- and sector-specific; thus, this playbook has been designed for the steel sector in India.

What does the guide cover?

- Step-by-step outline and guidance on how to conduct a CTA
- Real-world case study of a leading primary steel producer (hereafter identified as Company X)
- Insights into the dynamics of the steel sector in India and the breakdown of the dependencies associated with each steel decarbonisation lever in India from a technology, market, and policy point of view

How is the guide structured?

The playbook is organised into five sections. Section 1 introduces the need for a CTA. Section 2 outlines the methodology and provides guidance on how to conduct a CTA. Section 3 provides a walkthrough of a CTA with a case study covering the key insights of the CTA results for Company X. Section 4 briefly discusses what is needed for CTAs to be mainstreamed. Section 5 includes detailed appendices covering the in-depth CTA of Company X and a primer on the decarbonisation of India's steel sector, which provides a background for the CTA case study and helps bankers develop a broader perspective on how the sector is evolving.

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FOREWORD

Shri Ravindra Singh Negi
(FRM, SCR, CAIIB, PGDBF)
Group Chief Risk Officer
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India's journey to net zero by 2070 will depend in significant part on how effectively we transition our hard-to-abate sectors. Steel, cement, chemicals, and other heavy industries form the backbone of our economy, yet they also represent some of our most significant decarbonisation challenges. As financiers, we cannot afford to rely solely on historical data when the future demands forward-looking insight. Understanding how our clients in these sectors are positioned — their vulnerabilities, strategies, and readiness — is no longer optional but essential to responsible banking.

This is one of the key reasons why Corporate Transition Assessments (CTAs) matter. The CTA framework presented in this report offers Indian banks a structured, decision-useful approach to evaluate client transition readiness across three critical dimensions: strategy and ambition, feasibility, and accountability. What distinguishes this framework is its emphasis on asset-level analysis, forward-looking investment alignment, and dependency mapping — tools that allow us to move beyond surface-level disclosures and understand the granular realities of how companies are evolving. The insights generated through the application of this framework are not intended solely for compliance; they can inform risk management, shape business development, and guide meaningful client engagement.

At Bank of Baroda, we are laying a strong foundation in this space and have committed to achieving net-zero emissions by 2057. We have established a strong governance structure and implemented dedicated frameworks with defined targets to channel finance towards transition. Our sustainable finance portfolio, spanning solar financing, green hydrogen lending, energy-efficient projects, and clean transportation, supports India's clean energy ambitions. Our bank remains committed to raising awareness and building capacity not just across the bank and its group entities, but also across our value chain partners. We believe that the key to reaping the full benefits of transition planning and implementation lies in successful collaboration.

It is encouraging to see RMI and the Climate Policy Initiative collaborate on this playbook as a practical, actionable guide for Indian banks. We look forward to applying these insights and see clear potential for this framework to add value across the Indian banking industry.

Shri Ravindra Singh Negi
Group Chief Risk Officer
Bank of Baroda

Section 1

The Value of Corporate Transition Assessments

The Reserve Bank of India (RBI) is increasingly signalling the need for Indian banks to more deeply integrate climate in risk assessments and financing strategy

2021

Establishment of Sustainable Finance Group

2022

Discussion paper on climate risk and sustainable finance

2023

Release of green deposit framework

First sovereign green bond issuance

2024

Announcement of Climate Risk Information System: *RBI announced that it is working to build a national platform that will aggregate climate physical and transition risk data for financial institutions*

Draft disclosure framework for climate-related financial disclosures: *Requires banks to disclose climate action plans including information regarding financed emissions targets and climate risk assessment*

2025

Regulatory sandbox on sustainable finance: *RBI announced the creation of an on-tap cohort to test new sustainable finance solutions and recently put out a call for tech-enabled climate solution providers*

Draft Expected Credit Loss Framework: *The draft ECL guidelines, while not explicitly referring to climate risks, enable banks to consider forward-looking climate-related factors — such as physical or transition risks — when estimating expected credit losses*

Draft Standardised Approach Directions: *These directions state that the banks may give proper consideration to climate-related financial risks as part of the counterparty due diligence*

Type of RBI action

- Increasing green finance flows
- Ensuring appropriate climate risk assessment
- Ensuring overall climate-aligned banking

There is also growing market pressure for banks to align themselves with the green transition as India's domestic policy continues to gain momentum

Landmark climate finance regulations around disclosures, carbon markets, and labelling have been released or are being developed, creating a favourable market for climate-aligned businesses. Key sectors are undergoing a green transition, creating a positive business environment for corporations to move towards low-carbon businesses.

Securities and Exchange Board of India	Strengthened **Business Responsibility and Sustainability Reporting** disclosures; issued guidance for social, sustainability, and sustainability-linked bonds (SLBs)	**Progress**: Half of India's installed power capacity now comprises non-fossil fuel sources; however, clean energy accounts for <30% of electricity.[i, ii] **Looking ahead**: To boost renewable energy integration, the Ministry of Power has laid out INR5,400 crore (cr) of viability gap funding (VGF) to support 30 gigawatt-hours (GWh) of battery energy storage systems and is expected to mobilise INR33,000 cr in investments.[iii]
Ministry of Finance	Developing a **climate finance taxonomy** covering power, mobility, industrial sectors (steel, iron, cement), buildings, and agriculture/food/ water security	**Progress**: As of October 2025, electric vehicles (EVs) have reached 8.58% sales penetration, with 60.45% for three-wheelers, but there are low penetration rates across other segments.[iv] **Looking ahead**: To meet the 30% target by 2030, penetration would need to increase by 22%. To support this, the INR10,900 cr PM Electric Drive Revolution in Innovative Vehicle Enhancement (E-DRIVE) scheme was released in 2024.[v]
Ministry of Power and Ministry of Environment, Forest, and Climate Change	Operationalised the voluntary carbon market and **Carbon Credit Trading Scheme (CCTS)**; set emissions targets for hard-to-abate sectors	**Progress**: Decarbonisation targets have been set by large industrial groups like TATA Steel, JSW, and Aditya Birla, which will have knock-on effects on suppliers. **Looking ahead**: There are signs of a large Green Steel Mission currently being developed,[vi] the INR19,744 cr Green Hydrogen Mission is already operational,[vii] and there is a INR1,000 cr ADEETIE programme for medium, small, and microenterprise energy efficiency, demonstrating sustained policy commitment to industrial decarbonisation.[viii]

Source: (i) "India's Renewable Energy Capacity Achieves Historic Growth in FY 2024-25," Press Information Bureau (PIBP), 2025; (ii) "Share of Clean Energy in India's Electricity Less Than 30%," *The Hindu*, 2025; (iii) *VGF Scheme Expands to Support 30 GWh of New Standalone BESS Development in India*, JMK Research & Analytics, 2025; (iv) EV Vahan dashboard; (v) *EVs in India*, NITI Aayog, 2025; (vi) "IMPLEMENTATION OF THE GREEN STEEL MISSION", PIB, 2025; (vii) *Augmenting the National Green Hydrogen Mission*, Council on Energy, Environment and Water, 2025; (viii) "ADEETIE," Bureau of Energy Efficiency (BEE).

In response, banks are building climate governance structures and fundamental climate capabilities like financed emissions measurement and scenario analyses

28

Banks that have set up dedicated committees/ policies to oversee climate risk management[i]

13+

Banks that are using or initiating the use of climate scenario analysis to inform their strategy[i]

12

Banks that are signatories to the Partnership for Carbon Accounting Financials (PCAF),[ii] launched recently in India to support accurate measurements of financed emissions

Discussions with banks across the spectrum reveal that most large public and private sector banks have proactively begun establishing climate policies and developing systems to measure physical climate risks. In contrast, many midsized and smaller financial institutions are still in the early stages of their climate risk management journey and are waiting for further guidance from the RBI before taking stronger action.

Source: (i) *Anusha Das and Sagar Asapur, Unprepared III: India's Banks Moving Too Slowly In The Face Of Climate Crisis*, Climate Risk Horizons, 2024; (ii) "PCAF launches India chapter New India hub responds to growing calls for guidance and harmonization on Scope 3 emissions reporting from country's financial institutions", Partnership for Carbon Accounting Financials (PCAF), 2025.

Looking ahead, banks need to understand how their companies may be affected by the climate transition to accurately plan for transition risks and opportunities

By answering some of the following fundamental questions about their companies ...

? To what extent is the company vulnerable to transition risk over the short, medium, and long term, based on its current business lines, assets, and transition drivers in its key geographies of focus?

? How could the company strategy evolve in terms of production, geographies, key customers, and so on, to manage risk under different transition scenarios?

? What effort is the company making, if any, to decarbonise and align itself with the green transition; what needs to be true for that to happen; and how likely is that scenario?

... banks can identify key insights to inform their own climate risk and financing strategy

Identify assets and companies in the bank's portfolio that are most vulnerable to transition risk

Inform realistic stress testing and scenario analysis to identify how high-carbon companies/ assets could create material financial or reputational risks

Spotlight opportunities for the bank to design and develop transition finance products to support companies making low-carbon investments

Enable the bank to develop transition risk management strategies, company and sectoral financing strategies, and an internal decarbonisation strategy that is grounded in a deep understanding of the bank's portfolio

Source: *Creating Transition Intelligence*, RMI, 2025.

The corporate transition assessment (CTA) is a due diligence framework that can help banks surface the insights needed to accurately plan for transition risks and opportunities.

This involves assessing the extent to which a company or investee will be affected by the green transition; understanding the strategies available to the company to decarbonise its operations based on market, policy, and technological feasibility; and assessing how the company's current and planned actions may reduce or increase its exposure to transition risk over time.

The CTA differs from other ratings and assessment approaches due to its focus on asset-level analysis and feasibility mapping of decarbonisation efforts

Key elements of a CTA	Description	Value for financial institutions
Asset-level analysis of the corporation's production capacity	A granular assessment of the company's key business lines, geographies, and assets to identify the most financially and environmentally material assets.	It helps financial institutions identify a company's most financially and environmentally significant assets, and the assets most vulnerable to climate risk; understand potential decarbonisation pressures based on the company's technology and region; and gain deeper insights into the company's transition exposure.
Assessment of investments and asset pipeline for alignment with transition needs	An assessment of the extent to which companies are well positioned to respond to transition drivers based on the investments they are making in decarbonisation and their alignment with external benchmarks.	It helps financial institutions better assess how a company's efforts align with its ambitions and external benchmarks, such as scenarios, industry pathways, and peer efforts. This helps to surface any potential reputational risks due to misalignment and to clarify how the company's market position may evolve over time, while also identifying potential transition risks or opportunities stemming from the company's actions.
Mapping market, policy, and technology factors influencing the corporation's decarbonisation	An analysis of external constraints — such as technological readiness, market conditions, and policy support — to gauge the feasibility and timelines of transition.	It allows financial institutions to evaluate whether a company's targets are feasible and to identify potential barriers, even if no formal targets are set. This insight helps financial institutions understand the likely progression of the company's transition journey and guides their overall strategy to support the company.

Source: *Creating Transition Intelligence*, RMI, 2025.

CTAs can unlock several sources of value for the bank — from surfacing transition risks and opportunities in the loan book to supporting in regulatory disclosures (1/2)

Bank functions	How a CTA informs internal processes/ functions of a bank	How internal processes/guidelines of a bank can shape the CTA	Implications
Sustainable finance/ environmental, social, and governance (ESG)	• Aggregating CTAs across companies would help banks assess alignment of their portfolio with internal or international sustainability frameworks. • Can inform the design of green/transition finance products tailored to sectoral transition needs. • Enables integration of transition insights into lending policies and risk management frameworks.	• Banks' internal sustainable finance frameworks and decarbonisation targets can define the metrics and granularity of CTA analysis. • Availability of sectoral lending data and sustainable finance taxonomies can influence the quality of portfolio-level CTA results.	• Enhances portfolio-level visibility on associated transition risks and guides frameworks for risk management. • Strengthens the bank's sustainable finance strategy and helps set credible net-zero targets. • Supports disclosures under Business Responsibility and Sustainability Reporting (BRSR)/Task-force on Climate-related Financial Disclosures (TCFD) and provides evidence for labelled transition finance.
Risk management	• Reveals financial and transition risks emerging from companies' pathways — such as exposure to stranded assets or compliance costs (e.g., carbon border adjustment mechanism [CBAM]). • Informs climate risk stress-testing, scenario analysis, and integration into internal risk rating models. • Supports proactive risk mitigation and portfolio-level monitoring.	• The sophistication of a bank's risk management systems can shape how CTA data is interpreted (e.g., whether risks are modelled qualitatively or quantitatively) and guide the depth and breadth of a CTA. • Risk management frameworks can guide the weight assigned to transition risks in credit evaluation.	• Enables early identification of transition-related portfolio risks. • Strengthens internal climate risk modelling and stress-testing capabilities. • Helps recalibrate sectoral risk appetites and capital planning.
Credit assessment	• Adds a forward-looking dimension to credit analysis by factoring in a company's decarbonisation strategy, capital expenditure (capex) plans, and technology choices. • Can inform sectoral credit strategies and future product design.	• Credit policies may determine how CTA findings feed into credit scoring and loan structuring.	• Enables smarter credit decisions, balancing transition risk with opportunity. • Supports design of financing structures aligned to company transition plans.

CTAs can unlock several sources of value for the bank — from surfacing transition risks and opportunities in the loan book to supporting in regulatory disclosures (2/2)

Bank functions	How a CTA informs banking operations	How bank operations shape CTA insights	Implications
Business development	• Identifies and documents transition plans of existing and prospective companies. • Uncovers cross-selling or new business opportunities linked to companies' transition journeys. • Deepens and strengthens company engagement by communicating transition expectations more effectively. • Arrives at loan pricing aligned with a company's transition risk profile.	• Enhance CTA accuracy and comprehensiveness by facilitating data gathering and company engagement. • Anchor point for communicating CTA-level data to other bank functions, thereby enhancing the robustness of the CTA. • Guide the depth of the CTA based on the potential impact and relevance of the company and company data availability.	• Deepens company relationships by positioning the bank as a transition partner. • Enables business teams to design company engagement strategies aligned with low-carbon pathways. • Supports the development of a proactive and opportunity-oriented business development strategy.
Product development and policy design	• Designs or recalibrates products and policies aligned with company and sector transition pathways. • Tracks decarbonisation progress at the product or portfolio level. • Defines internal limits and guidelines based on portfolio-level transition performance.	• Ensure product and policy frameworks feed back into CTA data models and sectoral benchmarks. • Establish standardised templates and indicators that feed into CTA design. • Refine CTA parameters by incorporating market intelligence and policy updates.	• Ensures product design and policy decisions remain responsive to changing transition dynamics. • Helps align financial products with both company needs and sectoral transition movements. • Guides the bank towards developing an adaptive and credible sustainable finance product suite.
Compliance	• Uses company and portfolio-level transition data to provide the basis for the bank's own decarbonisation efforts in alignment with regulatory or voluntary disclosures. • Ensures product portfolios adhere to evolving compliance and sustainability reporting frameworks. • Builds consistency between internal assessments and external reporting.	• Align CTA outputs with disclosure requirements (BRSR, TCFD, or regulatory guidance).	• Enables transparent, data-backed reporting on transition risks and financed emissions. • Strengthens the credibility of the bank's climate-related disclosures. • Positions the bank as compliant and forward-looking amid evolving regulatory expectations.

Section 2

Guidance on Conducting CTAs

Based on pilots and engagements with global banks, we have developed a framework to help banks gain actionable insights into corporate transitions

1 Strategy and ambition

Helps the bank identify the extent to which the company is exposed to transition risk and how, if at all, its decarbonisation strategies may mitigate the same

Transition vulnerability

Identify the company's key business lines, geographies, assets, technologies, and emissions hotspots and assess its vulnerability to transition drivers

Strategy assessment

Identify and assess the company's strategy for responding to transition drivers

2 Feasibility

Examines the feasibility of the company's efforts to transition based on its financial capability, its investments, and the techno-economic readiness of key decarbonisation levers

Investment alignment

Identify whether the company has the financial capacity to transition and the extent to which its investments align with its strategy and ambition

Dependency mapping

Identify key decarbonisation levers, and map policy, technology, and market dependencies, as well as the financial implication of a company's own transition efforts

3 Accountability

Examines the company's intention to decarbonise based on the governance and transparency mechanisms it has implemented

Governance

Assess the extent to which the company has allocated responsibility for decarbonisation across the organisation

Transparency

Assess the coverage and quality of the company's emissions measurement and reporting

Key components of the CTA

This guide focuses primarily on the first two pillars. Accountability considerations are addressed through existing governance and disclosure frameworks such as the LSE Transition Pathway Initiative, TransitionArc, and ESG ratings.

Source: *Creating Transition Intelligence*, RMI, 2025.

CTAs make sense for priority companies or transactions given that they are both time and resource intensive

CTAs should be done for companies that are most financially and environmentally material for the bank; these may include high-emissions companies that are already part of the bank's portfolio, or companies to which the bank may be considering extending new lines of finance.

Financial exposure of the bank (↑)

Low priority: Companies to which the bank has significant exposure and that are non-emissions-intensive or environmentally friendly in nature. These are not suitable targets for CTAs because the associated transition risk may be lower due to the adoption of green technology. However, these companies will be key for the bank as it reduces the emissions intensity of its portfolio.	**High priority:** Emissions-intensive companies in sectors such as power, steel, cement, and other hard-to-abate industries to which the bank has significant exposure are of primary interest for conducting a CTA.
Low priority: Companies to which the bank has limited exposure and that are non-emissions-intensive or environmentally friendly are not suitable targets for CTAs.	**Medium priority:** Emissions-intensive companies in sectors such as power, steel, cement, and other hard-to-abate industries to which the bank might have limited exposure. These could be systemically important firms whose activities affect the bank's companies. Additionally, these may include companies to which the bank provides customer or supplier financing.

Emissions-intensive sector (→)

Banks can also apply additional filters to identify strategic opportunities for conducting a CTA:

1. **Companies that may be affected by new regulations:** Companies or sectors significantly affected by new sustainability-focussed regulations (e.g., carbon market mechanisms, changes in Renewable Purchase Obligations, climate finance taxonomy).
2. **Companies that are transition market leaders that the bank wants to engage with more deeply:** Companies that are proactively advancing transition efforts and are open to transition finance.
3. **Companies that the bank is looking to onboard:** Companies not currently in the bank's portfolio but of strategic interest, where climate-aligned offerings can create a differentiated value proposition.

A CTA requires a wide range of data points from company financials and emissions data, to policy and market research

Company data	**Financial metrics** (revenue, EBITDA, etc.) disaggregated by business lines, geographies, and assets
	Production data by asset including production capacity, actual production, technology used, fuel, and electricity sources
	Emissions data (absolute and intensity for key business lines, geographies, and assets), Scopes 1 and 2 required
	Expansion and Investment data including capex allocated to brownfield and greenfield expansion and R&D, details of announced expansion including location, production capacity, type of technology, etc.
	Decarbonisation strategy data including formal and informal targets, decarbonisation levers to be used and pathway
External data	**Policy environment:** Details of national-and state-level policies promoting decarbonisation in the company's key sectors, or policies creating transition pressure for the company's key offtakers (subsidies, schemes, targets, penalties, etc.)
	Scenario data: Sectoral data from net-zero scenarios showing sectoral shifts in demand, production volumes, technology, emissions, and more, derived from national and global pathways
	Peer data: Production data and technology by asset, emissions data, decarbonisation pathway, and expansion and investment data
	Market data: Data on technical and commercial feasibility of key decarbonisation levers, preferably at a state or district level to appropriately map to company's assets

For companies above a certain size, public disclosures can be used at various stages to pull together data

Potential data sources

Step 1

Assess the company's transition vulnerability

- **Annual report/integrated report**: Review to understand the company's core revenue streams and assets, as well as any comments on transition pressures
- **Environmental clearances**: Identify any specific asset-level technologies and emissions figures
- **BRSR**: Examine disclosures on Scope 1 and 2 greenhouse gas (GHG) emissions (and Scope 3, if available)
- **Sector reports/policies**: Gauge the strength and timing of transition drivers due to changes in policy, market preferences, and technology shifts

Step 2

Identify and assess the company's transition strategy

- **Integrated report/climate report/transition plan**: Identify any soft or hard climate targets and strategies articulated by the corporation
- **Environmental clearances**: Identify any specific climate-related targets set at an asset level

Step 3

Assess the alignment of the company's investments

- **Integrated report/annual report/press releases**: Map out corporation-level expansion plans and investments in decarbonisation, as well as details on operational changes being made
- **Environmental clearances**: Examine asset-specific decarbonisation investments

Step 4

Map the company's dependencies on policy, market, and technology factors

- **Sector reports**: Break down the key components of the company's decarbonisation trajectory and leverage market research to understand feasibility

Step 5

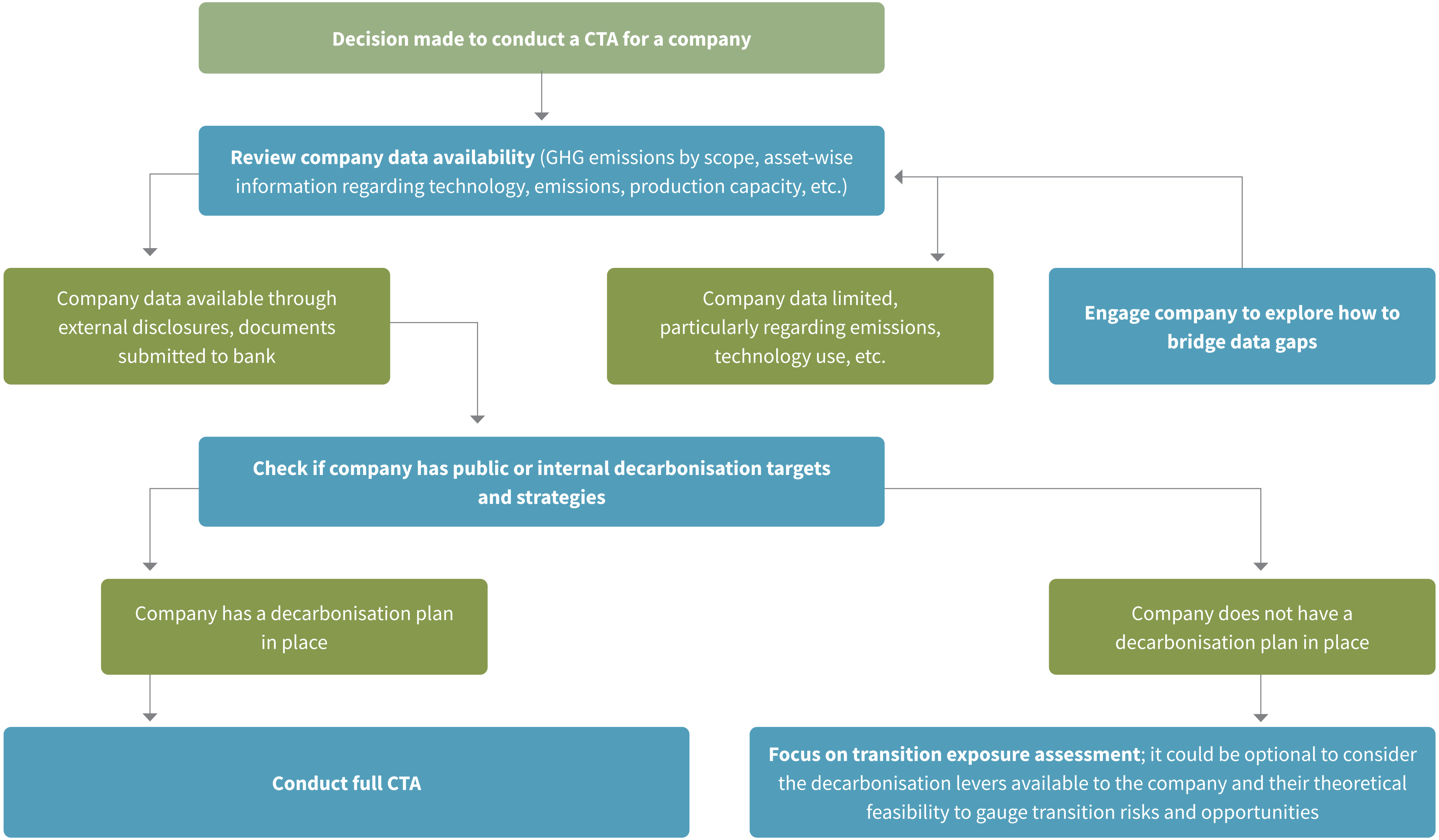
Assess the company's climate governance structure

- **TCFD and BRSR reports**: Evaluate the governance sections; can be used to evaluate a company's oversight and management of climate-related risks and opportunities

Third-party data sources such as Global Energy Monitor (GEM)* and S&P Capital IQ can also provide aggregated information on certain corporations for steps 1–3. GEM is particularly useful for finding aggregated data on asset-wise technology deployment for sectors such as steel and power.

*GEM provides asset-wise coverage of the power sector across fuel types, iron and steel, and cement, and provides data on the ownership structures of assets, as well as private equity flows.

However, in case of inadequate data, engagement with the company will be necessary to take forward parts of the CTA



Section 3

Walkthrough: CTA of a Leading Indian Steel Producer

Disclaimer on CTA Methodology

The following pages are designed to illustrate the insights that can be gained from conducting a CTA for a steel company. Company X was chosen due to the large amount of public information available, which allows for a CTA based on secondary research.

The authors appreciate Company X for being a leader in this space and taking proactive strides to realise the green transition.

The analysis has been conducted using publicly available information and is accurate to the extent feasible. In specific analyses, asset-level data from the GEM has been utilised, which may differ from company figures. Plants have been labelled accordingly. Existing plants are EP 1, EP 2, etc. Announced plants are AP 1, AP 2, etc.

Banks have the option to engage companies directly, potentially giving access to more granular and up-to-date information. This also allows CTAs to be conducted for companies of different sizes and for those without clear and publicly available transition strategies or targets.

This analysis does not constitute a judgement of Company X and recognises that certain information may not be publicly available. Rather than focusing on gaps, it simply seeks to illustrate the process of a CTA and identifies what else may be done if international standards are ever applied in India.

The following section is complemented with detailed appendices that include an overview of the analysis and a section providing context on the Indian steel sector.

Strategy and Ambition

Step 1

Transition vulnerability: Map the company's business lines, geographies, and key assets to relevant transition drivers to gauge transition exposure

1 Company footprint

Develop a strong understanding of the company's current operations to better understand how transition drivers (policy, market, technology) may affect it as it currently stands

Key geographies	Identify the geographies (national/ subnational) that drive the company's production and sales, and emissions, and account for the company's critical inputs
Key business lines	Map the company's core business lines, dominant sectors, and major offtakers
Key assets	Map the company's current assets and identify the most financially and environmentally material ones

2 Transition exposure

Map the sectoral transition drivers and their impact on the company's revenues and costs in the short, medium, and long term

Policy exposure	Identify how national and subnational policies may incentivise the low-carbon transition in the company's dominant sectors
Market exposure	Understand how demand for the company's products or green alternatives may evolve with time
Technology exposure	Understand how shifts in production technology may introduce new competition in the market

Step 1 **Transition vulnerability:** Map the company's business lines, geographies, and key assets to relevant transition drivers to gauge transition exposure

Area of inquiry		Key questions
Company footprint 	Which of the company's products or services and geographies are most financially material?	1. What percentage of consolidated revenue and EBITDA does each product or service contribute? 2. What percentage of consolidated revenue and EBITDA does each geography contribute? 3. What is the nature of business within key geographies considering both production capacity and sales?
	Which business lines drive the company's emissions footprint?	1. What are the total Scope 1 + 2 and Scope 1+ 2 + 3 emissions of the company? 2. What percentage of emissions does each product/service and geography contribute? 3. For sectors producing final outputs (e.g., vehicles) or raw materials (e.g., steel, cement), which production assets contribute the most to the company's emissions and what is their expected lifetime?
	To what extent are the company's operations already decarbonised?	1. What is the emissions intensity per production unit of the company by-product or service? 2. What are the technologies that the company utilises for the production and distribution of its goods? 3. What are the emissions intensities of comparable peers and how do they stack up against the target company? 4. What is the total capex the company has spent or committed thus far on decarbonisation efforts?
Transition exposure 	Is the company exposed to meaningful domestic pressure to decarbonise?	1. What regulatory pressures exist, such as a national vision to decarbonise, mandatory carbon rating schemes, industrial decarbonisation mandates, or green development plans? 2. Are the company's customers demanding low-carbon products due to voluntary commitments or mandates placed on them? 3. Will the company's offtakers need to pay a premium for the target company's products and will they be willing to pay? 4. What is the likely timeline for these pressures to emerge — are they short term (2030), medium term (2040), or long term (2050)?
	Is the company exposed to international pressure to decarbonise?	1. Same questions as above for any key geography of production or export target. 2. Specifically for export markets, are there any tariff or border mechanisms such as the EU CBAM that affect the target company?
	To what extent can transition drivers affect the company if it maintains the status quo?	1. What regulatory costs may the company face under the status quo (e.g., impact of carbon price, impact of penalties, impact of purchase of carbon credits)? 2. How might demand for the company's products decline under the status quo?

Source: *Creating Transition Intelligence*, RMI, 2025.

Transition vulnerability

India is a key market for Company X, where it faces limited short- and medium-term transition pressure

	CTA section	Observations	Key takeaways
Transition vulnerability	**Company footprint**	• >90% of Company X's production, sales, and revenue comes from its operations in India, where it currently has 34.2 million tonnes per annum (Mtpa) in steel production capacity, spread across Maharashtra, Karnataka, Tamil Nadu, and Odisha. • ~90% of its iron production is through coal-intensive blast furnace (BF) and rotary kilns. • ~60% of steel capacity is basic oxygen furnace (BOF).	• A majority of Company X's production comes from emissions-intensive BF-BOF routes. • 2035–45 is a critical transition period for Company X because it is when a significant portion of its BF capacity will be up for relining.
	Transition exposure	• **Domestic policy drivers:** India has laid down clear national ambitions to decarbonise its economy as per its Nationally Determined Contributions (NDCs) and net-zero 2070 target. Though India has not yet set a clear steel decarbonisation pathway, the release of the green steel taxonomy, the Green Steel Action Plan, and the Green Steel Mission signal the government's intent. • **Domestic market drivers:** Some companies in India have announced Scope 3 emissions targets, requiring them to procure low-emissions steel; however, there is limited overall demand for green steel right now. A meaningful shift may occur by 2050, led by the auto sector, but wider adoption will depend on the cost of green steel falling relative to conventional steel. • **International policy and market drivers:** Company X's most immediate transition driver is the EU CBAM. Exports accounted for ~8% of revenue in FY25, with >80% going to the EU. To address this, Company X is converting its EP 5 direct reduced iron (DRI) plant into a green steel facility.	• Company X faces limited immediate decarbonisation pressure in India, implying that its efforts are driven by its desire to lead the market and be future-ready. • Where it faces an immediate pressure (EU CBAM), the company has begun to take steps to meet requirements. As a result, the EP 5 plant may offer learnings for other assets in India.

Source: RMI analysis; CPI analysis; company environmental clearances; Annual Report 2024–2025, Company X; BRSR Reports FY23–FY25, Company X.

Step 2

Strategy assessment: Assess any decarbonisation efforts/strategy by the company from three lenses: (1) scope, (2) granularity, and (3) ambition

Company decarbonisation efforts/strategy

1 Scope

Investigate to what extent the company's decarbonisation efforts truly represent its emissions and asset profile

Emissions coverage	Look to see if the most material Scope 1, 2, and 3 emissions are incorporated in any decarbonisation efforts
Asset coverage	Evaluate the coverage of key current and future assets as part of decarbonisation efforts/targets

2 Granularity

Look for the degree of detail and clarity the company has on how it will decarbonise over the short and long term

Choice of levers	Assess which decarbonisation levers are selected and identify any lever-wise targets
Low-emissions expansion	Examine whether expansion plans clearly place focus on low-carbon production
Asset-level roadmaps	Examine if plans of any kind specify a decarbonisation pathway or retirement of existing assets
Timeline	Look for clarity over the short term (~ five years) and long term till net-zero target if applicable

3 Ambition

Benchmark the company's decarbonisation efforts to its own track record and external benchmarks to gauge how ambitious its efforts are

Historical progress	Consider whether the pace of decarbonisation is appropriate given historical efforts
Industry peers	Compare the company's ambition with the efforts of its peers
National pathways	Assess the alignment of the company's strategy with national pathways if available
Scenarios	Assess the company's alignment with independent scenarios to benchmark technology build-out, temperature alignment, etc.

Step 2

Strategy assessment: Assess any decarbonisation efforts/strategy by the company from three lenses: (1) scope, (2) granularity, and (3) ambition

Area of inquiry		Key questions
Scope	Does the company have any decarbonisation plans and, if so, to what extent do they account for its material assets and emissions categories?	1. What assets are covered under the company's targets? 2. What percentage of current production capacity, revenue, and emissions do these account for? 3. Considering expansion plans, is the current asset coverage under the stated strategy sufficient to account for a majority of production capacity and revenue? If not, does the company acknowledge the insufficient coverage and lay out plans to expand asset coverage?
Granularity	Does the company have any decarbonisation plans and, if so, what level of insight into its strategy does the company provide?	1. Are there absolute emissions, emissions intensity, or technology capacity targets and, if so, what are they? 2. What are the specific transition levers the company is exploring? 3. What actions or targets has the company laid out in the short, medium, and long term?
Ambition	Does the company have any decarbonisation plans and, if so, how ambitious are these relative to appropriate benchmarks?	1. If available, does the company's strategy fall in line with relevant international and national transition pathways with regards to (1) rate of decline in emissions, (2) emissions intensity, (3) technology mix, and (4) rate of change in technology mix? 2. How does the company's strategy align on these same dimensions with comparable domestic and international peers or recommendations by industry associations or bodies? 3. Are the company's targets validated by a credible organisation like the Science Based Targets initiative (SBTi)? 4. Is the rate of decarbonisation by the company in line with the rate of change aspired to by the financial institution? 5. Are the technologies the company intends to employ aligned with the kinds of assets the financial institution wants to finance as defined by its exclusion list/internal green or transition taxonomy?

Source: *Creating Transition Intelligence*, RMI, 2025.

Strategy Assessment

Company X's 2050 net-zero target leads India's ambition but may potentially need to evolve with time to factor in future expansion plans

	CTA section	Observations	Key takeaways
company strategy assessment	Scope	• **Asset coverage:** Company X's 2030 target of 1.95 tonnes CO_2 per tonne of crude steel (tCO_2/tcs) and its net-zero target for 2050 apply to its EP1–EP4 plants. These plants represented 100% of capacity in 2021 but now account for 87% of current capacity. If all newly announced plants are built by 2050, the target would cover only 22% of projected production capacity. • **Emissions coverage:** Company X's target covers Scope 1 and 2 emissions; however, Scope 3 emissions account for ~14% of current emissions and there is no clear breakdown of how Company X accounts for upstream emissions from coal and iron mining.	• Company X's currently disclosed emissions-reduction pathway may need to evolve to reflect its potential asset base in 2050 and its emissions profile.
	Granularity	• **Short term:** Company X's strategy would benefit from greater granularity on how it will achieve its 2050 target, including long-term investment plans and asset-specific decarbonisation roadmaps. Current reliance is on Carbon Capture, Utilisation, and Storage (CCUS) and carbon offsets to decarbonise its growing BF-BOF asset base. These are accepted levers for decarbonisation; however, the feasibility of CCUS needs to be monitored to avoid carbon lock-in. The government's strong support, with the INR 20,000 crore allocation to CCUS in the Union Budget 2026–27, and the ongoing pilots by the Department of Science and Technology (DST), will act as strong tailwinds.	• Company X's reliance on CCUS may pose transition risk if the technology proves neither commercially nor technically feasible. However, the risk of this is low given the government's strong support.
	Ambition	• **Industry benchmark:** Company X's net-zero target is more aggressive than India's 2070 target and is broadly in line with peers. By 2036, it will be in line with the five-star rating of the Indian green steel taxonomy. • **Scenario benchmarks:** Company X's decarbonisation pathway is broadly in line with independent scenarios for reducing emissions by 2050 and staying in line with <2°C warming.	• Company X's ambitions position it as a market leader. Going forward, gaining clarity on asset coverage and the feasibility of levers such as CCUS will be key.

Source: RMI analysis; CPI analysis; company environmental clearances; *Integrated Annual Report 2024–2025*, Company X; BRSR Reports FY23–FY25, Company X.

Feasibility of Decarbonisation

Step 3

Investment alignment: Assess the extent to which the company's investments are aligned with transition needs

1 Financing alignment

Investigate how the company is positioned to deploy capital for the transition

Financial capacity*	Identify the company's overall financial resources, its transition investment needs, and its ability to raise capital to bridge any financing gaps
Earmarked transition/ green finance	Identify if the company has ever raised financing specifically to support its green transition efforts, and, if so, under what conditions

2 Asset pipeline

Examine the actual physical asset pipeline the company is building out based on its investments in new clean assets or measures to decarbonise and/or phase out old polluting assets

Asset expansion	Identify the company's expansion plans to gauge its future production capacity, the technology choices it is making, and any clear plans to ensure climate alignment
Capex alignment	Identify the extent to which the company's capex plans are aligned with decarbonisation efforts
Future asset base	Based on the above, develop a map of what the company's future asset base may look like to identify alignment with net zero under different pathways and benchmarks

*We have not conducted a detailed analysis of this as banks are better positioned to gauge a company's financial health in accordance with their own internal benchmarks and the analysis of rating providers. ICRA's rating for Company X as of July 4, 2025, suggests a strong financial position.

Step 3

Investment alignment: Assess the extent to which the company's investments are aligned with transition needs

Area of inquiry		Key questions
Financing alignment	Does the company have the financial capability needed to realise its ambitions?	1. What is the estimated cost of transition for the company? 2. What is the company's likely route to financing its transition efforts (e.g., plough back profits, raise debt) 3. How financially healthy is the company and are there any developments that may constrain its ability deploy or raise capital? 4. To what extent is the company able to raise credit from lenders to support capex?
	Can the company raise earmarked transition/ green finance? If already done, are there conditions to the same that may pose a transition risk?	1. Does the company have a credible sustainability/green/transition finance framework that has been reviewed by a second-party opinion provider? 2. Does the company have a track record of meeting transition/green targets that can help build confidence in its capital raise? 3. Has the company already raised transition/green finance? 4. If so, what have these funds been raised for and how has utilisation been? Is the company at risk of any penalties?
Asset pipeline	How aligned are the company's actions with its stated ambitions?	1. To what extent are the company's capex investments and R&D investments flowing towards decarbonisation versus to maintain or expand emissions-intensive operations? 2. Is the company's capacity build-out and use of different production technologies in line with its stated targets or national pathways? 3. Is the company on track to reduce its emissions and bring down emissions intensity as per its stated goals?

Source: *Creating Transition Intelligence*, RMI, 2025.

Investment alignment

Looking ahead, Company X appears to be continuing to invest significantly in carbon-intensive production assets

	CTA section	Observations	Key takeaways
Investment alignment	**Financing alignment**	• Company X has raised US$500 million in SLBs, tied to the achievement of its 2030 emissions intensity target. The financing is used to refinance existing debt and fund capex for its decarbonisation strategy.	• Company X's SLB is a strong indicator of intention to be a market leader. It is highly unlikely to miss its 2030 targets. Even in such a case, this is likely to be financially immaterial.
	Asset pipeline	• More than 50% of capex plans outlined thus far appear to be going towards carbon-intensive expansion. However, this is lower than that of peers. • Company X appears to be continuing to invest in the BF-BOF route, with ~29 Mtpa of BFs and rotary kilns in the potential pipeline, of which a 4.5 Mtpa BF expansion at EP 2 is confirmed. In addition, 2.5 Mtpa of BOF capacity is currently under development, and ~28.5 Mtpa in additional capacity has been announced. • The only confirmed green steel assets in the pipeline are the 10 Mtpa plant at EP 5 that aims to service EU demand and a 3 Mtpa scrap electric arc furnace (EAF) facility in Andhra Pradesh. • Technology choices for 47 Mtpa of announced capacity have not been disclosed, although the company has stated its intention to follow green best practices.	• Compared with peers, Company X has a higher share of capex going towards decarbonisation, which may position it well to be a green steel leader going forward. • However, even if the company develops gas-based DRI-EAF at its major announced plants, more than 50% of future capacity would remain BF-BOF, requiring CCUS to be feasible at scale.

Source: RMI analysis; CPI analysis; company environmental clearances; *Integrated Annual Report 2024–2025*, Company X; BRSR Reports FY23–FY25, Company X.

Step 4

Dependency mapping: Determine the drivers that may impact the company's ability to decarbonise or fully utilise the levers available to it

1 Available decarbonisation levers

Identify the abatement potential of different levers and the company's likely/chosen set of levers

Abatement potential	Benchmark the emissions reduction potential of different levers across steelmaking routes
Company relevance	Identify which levers are most relevant for the company based on its asset base and/or which ones the company plans to utilise

2 Feasibility of levers

Assess the feasibility of the company's levers being able to support short- and long-term decarbonisation

Techno-economic feasibility	Assess the dependencies that determine the techno-economic feasibility of the lever including Technological Readiness Level (TRL), costs, and policy, preferably at an asset level
Transition timelines	Identify the time period in which the use of a lever for decarbonisation may be feasible for the company

Step 4

Dependency mapping: Determine the drivers that may affect the company's ability to decarbonise or fully utilise the levers available to it

Area of inquiry		Key questions
Available decarbonisation levers	What are the decarbonisation levers available to the company and to what extent has it begun to leverage them?	1. What specific pathways are available for the company to decarbonise its production based on its sectors of operation? 2. What is the abatement potential of each of these levers, which ones are low-hanging fruit, and which are likely to account for major emissions reductions? 3. Which decarbonisation levers, if any, has the company already begun to use and plans to focus on going forward?
Feasibility of levers	Is the technology behind key decarbonisation levers at a sufficient level of technological and commercial readiness?	1. Is the technology needed by the company already at a high TRL or likely to be technologically ready in line with decarbonisation timelines? 2. Is the technology needed by the company already commercially feasible or likely to be feasible in line with decarbonisation timelines? 3. Is the company able to, or projected to be able to, secure the technology or inputs it needs to transition?
	Is the company's transition supported or hindered by national and subnational policies?	1. Are there regulatory requirements that act as barriers to the company's transition at the national or state level by either reducing the availability or commercial viability of key technological inputs (e.g., import restrictions or duties, local content requirements, labour challenges)? 2. Do central or state-level governments offer incentives to promote the uptake of key decarbonisation levers? 3. Based on the company's geographical spread and asset base, is the company well positioned to make use of available incentives?

Source: *Creating Transition Intelligence*, RMI, 2025.

Dependency mapping

Company X is likely to meet its 2030 target, but 2050 achievement depends both on policy support and technological breakthroughs for CCUS and green hydrogen

CTA section	Observations	Key takeaways
Feasibility of levers	• **Energy efficiency:** These measures are a low-hanging fruit across all steelmaking routes. Company X has already taken measures to introduce energy efficiency across plants. • **Renewable energy:** Company X currently meets only 20% of its electricity needs from renewable energy, but at current growth rates, this could increase to 43% by 2030. It is yet to commission >7.5 gigawatts (GW) of its 2030 target of 10 GW of renewable energy. In the long term, EAF build-out would require an additional 7–10 GW in capacity at a cost of US$4 billion–US$6 billion. • **Alternate fuels:** Company X has begun pilots for green hydrogen (GH2) at EP 1; however, its continued reliance on BF-BOF routes may limit its ability to transition to GH2 in the long term. Deployment in the long term may also be constrained by the availability of natural gas as a transitional fuel and by the high cost of GH2. • **Raw material efficiency:** Company X is investing significantly in beneficiation and pelletisation of iron ore. Its 20% scrap utilisation rate falls below India's national 50% target by 2047. Its maximum utilisation of scrap may be constrained if it builds out more BF-BOF capacity because BF-BOF can achieve only 25% utilisation of scrap compared with 100% in EAFs. Fundamentally, however, the key bottleneck to scrap utilisation will remain domestic availability. • **CCUS:** However, the government's strong support through the INR20,000 crore allocation to CCUS in the Union Budget 2026–27 and ongoing pilots by DST may meaningfully accelerate feasibility and timelines.	• Company X is well positioned to capture immediate decarbonisation levers like energy efficiency, renewable energy, and scrap utilisation, making its 2030 target achievable. • Continued investment in the BF-BOF route and the stated reliance on CCUS may pose a long-term transition risk, as CCUS remains unproven. However, the risk of this may be reduced given the government's strong support.

Source: RMI analysis; CPI analysis; company environmental clearances; *Integrated Annual Report* 2024–2025, Company X; BRSR Reports FY23–FY25, Company X.

Finally, formulate a view on the company's transition outlook: Identify what transition opportunities and risks the company offers to the bank

1

Opportunities

Identify what kinds of financing opportunities the company's decarbonisation efforts may offer, including opportunities to finance new plants and supplier or offtaker financing to enable the company's transition

2

Risks

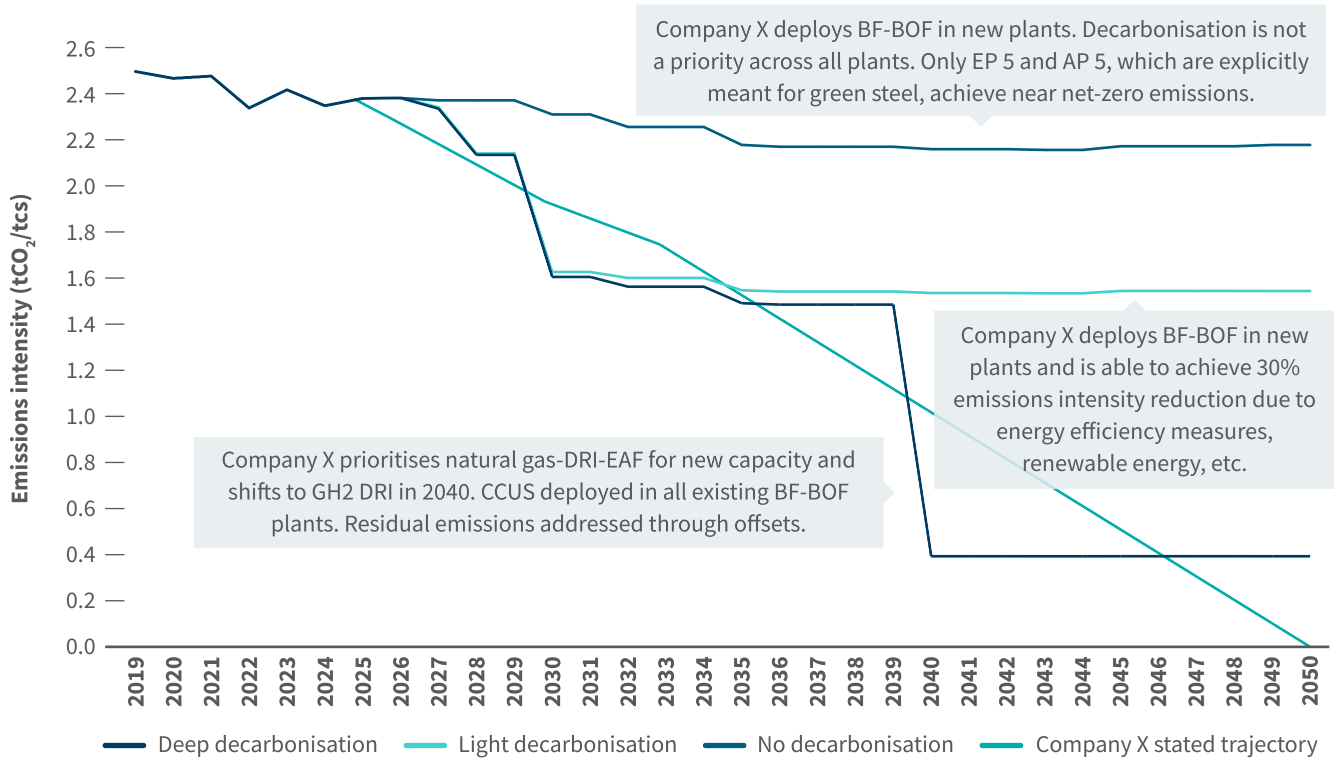
Determine if the company's overall decarbonisation plan, including the use or absence of specific levers, introduces transition risks — such as reliance on unproven technologies, levers limited by domestic availability, or constraints due to the company's investments that might affect its ability to use certain strategies

Overall transition outlook

Depending on the choices Company X makes today, its emissions trajectory may vary significantly

Investing in natural gas-DRI-EAF today enables Company X to shift to GH2 DRI in the future and unlock deep decarbonisation; opting for BF-BOF risks locking in carbon emissions should CCUS not become commercially feasible

Illustrative emissions intensity projections for Company X year-over-year based on its decarbonisation pathway (in tCO_2/tcs)



Source: RMI analysis; CPI analysis; company environmental clearances; *Integrated Annual Report 2024–2025*, Company X; BRSR Reports FY23–FY25, Company X.
Note: This is illustrative based on available information. This is not intended to be a prediction of the company's actual emissions trajectory.

Implications of the CTA for the bank

Company X is a market leader and will require significant transition finance

	CTA section	Observations	Key takeaways
Transition outlook	**Transition opportunities**	• Company X plans to nearly triple its production capacity, assuming all announced plants come through. To ensure alignment with decarbonisation pathways, supporting Company X with energy efficiency and renewable energy integration is an immediate opportunity. • In the medium to long term, there may be a significant opportunity to support the build-out of GH2-DRI-EAF production routes and finance Company X's procurement of raw materials like high-grade iron ore and scrap. • Build-out of CCUS also offers an engagement and financing opportunity, but requires monitoring to ensure technology is becoming feasible.	**Significant opportunities** • Company X's decarbonisation pathway offers a significant financing opportunity. • The company's suppliers and offtakers will also require support to enable Company X's transition, opening room for bundled supplier/offtaker financing agreements.
	Transition risks	• Company X will need to ensure its decarbonisation target accounts for future expansion plans. • Continued investment in BF-BOF assets through relining or expansion risks locking in carbon emissions if CCUS does not materialise. • Continued investment in the BF-BOF route and reliance on CCUS pose long-term transition risks if these technologies remain unproven at scale. Ongoing government support and public investment in CCUS can mitigate this risk.	**Minimal short-term risks, but potential for long-term uncertainty** • In the short term, given limited decarbonisation pressure within India, Company X's efforts are still leading the market. • In the long term, the company will need to align its targets with its expansion plans, while banks should monitor the technical and commercial feasibility of CCUS to assess whether BF-BOF capacity can be decarbonised.

Source: RMI analysis; CPI analysis; company environmental clearances; *Integrated Annual Report 2024–2025*, Company X; BRSR Reports FY23–FY25, Company X.

Section 4

Pathways for Mainstreaming CTAs

Looking ahead, the value and ease of conducting CTAs will improve as regulatory and market enablers are established

Pathway for mainstreaming CTAs	Market signals to track	Market developments
There is greater incentive to conduct CTAs	Regulatory direction from RBI for banks to incorporate climate in risk assessments and strategy.	RBI has signalled to banks to step up climate efforts and has opened space for climate integration in risk assessments.
	Increase in the pace of transition due to policy changes or market developments across key sectors that make transition risk a more immediate concern.	While some sectors like power and automobiles are seeing rapid change, the pace of transition in industrial sectors is limited and likely to be gradual.
Conducting CTAs becomes easier	Corporate transition data availability increases due to direction from regulators like the Securities and Exchange Board of India (SEBI) or market pressure.	Implementation of BRSR core by SEBI will increase data availability. We are also likely to see an increase in transition bond issuances that require relevant disclosures because SEBI includes transition bonds as part of its green debt frameworks and IFSCA's transition bond framework has set precedence for transition plan disclosures.
	Development of national decarbonisation pathways of key sectors by NITI Aayog and civil society.	NITI Aayog has recently released sectoral decarbonisation pathways, including for steel. These pathways can support banks conducting CTAs and companies in setting credible targets.
	Development of climate-aligned taxonomy specifying green/transition technologies and activities.	The climate taxonomy is being developed for sectors such as power and steel by the Ministry of Finance.

Section 5

Appendices

Appendix A: Complete CTA of company X

Strategy and Ambition

1. Transition vulnerability
   i. Company footprint
   ii. Transition exposure
2. Strategy assessment
   i. Scope of strategy
   ii. Granularity of strategy
   iii. Ambition of strategy

Company footprint

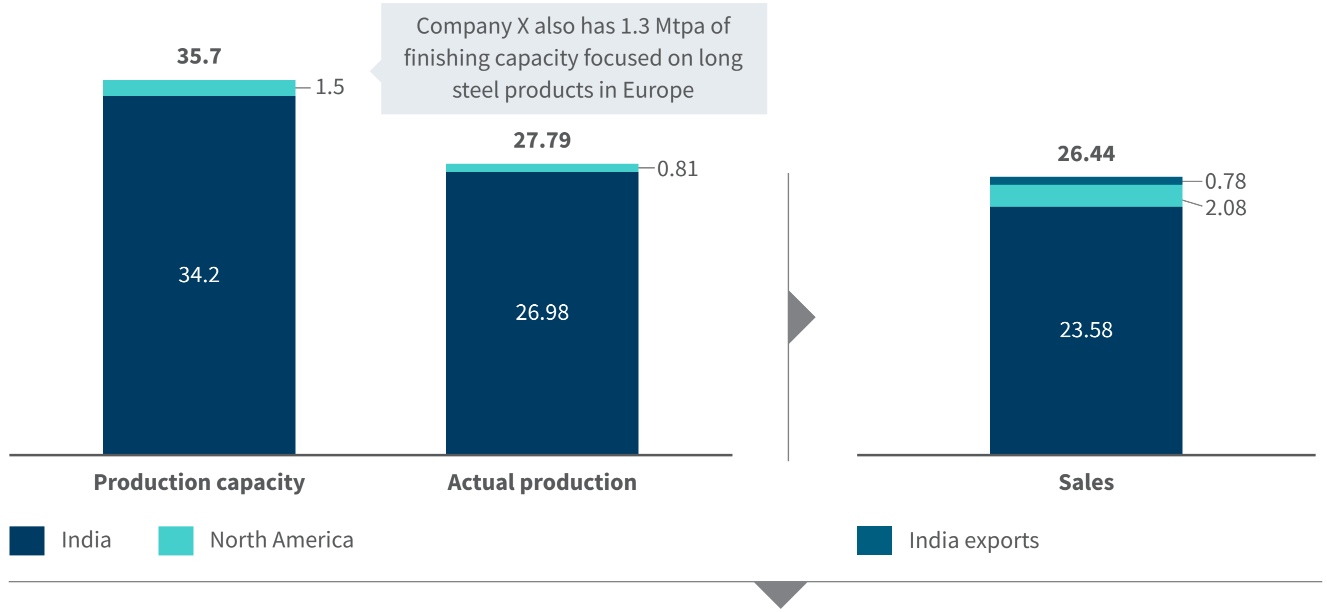
Key regions

Map the geographies that drive sales and production to narrow the focus of the assessment

Company X's production and sales are primarily driven by its India portfolio

Company X's operations are concentrated in India. India production primarily serves domestic consumers; only 10% is exported.

Production and sales volumes (in Mtpa) of Company X for FY25 by region



Potential next steps

Diving deeper into Company X's India operations will help better clarify its transition vulnerability and contextualise its strategy.

Notes from analysis

The company's choices in other regions can offer insight into its overall transition focus and capabilities. For example, Company X's operations in North America use low-emissions steelmaking, operating the largest and most modern Consteel EAF technology in North America. Learnings from there may be transferable to India.

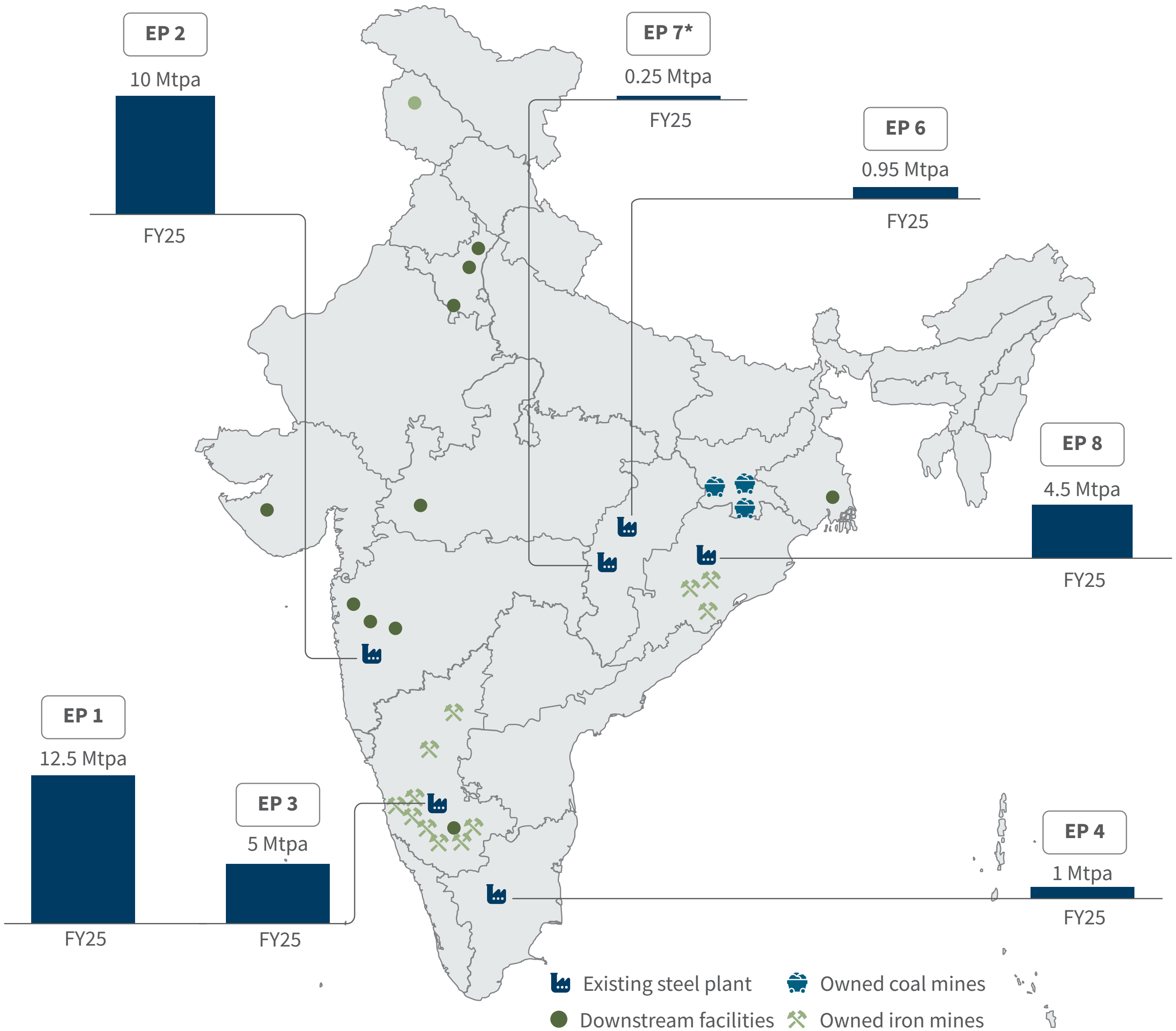
Source: *Integrated Annual Report 2024–2025*, Company X; "Financial results for Q4 FY25 and FY25 overall," Company X.

Company footprint

Asset base

Identify the company's key production assets to better understand transition options

EP 1 and EP 2 account for >60% of Company X's steelmaking capacity



Source: Iron & Steel database, GEM, 2025; *Integrated Annual Report 2024–2025*, Company X; "Investor presentation Q4–FY25," Company X
*Data on EP 7 steel plant at the asset level was limited, and hence EP 7 is not covered in subsequent sections of the CTA.

Company footprint

Asset base

Identify the company's key production assets and plans to better understand transition options

However, looking ahead, Company X's capacity is projected to nearly triple by 2050 and new plants may dominate

Plant	State	Nature of plant	Operational capacity (Mtpa) FY25	Planned capacity addition (Mtpa)	Potential total in 2050 (Mtpa) based on public announcements	Percentage of total capacity in 2050 based on public announcements**
EP 1	Karnataka	Existing	12.5	2	14.5	12%
EP 2	Maharashtra	Existing	10	5	15	12%
EP 3	Karnataka	Existing	5		5	4%
EP 4	Tamil Nadu	Existing	1	0.2	1.2	1%
EP 5	Maharashtra	Existing	0.9 (DRI)***	10	10	8%
EP 6	Chhattisgarh	Existing	0.95	0.25	1.2	1%
EP 7*	Chhattisgarh	Existing	0.25		0.25	0%
EP 8	Odisha	Existing	4.5		4.5	4%
AP 1	Maharashtra	Planned		25	25	20%
AP 2	Karnataka	Planned		4	4	3%
AP 3	Odisha	Planned		18	18	14%
AP 4	Odisha	Planned		13.5	13.5	11%
AP 5	Andhra Pradesh	Planned		3	3	2%
AP 6	Jharkhand	Planned		10	10	8%
Total			**34.2**	**90.95**	**125.15**	

Source: Iron & Steel database, GEM, 2025; *Integrated Annual Report 2024–2025*, Company X; "investor presentation," Company X, Q4–FY25,
*Data on EP 7 steel plant at the asset level was limited, and hence is not covered in subsequent sections of the CTA.
**Considering 2050 as an estimated timeline for when all announced expansion plans become operational.
***This has not been included in the total.

Company footprint

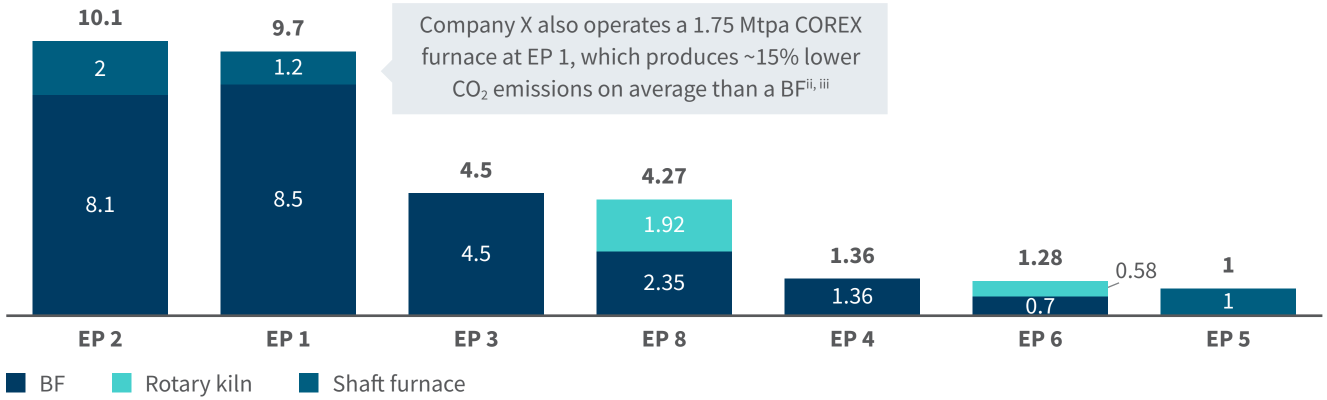
Asset base

Identify the ironmaking and steelmaking technologies currently being used by the company at key plants

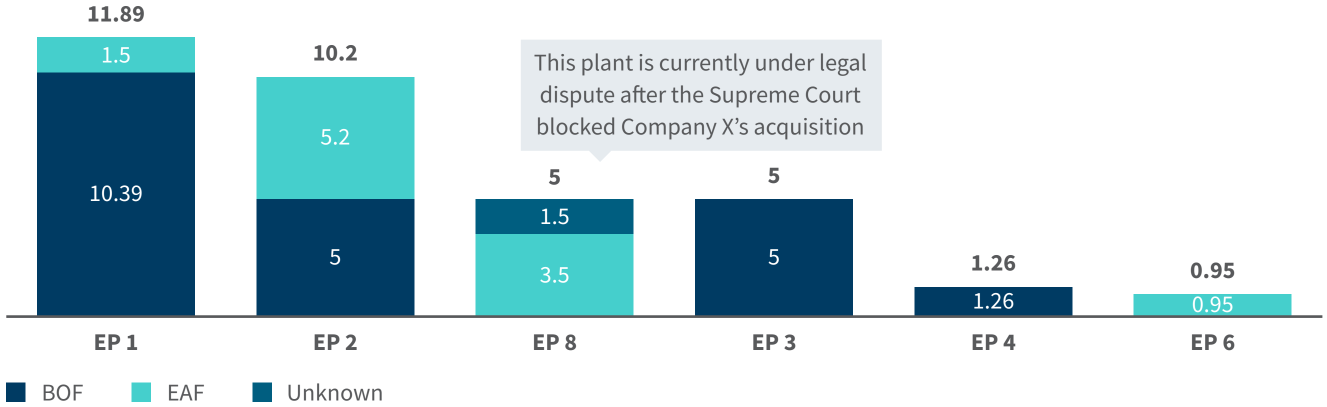
Company X primarily relies on emissions-intensive production routes for iron and steel across key plants

87% of Company X's current iron production is through emissions-intensive coal-fed BFs and rotary kilns and 60% of Company X's current steel production capacity focuses on BOF. The significant EAF capacity is a positive signal.

Type of ironmaking technology in operation by plant, 2025 (in Mtpa)[i]



Type of steelmaking technology currently under operation by plant, 2025 (in Mtpa)



Source: (i) Iron & Steel Tracker, GEM; (ii) "Investor presentation," Company X, 2020; (iii) "COREX process," IspatGuru.

Company footprint

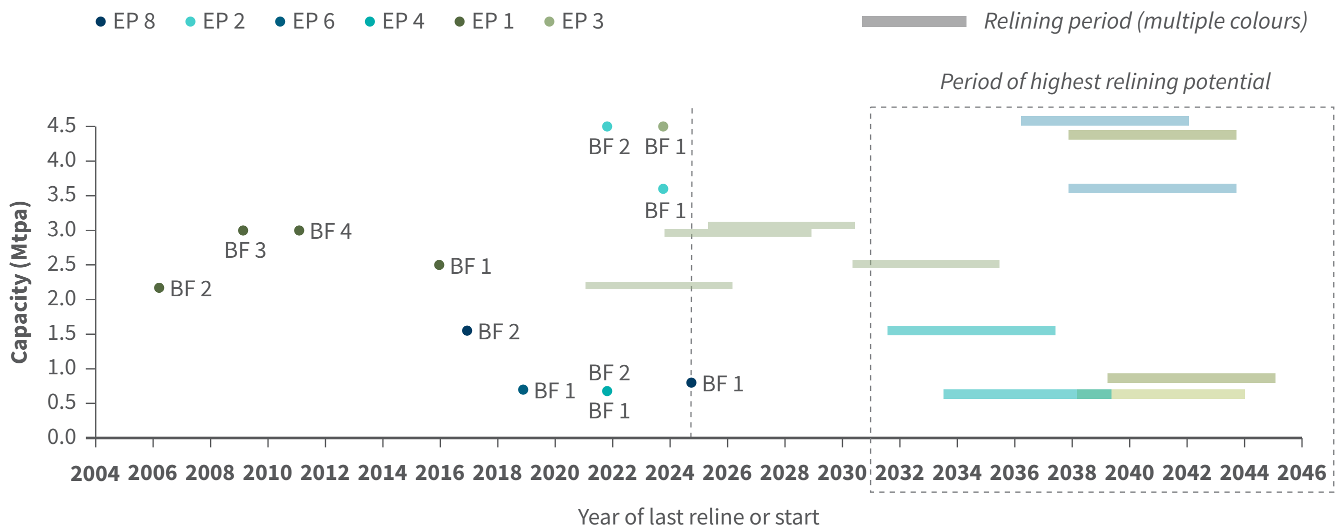
Asset base

Identify the potential transition timelines for high-emissions iron-producing assets

Choosing to reline the existing BF fleet will make CCUS necessary for long-term decarbonisation

More than 60% of Company X's current BF fleet is still early in its campaign life and will be up for relining between 2030 and 2045

Year of relining/start for Company X's BFs and estimated period for next relining



Potential next steps

Engagement with the company will be critical in supporting the transition from BFs at the point of retirement and exploring ways to de-risk and improve the economics of alternatives to avoid relining of BFs between 2035 and 2045

Source: Iron & Steel Tracker, GEM, 2025; Blast furnace tool, GEM, 2025.
Note: Period of estimated relining calculated by taking the last confirmed period of relining as per GEM or the year of start if the plant is less than 20 years old and setting a lower-bound relining year using a 15-year campaign period and an upper-bound relining year using a 20-year campaign period.

Strategy and Ambition

1. Transition vulnerability
   i. Company footprint
   ii. Transition exposure
2. Strategy assessment
   i. Scope of strategy
   ii. Granularity of strategy
   iii. Ambition of strategy

Transition exposure

Policy exposure

Identify the key policies and regulations that may provide tailwinds or headwinds to the company's transition

Support for green steel is building in India; however, there is limited immediate transition pressure

Policy drivers		Decrease in revenue			Increase in cost		
		2030	2040	2045	2030	2040	2045
Policy drivers	Demand from export markets	The EU accounts for 40% of Indian steel exports. At current emissions intensity, the EU CBAM will raise the cost of exported Indian steel by ~30%, making it uncompetitive in the region and directly reducing demand. Several EU companies have already committed to green steel procurement. Some 66% of major buyers anticipate buying at least 25% of green steel by 2030.					
	RPO mandate				Steel producers must procure 43.3% of electricity from renewable energy by 2030. The landed cost of renewable energy can at times be more expensive, particularly if sourced from the grid.		
	CCTS				India's draft targets under the CCTS scheme require minimal emissions reductions in the next two years from steel companies, which is likely to primarily come from energy efficiency measures and uptake of scrap in steelmaking, requiring up-front investment. Failure will result in a penalty on companies.		
	Taxonomy	Consumers may begin asking for taxonomy-aligned steel products. However, the short-term impact will be limited because the market will take time to change.					
	Green procurement		The Ministry of Steel (MoS) may prioritise low-carbon steel for public procurement, starting with PSUs. A ~30% share may be proposed, with different targets for each of the three taxonomy tiers.[i, ii]				

Degree of impact

Source: (i) "Green Steel Mandate in Works for Government Projects," *The Economic Times*, 2025; (ii); "Govt May Harness Public Sector Undertakings to Drive Green Steel Consumption," *Mint*, 2025.

Transition exposure

Market exposure

Identify the key offtakers for the company's steel products to understand their potential demand for green steel

Company X's key customer segments are currently exerting limited demand for decarbonisation

Percentage of Company X's sales in FY25		Description	Pressure to decarbonise
Industrial	51%	Steel for national and regional projects such as metros; bridges; trains; oil, gas, and water pipelines; and solar power plants. This includes long products like TMT bars and wire rods because they are important for key infrastructure projects.	At present, there is no clear pressure to decarbonise from this sector. Only a few companies like Lodha and JLL have emissions reduction targets. However, this can develop further if the MoS prioritises low-carbon steel for public procurement, beginning with PSUs.
Retail	36%	Sales from Company X's 2,300 retail stores for distributors and end consumers. Some of the branded products include Company X's range of prepainted, colour-coated steel sheets, and durable, corrosion-resistant roofing and cladding solutions.	The sector exerts the least pressure to decarbonise because retail sales are disaggregated across multiple buyers who are often price sensitive and would be unwilling to pay a green premium for low-emissions steel.
Automotive	13%	Includes hot and cold rolled steel products for retail and commercial vehicles. It also consists of electrical steel for the emerging EV segment.	The automotive sector is moving towards EVs, and automakers in India (e.g., Tata Motors and Mahindra) and global companies operating in India (e.g., Volvo) have stated emissions reduction targets that extend to their supply chain. Thus, the pressure to decarbonise from this segment is relatively higher than other sectors.

Company X is nonetheless trying to cater to existing demand through a distinct product that allows customers to claim Company X's own verified carbon dioxide emissions reductions across its steel value chain as a part of their own Scope 3 reductions.

Source: *Integrated Annual Report* 2024–2025, Company X.

Strategy and Ambition

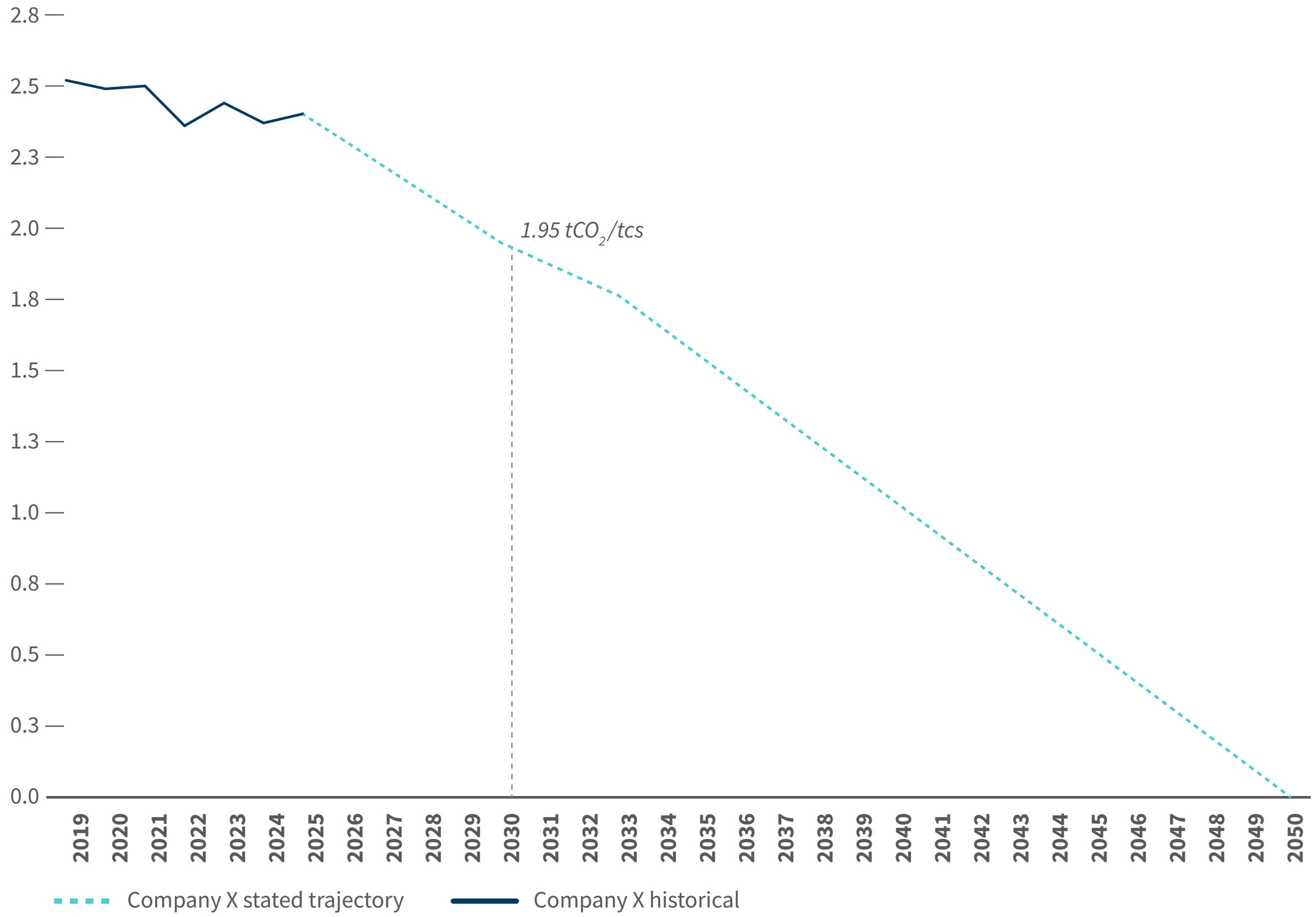
1. Transition vulnerability
   - i. Company footprint
   - ii. Transition exposure
2. **Strategy assessment**
   - i. Scope of strategy
   - ii. Granularity of strategy
   - iii. Ambition of strategy

Strategy overview

A clear emissions intensity trajectory is ideal; however, most steel producers lack the same, requiring engagement to better understand the pathway

Company X has a net-zero target for 2050 and a 1.95 tCO_2/tcs 2030 target, covering Scope 1 and 2 emissions from its three integrated steel plants

Company X's stated decarbonisation pathway and strategy through 2050 (in tCO_2 Scope 1 and 2/tcs)



Source: "Climate Action Plan," Company X, 2024.
Note: Company X's target to achieve 1.95 tCO_2/tcs is primarily based on its three integrated plants: EP 1, EP 2, and EP 4.

Strategy and Ambition

1. Transition vulnerability
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   ii. Transition exposure
2. Strategy assessment
   i. **Scope of strategy**
   ii. Granularity of strategy
   iii. Ambition of strategy

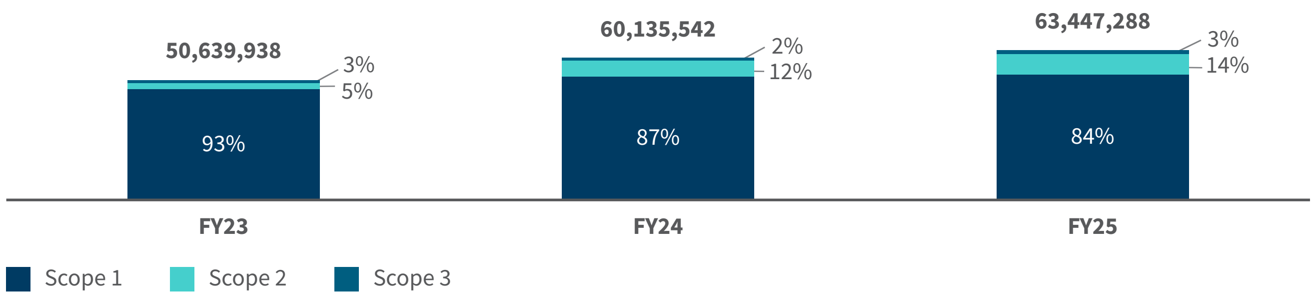
Scope of strategy

Emissions coverage

Understand the company's main sources of emissions and check for any major omissions

Company X's target covers Scope 1 and 2 emissions; coverage of significant Scope 3 emissions and upstream emissions from coal mining could be considered

Company X's Scope 1, 2, and 3 emissions from FY2023 to FY2025 (tCO_2)[i]



Potential next steps

- Identifying drivers of Scope 3 emissions and better understanding their choice not to include in targets can provide insight into the company's ambition and may reveal upstream bottlenecks to decarbonisation.
- Coverage of emissions from mining or purchases, particularly methane emissions from coal mining, needs to be further examined because the warming potential of a tonne of methane is 83x a tonne of carbon dioxide over a 20-year period.[ii]

Notes from analysis

- Neither CBAM nor the Indian green steel taxonomy account for methane emissions embodied in steel products, reducing pressure to report on them.
- Company X tracks Scope 3 emissions as per the GHG Protocol within its legal boundary such as purchased goods (which may include embodied methane emissions in imported coal), upstream and downstream transportation, and business travel.[iii]
- Some upstream emissions may get covered in Scope 1 emissions for Company X due to ownership of iron and coal mines and vertical integration with steel plants like EP 1. However, the extent of this is unclear.[ii]

Source: (i) BRSR reports for 2023-2024 and 2024-2025, Company X; (ii) "Company X," Carbon Transition Analytics, 2025; (iii) *Integrated Annual Report 2024–2025*, Company X.

Scope of strategy

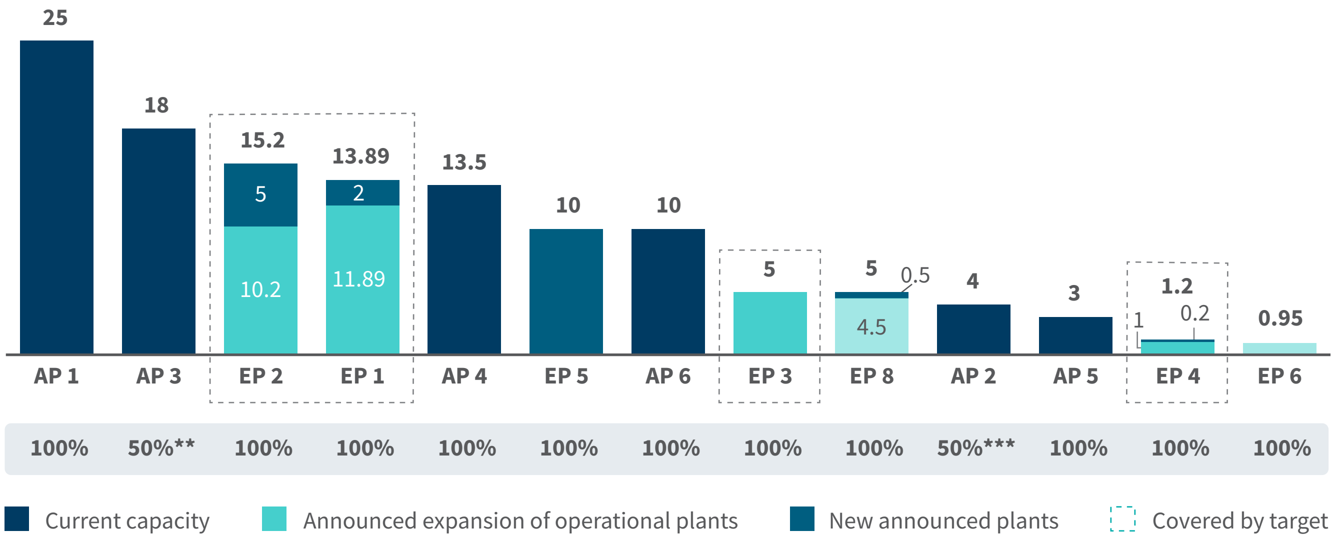
Asset coverage

Consider if the company has included all current and future production assets in its strategy

Company X's target may need to be updated to account for future capacity expansion

When targets were set in 2021, they accounted for 100% of all production; however, today these cover only ~85% of the company's production capacity, and by 2050 will cover only ~22% of projected production capacity should all announced plants be built*

Operational capacity and announced capacity expansion plans by plant as of 2025 (in Mtpa)



Notes from analysis

Assessment can be complicated by asset ownership structures. AP 3 and AP 2 are joint ventures with two foreign companies. Instead of excluding these from the assessment, asset emissions and production capacity can be allocated to the company on the basis of its ownership share. For example, Company X has a 50:50 partnership with a foreign steel company and hence 50% of the capacity and resulting emissions should be allocated to Company X. This helps to more accurately capture the company's responsibility for future decarbonisation efforts.

Source: Iron & Steel Tracker, GEM, 2025; RMI and CPI analysis of Company X disclosures and press releases; Climate Action Plan, Company X, 2024; Sustainability Linked Bond framework, Company X, 2021.
*Assume that all plants are operational by 2050 based on announced timelines where available.
**50% assumed for now. Partnership details with joint owner not disclosed yet.
***50:50 joint venture with foreign steel company for electrical steel production.

Strategy and Ambition

1. Transition vulnerability
    i. Company footprint
    ii. Transition exposure
2. Strategy assessment
    i. Scope of strategy
    ii. **Granularity of strategy**
    iii. Ambition of strategy

The MoS has identified six levers for decarbonisation, which we use to assess Company X's decarbonisation efforts

Pathways for decarbonising steel production

Reduce the emissions intensity of existing routes

- Improve **energy efficiency** — Deploy best-available technologies — waste heat recovery, advanced process controls, high-efficiency drives — to cut specific energy use in iron and steelmaking.
- Replace coal with **renewable electricity** — Replace captive coal and grid power with solar, wind, and round-the-clock renewable energy hybrids (plus storage) to shrink Scope 2 emissions.
- Use **alternative fuels** to reduce role of fossil fuels in iron production — Switch part of the fossil reductant/fuel to lower-carbon options — biochar, natural gas, and GH2 — to curb direct carbon dioxide.
- Scale use of **CCUS** — Capture carbon dioxide from BFs, kilns, and reformers for geological storage or conversion to chemicals/fuels.
- Increase the efficiency of **raw material** utilisation — Raise scrap utilisation, improve ore beneficiation/pelletisation, and valorise slag to cut virgin-ore demand, energy use, and waste.

+

Transition away from conventional routes

- Transition BF-BOF and coal-DRI EAF routes to **green hydrogen DRI-EAF** route. Natural gas DRI can be used as a transitional stage.
- Shift iron production from BFs and coal-DRI (rotary kilns) to emerging technologies such as electrowinning, HIsarna hydrogen plasma smelting reduction, and molten oxide electrolysis.

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

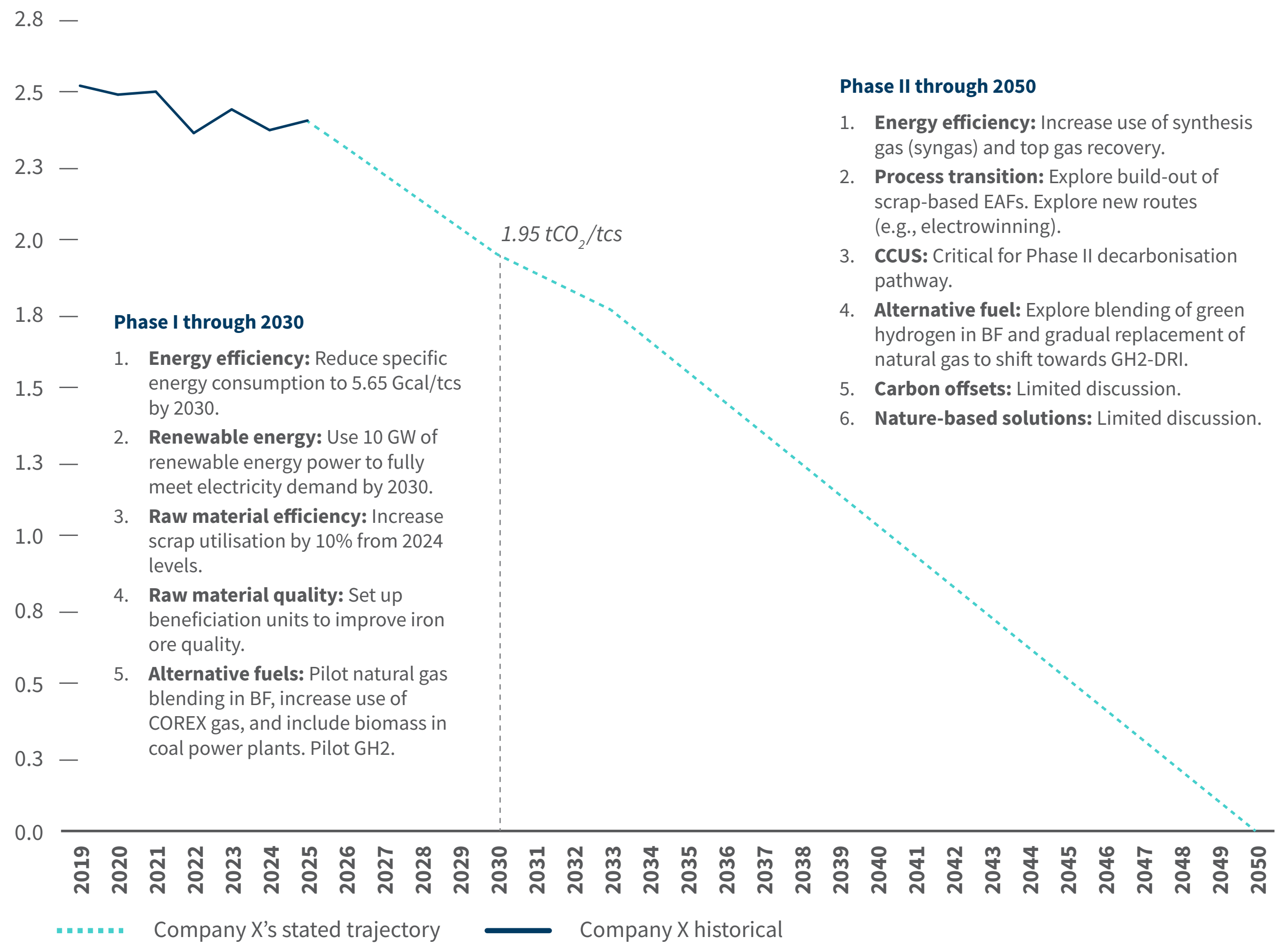
Granularity of strategy

Decarbonisation levers and timeline

Look for alignment between company's strategy and core decarbonisation levers

Company X adopts all six decarbonisation levers; Phase I through 2030 targets low-hanging fruit, while Phase II targets net zero by 2050 with less clarity on the approach

Company X's stated decarbonisation pathway and strategy through 2050 (in tCO_2 Scope 1 and 2/tcs)



Source: "Climate Action Plan," Company X, 2024.

Granularity of plan

Asset decarbonisation plans

Examine how the company plans to decarbonise its existing assets

Company X has set short-term targets for key operating assets, but greater long-term decarbonisation clarity would benefit banks

Plant	Emissions intensity (FY25)	Target emissions intensity/planned reduction	Planned actions
EP 1	2.49 tCO_2/tcs	31% reduction in emissions intensity by 2030	Limited information in environmental clearances on actions that will be taken to meet emissions intensity reduction.
EP 2	2.66 tCO_2/tcs	0.65 tCO_2/tcs emissions intensity reduction by FY28	Clear year-by-year plan to increase renewable energy, scrap, use of best available BF technology.
EP 3	2.63 tCO_2/tcs	31% reduction in specific carbon dioxide emissions by 2030	Limited information in environmental clearances on actions that will be taken to meet emissions intensity reduction.
EP 4	2.73 tCO_2/tcs	2.59 tCO_2/tcs by 2027 as per draft CCTS targets	Limited information in environmental clearances on actions that will be taken to meet emissions intensity reduction. Focus on renewable energy and energy efficiency — specifically heat recovery.
EP 5	0.92 tCO_2/tcs	Low-emissions steel production by 2030	Unit will be turned into a 10 Mtpa green steel facility to meet EU CBAM requirements.
EP 6	Not available	Not available	Not available
EP 8	Not available	Not available	Not available

Potential next steps

Engage the company to better understand emissions intensity reduction actions to be taken in EP 1, EP 3, and EP 4. Engagement on EP 6 and EP 8 will be necessary to understand baseline and decarbonisation plans.

Source: Environmental Clearances, Company X, 2024 and 2025.

Granularity of plan

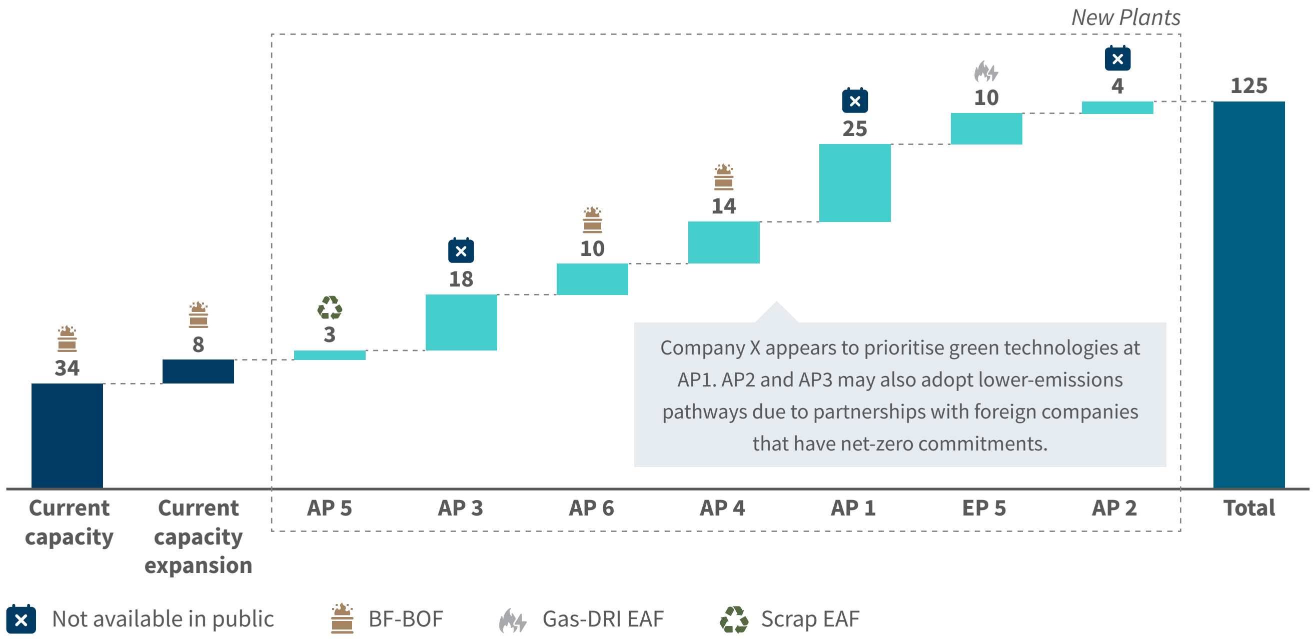
Low-emissions expansion

Consider if the company has clear plans to build low-emissions capacity going forward

Company X has ambitious expansion plans, but the extent to which low-carbon production routes will be adopted is unclear

Based on public information, ~40% of projected production capacity has limited or no information about its planned technology route or emissions intensity

Planned new capacity by plant and steelmaking route by 2050 (in Mtpa)



Potential next steps

Engagement and deeper investigation are needed to understand what kind of steel production route Company X intends to pursue across AP 3, AP 1, and AP 2. This is crucial because these three plants will make up ~40% of the total steel production capacity by 2050. Therefore, the company's overall emissions reductions will rely on the technology deployed for these plants.

Source: "Iron & Steel Tracker," GEM, 2025; RMI analysis of Company X disclosures and press releases.
Note: Steel plants, especially large plants, are heterogenous in nature, with multiple types of iron and crude steel production technologies being used. For the sake of clarity, we have tried to distil the type of technology route that contributes the most to production for a given plant.

Strategy and Ambition

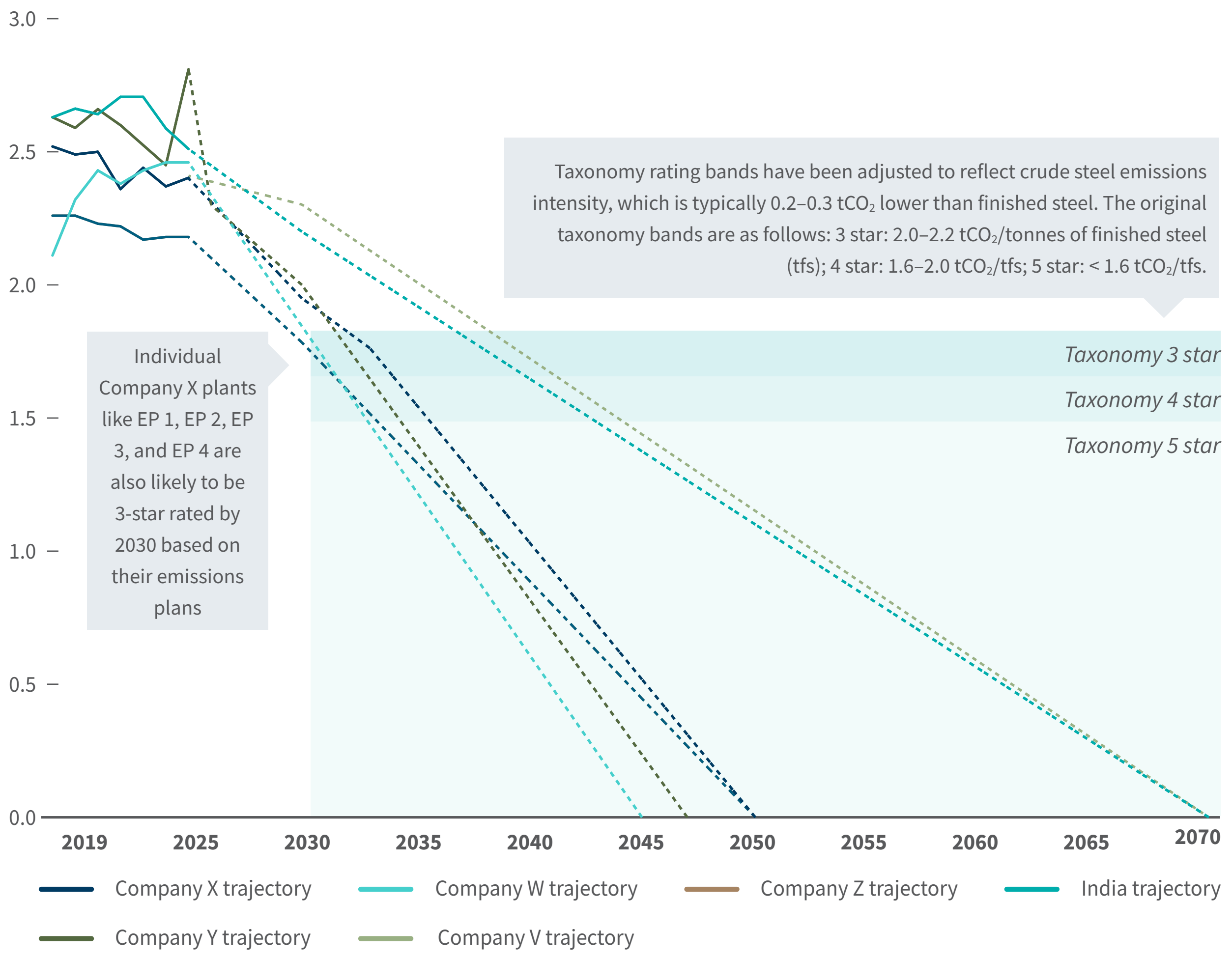
Ambition

Industry and peer benchmark

Benchmark the emissions intensity trajectory to national and peer trajectories

Company X's trajectory is in line with ambitions of peers and India's green steel taxonomy; targets may evolve once expansion is factored in

Company X's emissions trajectory vs. India's trajectory and industry peers (in tCO_2 /tcs)



Source: Climate Action Plan, Company X, 2024; steel company database, LSE Transition Pathway Initiative, 2025; India Green Steel Taxonomy, MoS, 2025; *Integrated Annual Report*, Company W, FY25; sustainability report, Company Z, FY25; Annual Report, Company V, FY25.
Note: India trajectory calculated through linear extrapolation going from current emissions intensity to $2.2tCO_2$/tcs in 2030 and then 0 by 2070 in line with India's target. Company Z is assumed to achieve net zero by 2050 in line with the commitments of its parent companies.

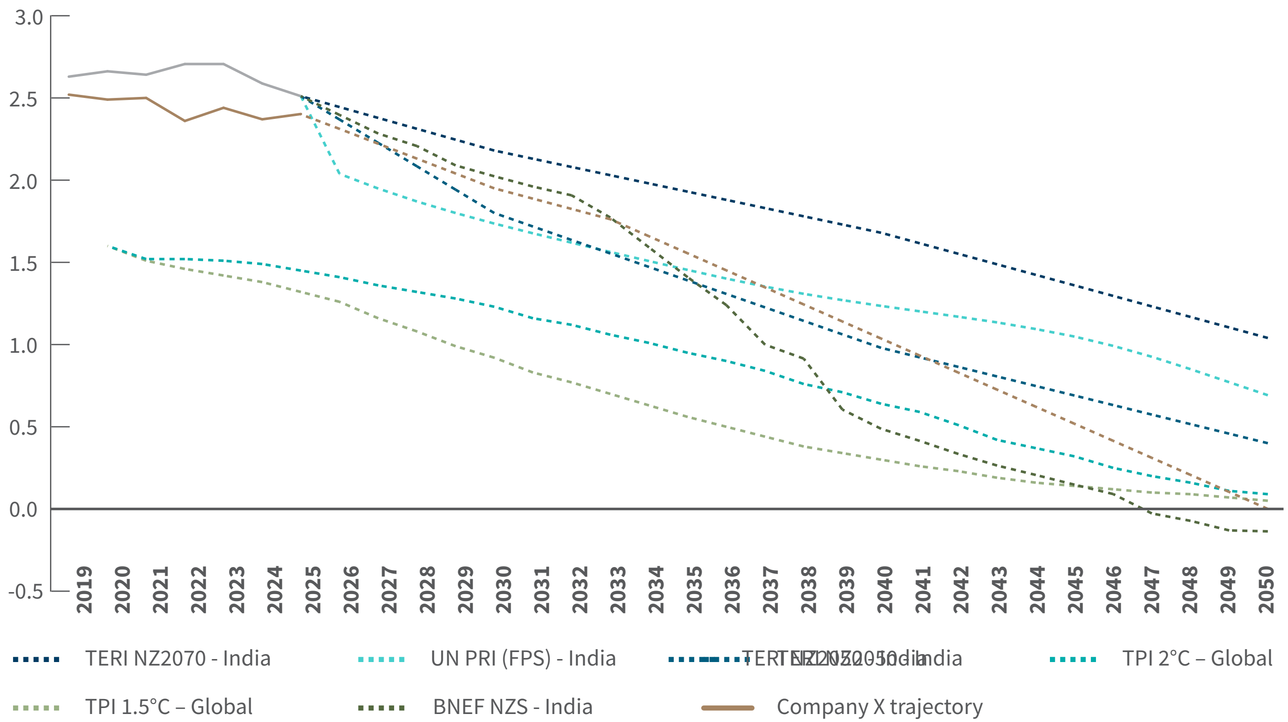
Ambition

Scenario benchmark

Benchmark emissions intensity trajectory to regional and global independent scenarios

Although Company X's 2050 target is < 2°C aligned, its emissions intensity remains elevated compared with global benchmarks until then

*Company X's emissions trajectory compared with independent national and global steel emissions intensity scenarios aiming for <2°C alignment in tCO_2/tcs**



Potential next steps

For financiers concerned about Company X's steel elevated emissions intensity resulting in higher-than-advised absolute carbon emissions, engaging the company to understand constraints to faster decarbonisation will be critical.

Source: Appendix B, pages 166–168.
*TERI NZ2050 and NZ2070 emissions intensity trajectory constructed based on steel production volumes in each year by different steelmaking routes provided by TERI and average emissions intensities for these routes.

Feasibility

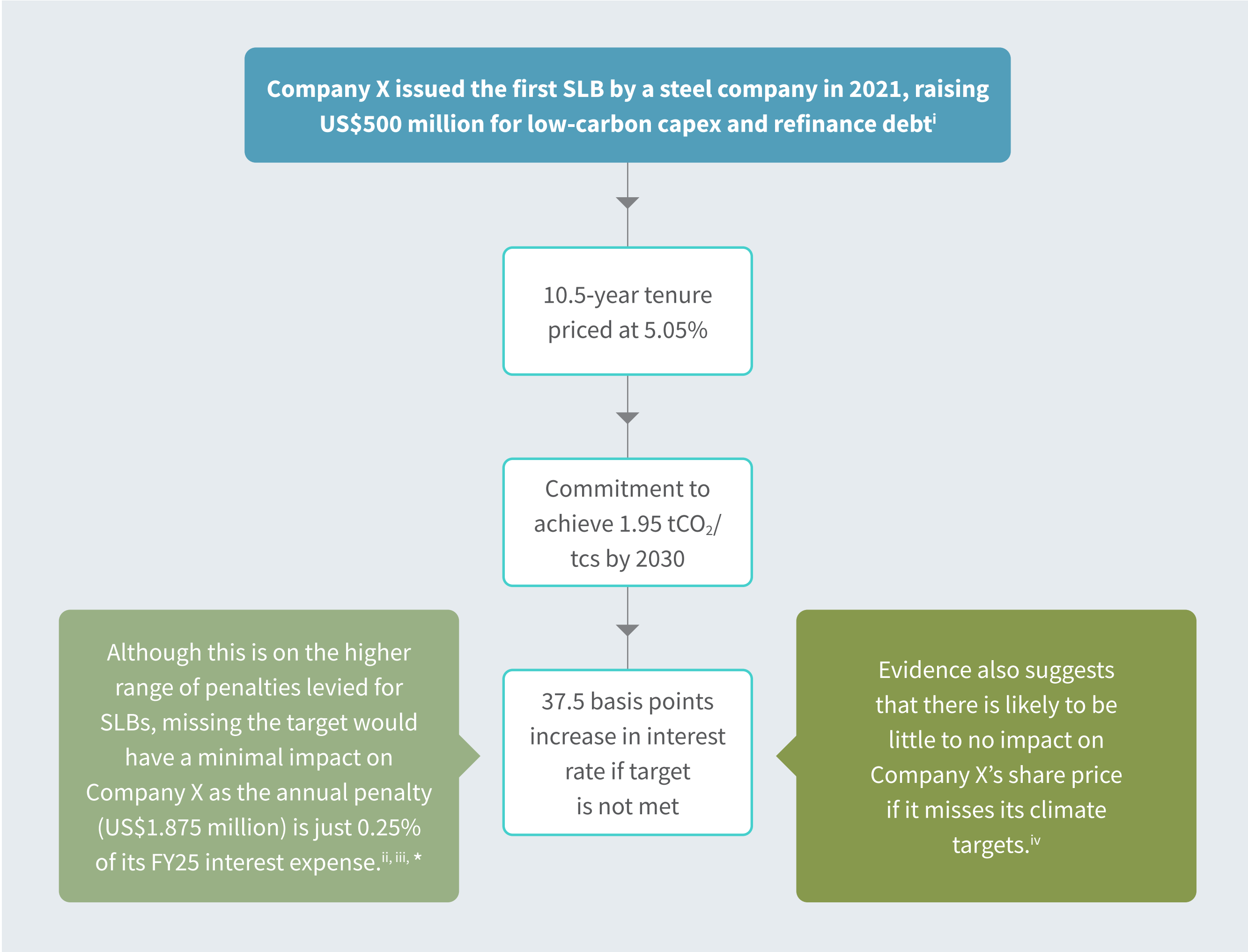
1. Investment alignment
   i. **Financing alignment**
   ii. Asset pipeline
2. Dependency mapping
   i. Renewable energy
   ii. Raw material efficiency
   iii. Alternate fuels
   iv. CCUS

Financing alignment

Earmarked transition finance

Identify if any transition or green finance has been raised by the company and any associated conditions

Company X's first-of-a-kind US$500 million transition-linked debt issuance in 2021 is a positive signal



Source: (i) Publicly available data from Company X; (ii) "Pricing of Sustainability-Linked Bonds," *Journal of Financial Economics*, 2024; (iii) *Integrated Annual Report* 2024-2025, Company X; (iv) "Limited Accountability and Awareness of Corporate Emissions Target Outcomes," *Nature Climate Change*, 2025.

*Penalty expense calculated as 0.375% of issuance size of US$500 million. Company X's annual interest expense of INR6,199 cr converted to US dollars using exchange rate of INR83 = US$1.

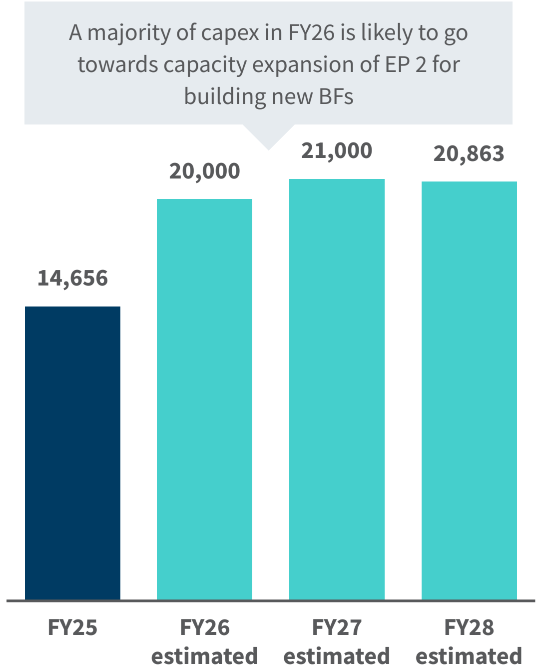
Financing alignment

Alignment of capex

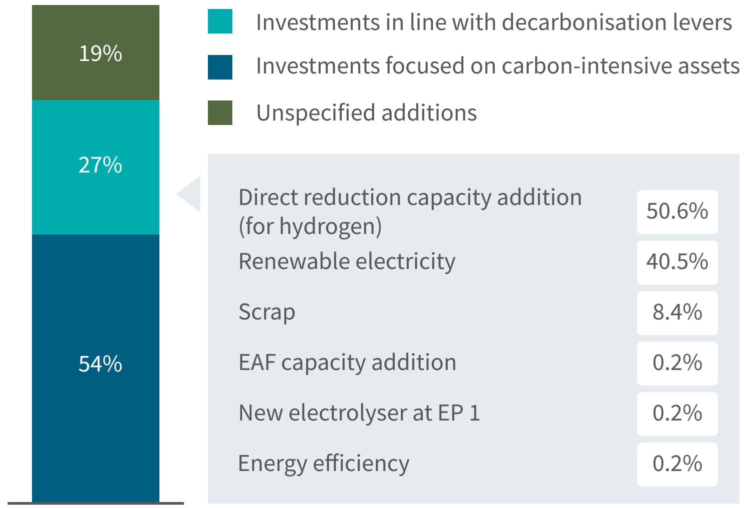
Investigate the company's long-term capex plans for alignment with decarbonisation efforts

Over the long term, more than 50% of planned investments are focused on carbon-intensive production assets

Annual capex, 2025–28 estimated (INR cr)[i, ii]



Share of planned investments aligned with decarbonisation efforts (in % of total planned)[iii]



Direct reduction capacity addition (for hydrogen)	50.6%
Renewable electricity	40.5%
Scrap	8.4%
EAF capacity addition	0.2%
New electrolyser at EP 1	0.2%
Energy efficiency	0.2%

Notes from analysis

Due to lack of disclosure requirements, capex or investment alignment needs to be pieced together from a variety of sources. Banks may be able to request the same directly from companies, and transition intelligence firms like Carbon Transition Analytics can help. However, disclosure norms will need to evolve to make analysis simpler.

Source: (i) Press releases, Company X; (ii) "*Integrated Annual Report* 2024–2025," Company X; (iii) "*Company X*," Carbon Transition Analytics, 2025.

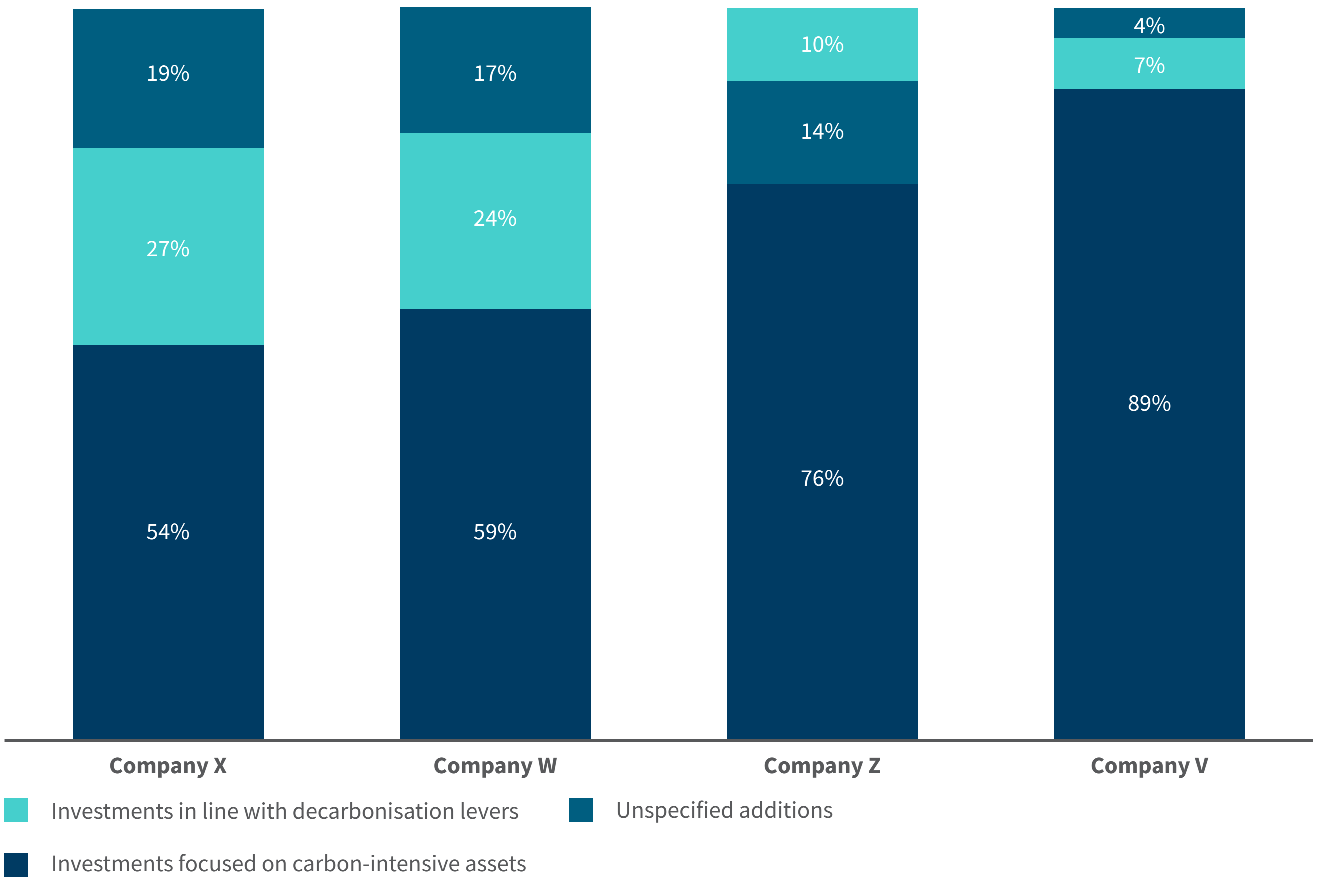
Financing alignment

Alignment of capex

Benchmark the company's long-term capex plans relative to industry peers to identify how its market position may evolve

Although Company X leads industry peers in capex aligned with decarbonisation measures, >50% of investment is in emissions-intensive routes

Share of planned investments aligned with decarbonisation efforts, Company X, Company W, Company Z, and Company V (in % of total planned)[i]



Source: "*Company X*," Carbon Transition Analytics, 2025.

Feasibility

1. Investment alignment
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   iv. CCUS

Asset pipeline

Iron assets

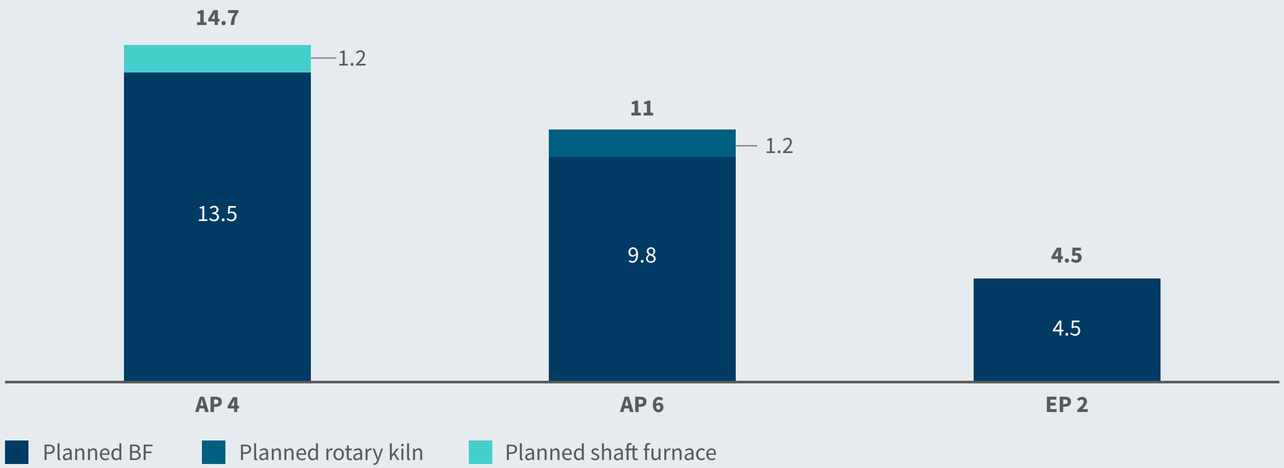
Identify the iron production capacity that the company intends to add and the kinds of technologies being adopted

Company X continues to invest in blast furnaces because they are cost competitive in India, thereby making the realisation of CCUS a key determinant of its decarbonisation feasibility

Company X's planned iron production capacity appears to primarily be focused on BFs, although only the 4.5 Mtpa expansion plan at EP 2 is confirmed

Current and planned iron capacity by plant and technology type (in Mtpa)

Announced iron capacity by plant and technology type (in Mtpa)[1]



Source: "Iron & Steel Tracker," GEM, 2025.

Asset pipeline

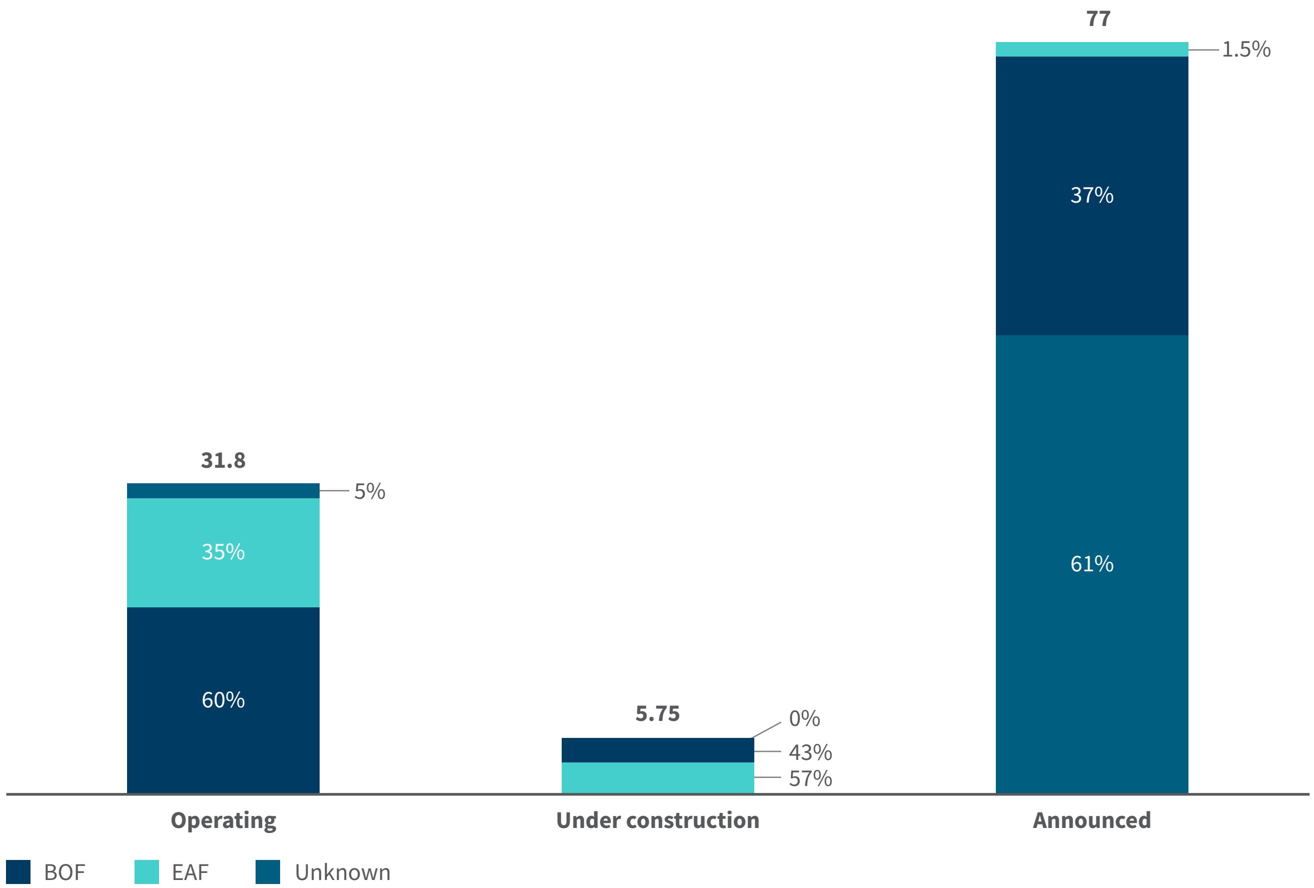
Steel assets

Identify the kind of steel production technology that is currently in the company's pipeline

In line with BF investments, Company X appears to be continuing to focus on building out BOF capacity (1/2)

Approximately 37% of planned steelmaking capacity appears to focus on BOFs; greater clarity on technology choices for greenfield expansion is needed to assess the overall trajectory

Current and planned capacity by plant and technology type as of 2025 (in Mtpa)



Source: "Iron & Steel Tracker," GEM, 2025.

Asset pipeline

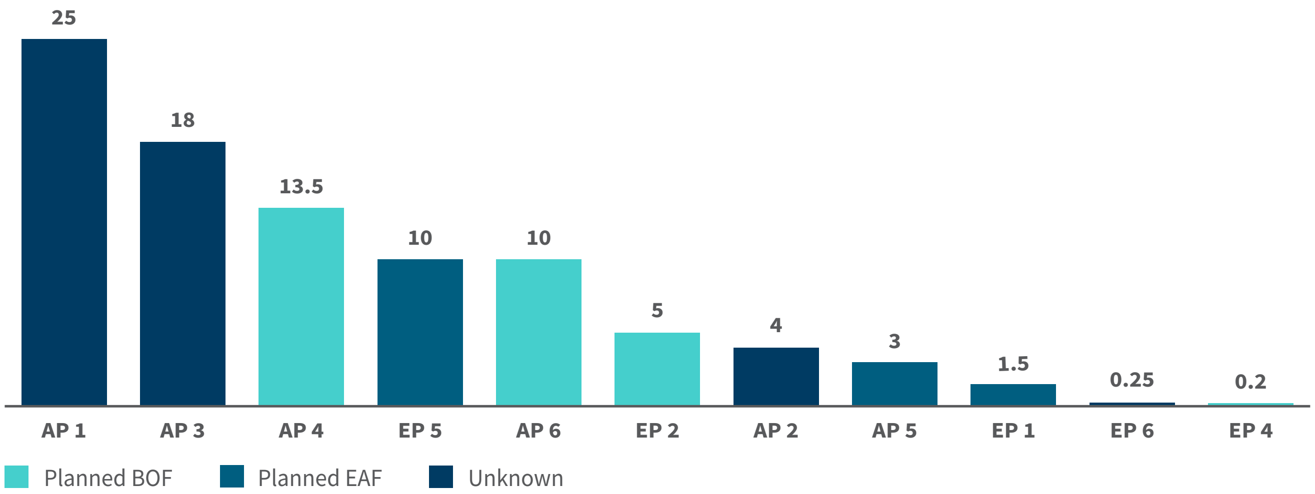
Steel assets

Identify the kind of steel production technology that is currently in the company's pipeline

In line with BF investments, Company X appears to be continuing to focus on building out BOF capacity (2/2)

BOF capacity is being planned for the new AP 4 and AP 6 plants and an expansion to EP 2 in line with BF additions; additions of EAF to EP 5 and AP 5 are in line with green steel ambitions for those plants

Planned capacity by plant and technology type as of 2025 (in Mtpa)



Potential next steps

It is critical to dive deeper and investigate the different steelmaking routes the company is considering for its major plants and the potential impact of different choices on its decarbonisation pathway.

Notes from analysis

In making sense of expansion plans, it is important to consider the likelihood of plans materialising by monitoring status of approvals and other signals of progress.

Source: "Iron & Steel Tracker," GEM, 2025.

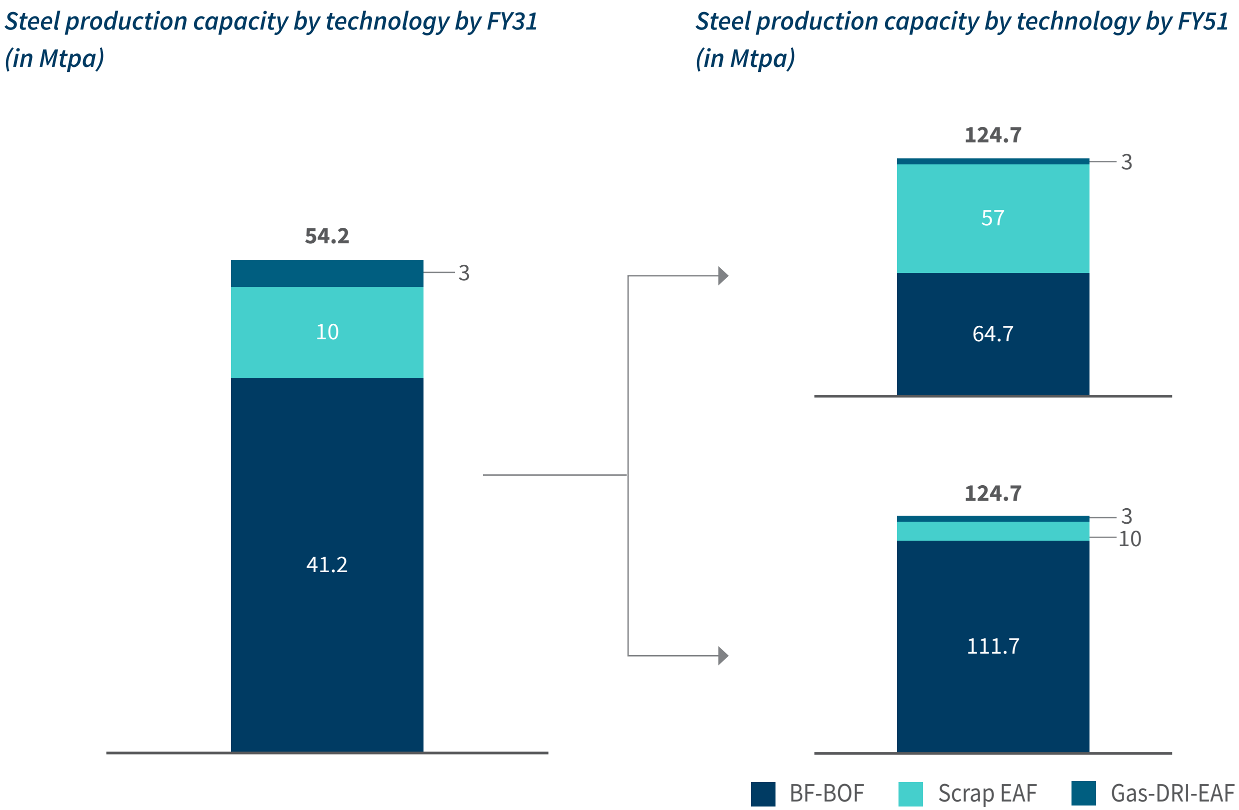
Asset pipeline

Future asset base

Map the company's future steel production capacity by technology

Even if Company X prioritises natural gas-DRI-EAF for new plants, BF-BOF will still account for ~50% of capacity by 2050

Company X's ability to achieve net zero will depend on its ability to decarbonise its BF-BOF assets



Source: Integrated reports, Company X, 2023-2025; "Iron & Steel Tracker," GEM, 2025; publicly available data.

Feasibility

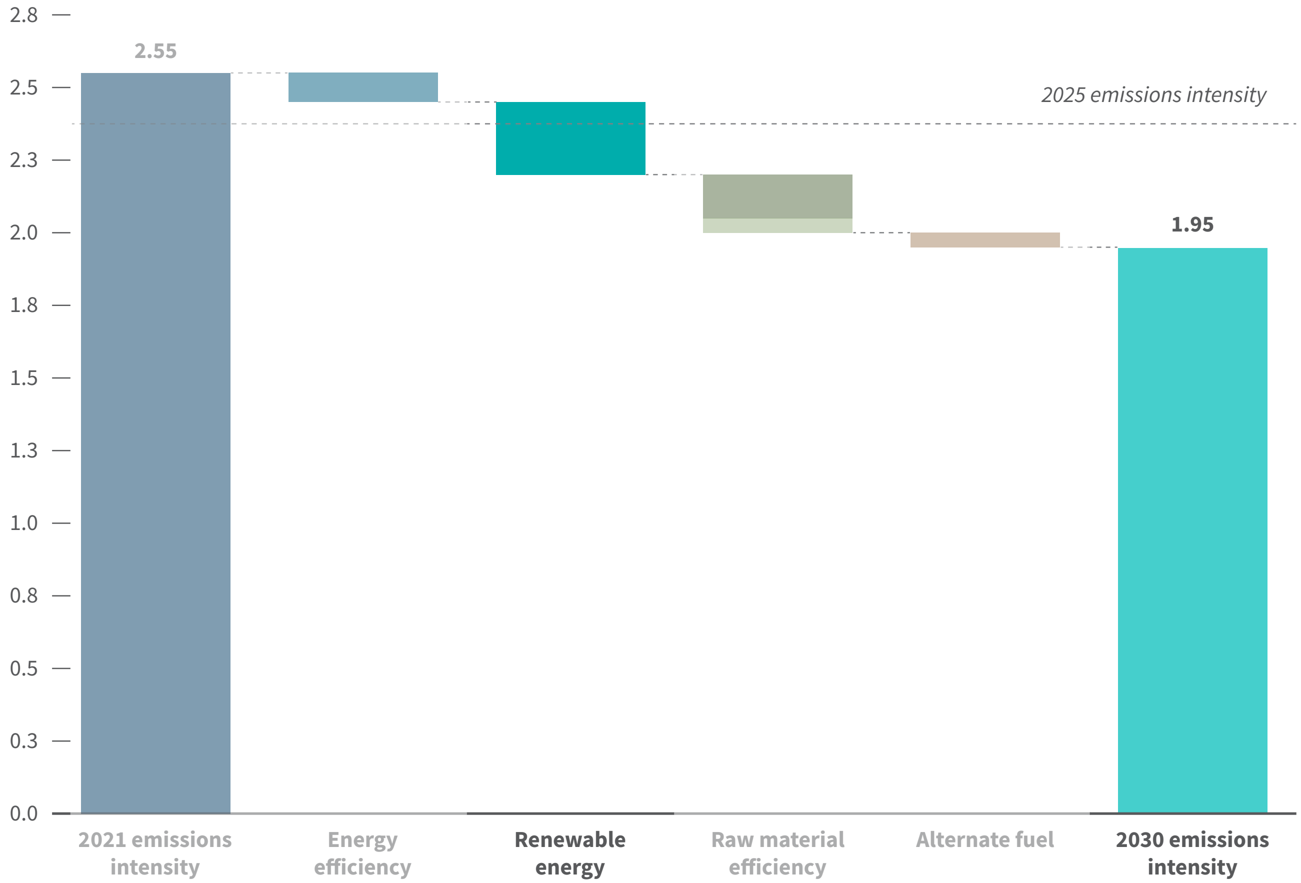
1. Investment alignment
    i. Financing alignment
    ii. Asset pipeline
2. Dependency mapping
    i. **Renewable energy**
    ii. Raw material efficiency
    iii. Alternate fuels
    iv. CCUS

Company overview

Map the extent to which the company is focussing on renewable energy to reduce emissions

Adoption of renewable energy accounts for ~40% of the planned emissions intensity reduction for Company X's 1.95 tCO_2/tcs target

Contribution of levers to Company X's emissions reduction until 2030 (Scope 1 and 2, tCO_2e/tcs)



Source: Climate Action Plan, Company X, 2024.

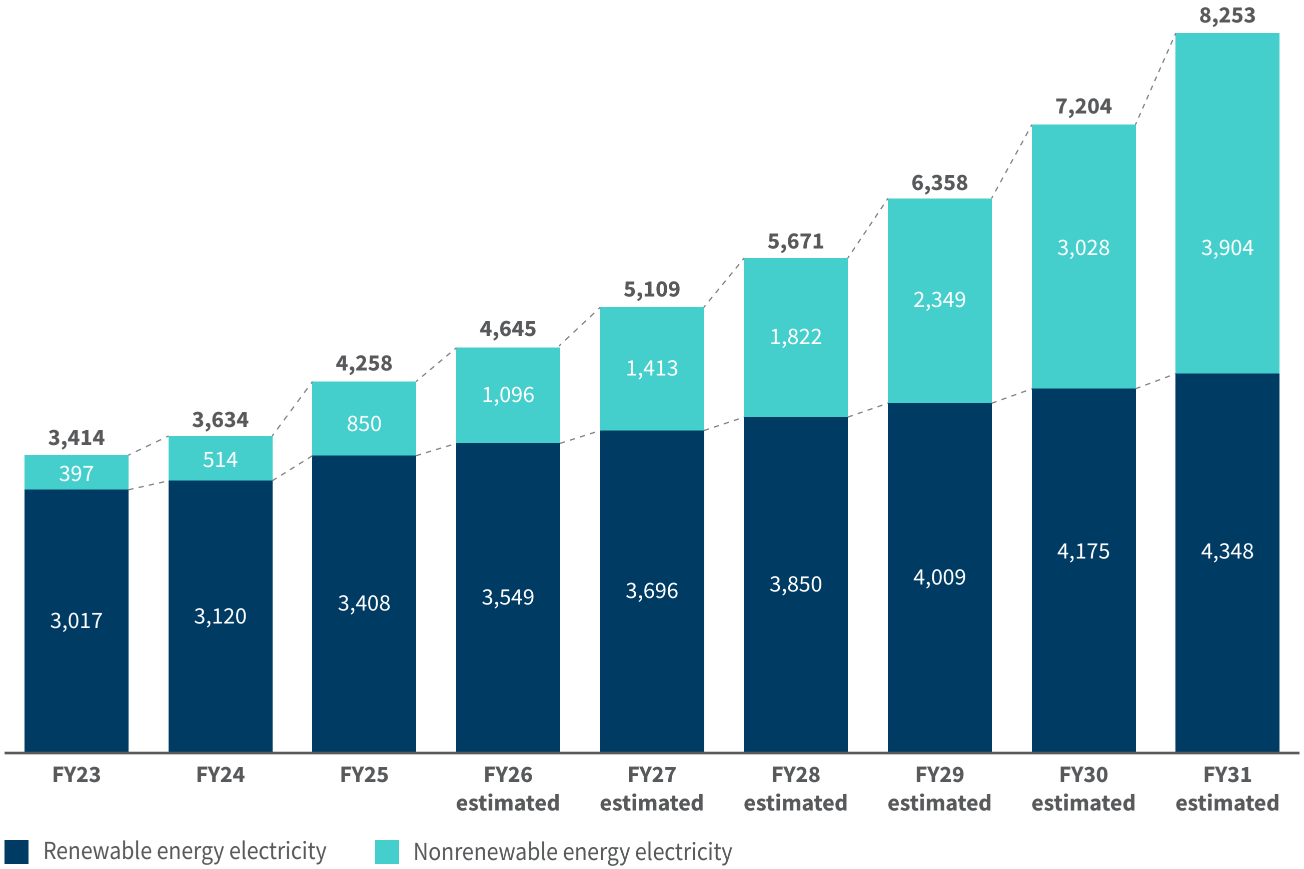
Company overview

Map the company's current use of renewable energy to understand its readiness to transition to renewable energy

~80% of Company X's electricity comes from nonrenewable energy sources, although the renewable energy share has been increasing

Assuming Company X's electricity demand from renewable and nonrenewable energy continues to grow at historical rates, ~47% of Company X's electricity in FY31 could come from renewable energy sources

*Total estimated electricity consumption by source, FY23–31 (in GWh)[i, *]*



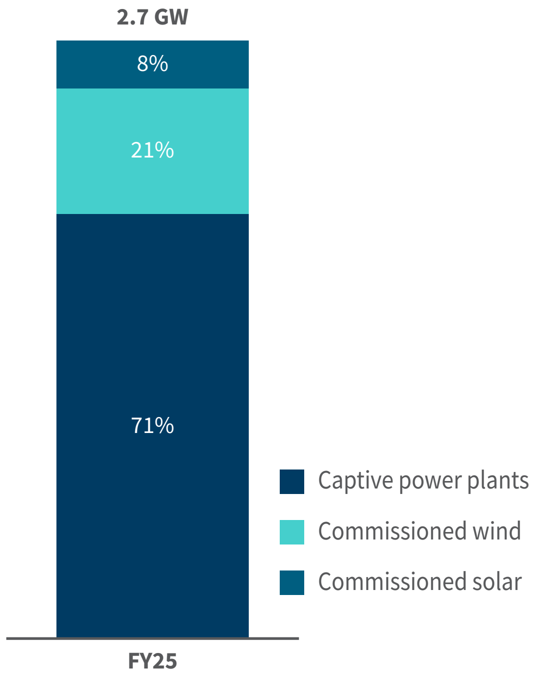
Source: BRSR reports FY23, FY24, FY25, Company X.
*Energy consumption from electricity in gigajoules was converted to megawatt-hours using the conversion rate of 1 Gigajoule (GJ) = 0.27778 Megawatt-hours as per the US Energy Information Administration.

Company overview

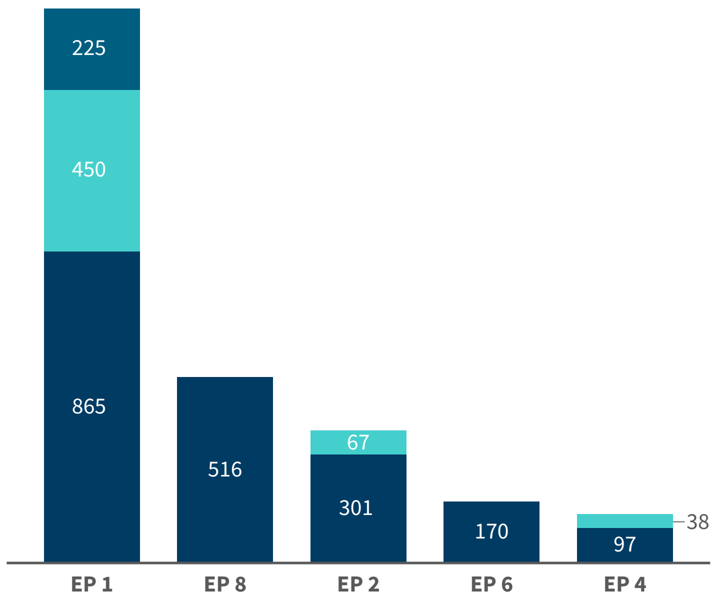
Map the company's current renewable energy capacity

~71% of Company X's 2.7 GW installed power generation capacity is a mix of thermal and waste heat recovery captive power plants

Installed power capacity by type



Installed power capacity by crude steel plant and type (in megawatts [MW])



Potential next steps

Company X employs a combination of waste heat recovery and coal for its captive power plants. The exact proportion between waste heat recovery and coal is not publicly available and warrants further investigation through company engagement. Waste heat recovery systems are an energy efficiency measure that should be encouraged more, alongside efforts to reduce coal usage.

Source: *Integrated Annual Report*, Company X, 2024–2025.

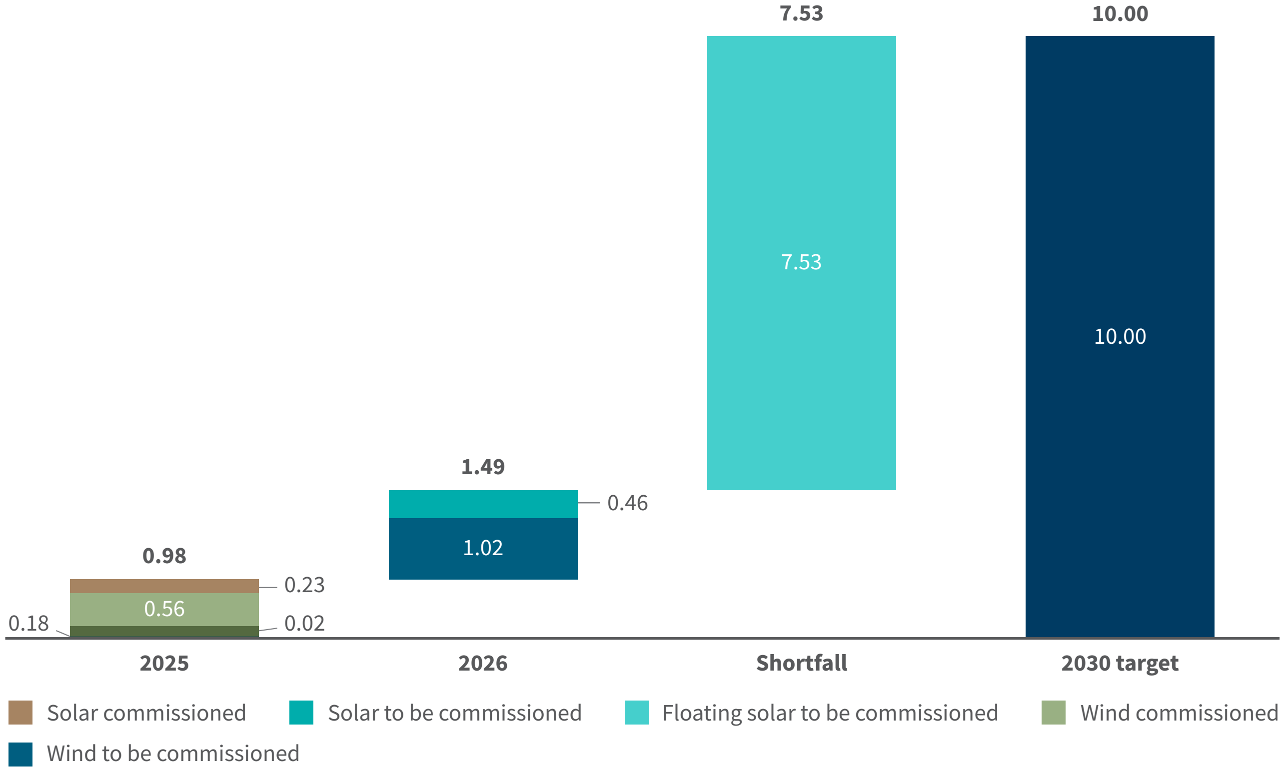
Company assessment

Assess the extent to which the company is on track to achieve its renewable energy targets

Company X is yet to lay out plans for the remainder ~7.5 GW of RE for its 2030 target; historical rate of progress implies this will not be an issue

To meet its 2030 target, ~1.8 GW of renewable energy will need to be commissioned annually from 2027 onwards

Company X's renewable energy capacity expansion, FY25–FY31 (in GW)



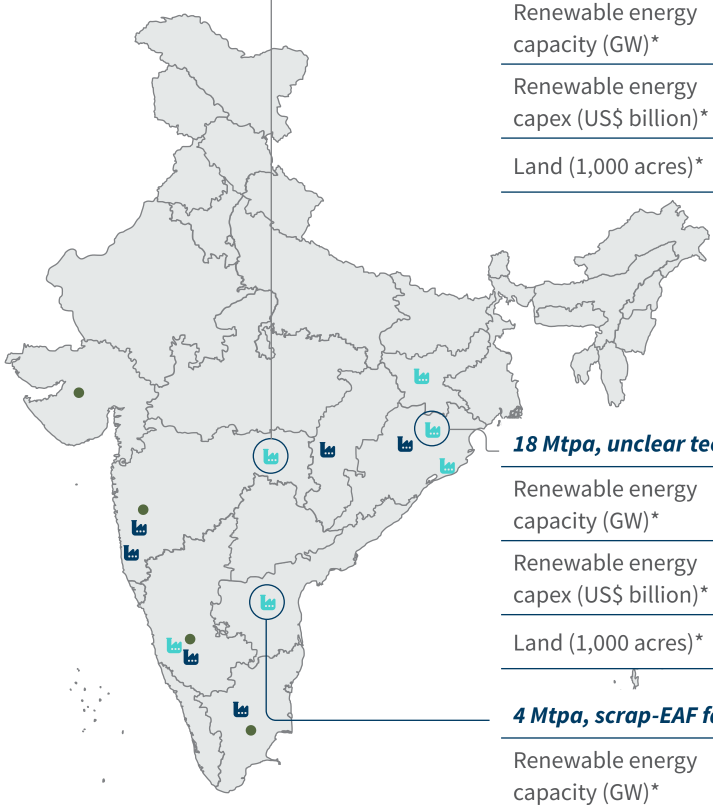
Company X has contracted for 6.2 GW for renewable energy with an energy generation company, opting for the group captive model, and 2.7 GW of battery storage. Company X's ability to meet renewable energy targets will likely depend on the contracted company's ability to build capacity.

Source: *Integrated Annual Report*, Company X, 2024–2025; *Integrated Annual Report*, Company X, 2023–2024.

Company assessment

Assess potential for further renewable energy capacity addition based on the company's current assets and expansion plans

Company X will require 11–14 GW of renewable energy if it prioritises EAF build-out; generators will need US$6 billion–US$9 billion in capex to meet this demand



Existing steel production plants

Planned steel production plants

Renewable energy capacity installation

25 Mtpa, unclear technology (EAF assumed), AP 1, Maharashtra[i]

Renewable energy capacity (GW)*	6–7.5	Captive model in state is the most cost-effective renewable energy procurement route. Company X's sister company has plants serving EP 2 and has acquired 45 MW of wind assets in Sangi district and 52 MW of additional assets in state.
Renewable energy capex (US$ billion)*	3–4	
Land (1,000 acres)*	24–30	

18 Mtpa, unclear technology (EAF assumed), AP 3, Odisha1

Renewable energy capacity (GW)*	4–5.5	Captive and third-party model in state is the most cost-effective renewable energy procurement route. Company X Energy primarily operates thermal capacity in the state and has a 49.5 MW wind plant in the pipeline in Koraput.[ii]
Renewable energy capex (US$ billion)*	2–3	
Land (1,000 acres)*	17–22	

4 Mtpa, scrap-EAF facility, AP 5, Andhra Pradesh1

Renewable energy capacity (GW)*	1–1.2	Captive OA model in state is the most cost-effective renewable energy procurement route. Company X Energy acquired wind plants in the state and recently received approval for an 88 MW wind plant in Aspari district.[iii]
Renewable energy capex (US$ billion)*	0.5–0.7	
Land (1,000 acres)*	4–5	

Source: (i) Iron & Steel Tracker, GEM, 2025; (ii) "Upcoming RE projects," *Go Green, Government of Odisha*; (iii) "Andhra RE approval," *The New Indian Express*, 2025

*Step (i) Calculated lower and upper bound of total annual electricity needed for each plant by multiplying total yearly production (production capacity x 80% utilisation factor) with estimated electricity consumption for EAF routes (660–820 kilowatt-hours/t). Step (ii) Calculated average continuous load needed by EAF by dividing annual electricity need by the number of operational hours in year (assumed as 8,760). Step (iii) Calculated necessary renewable energy capacity by dividing the average continuous load by the capacity utilisation factor for solar (21%) and wind (28%–32%) assuming 50:50 hybrid system. Step (iv) Calculated capex needed using US$550/kilowatt for solar photovoltaics and US$550/kilowatt for wind. Step (v) Calculated land needed using 4.5 acres/MW for solar and 3.38 acres/MW for wind.

Transition risk and opportunity

Based on the assessment, consider whether the company's efforts pose a transition risk or opportunity

Renewable energy may offer limited long-term decarbonisation potential for Company X due to its continued reliance on the BF-BOF route

Transition risk

- **Renewable energy impact:** A majority of Company X's capacity operates the BF-BOF route, where renewable energy plays a minimal role. In the long term, renewable energy adoption alone cannot achieve deep decarbonisation.

Transition opportunity

- **Short-term renewable energy needs:** Financing engagements with the company may help ensure that the renewable energy shortfall is addressed.
- **Long-term renewable energy needs:** Company X has ambitious expansion plans. If it opts for the EAF production route, paired with renewable energy, significant additional capacity and financing will be needed to support the transition.

Feasibility

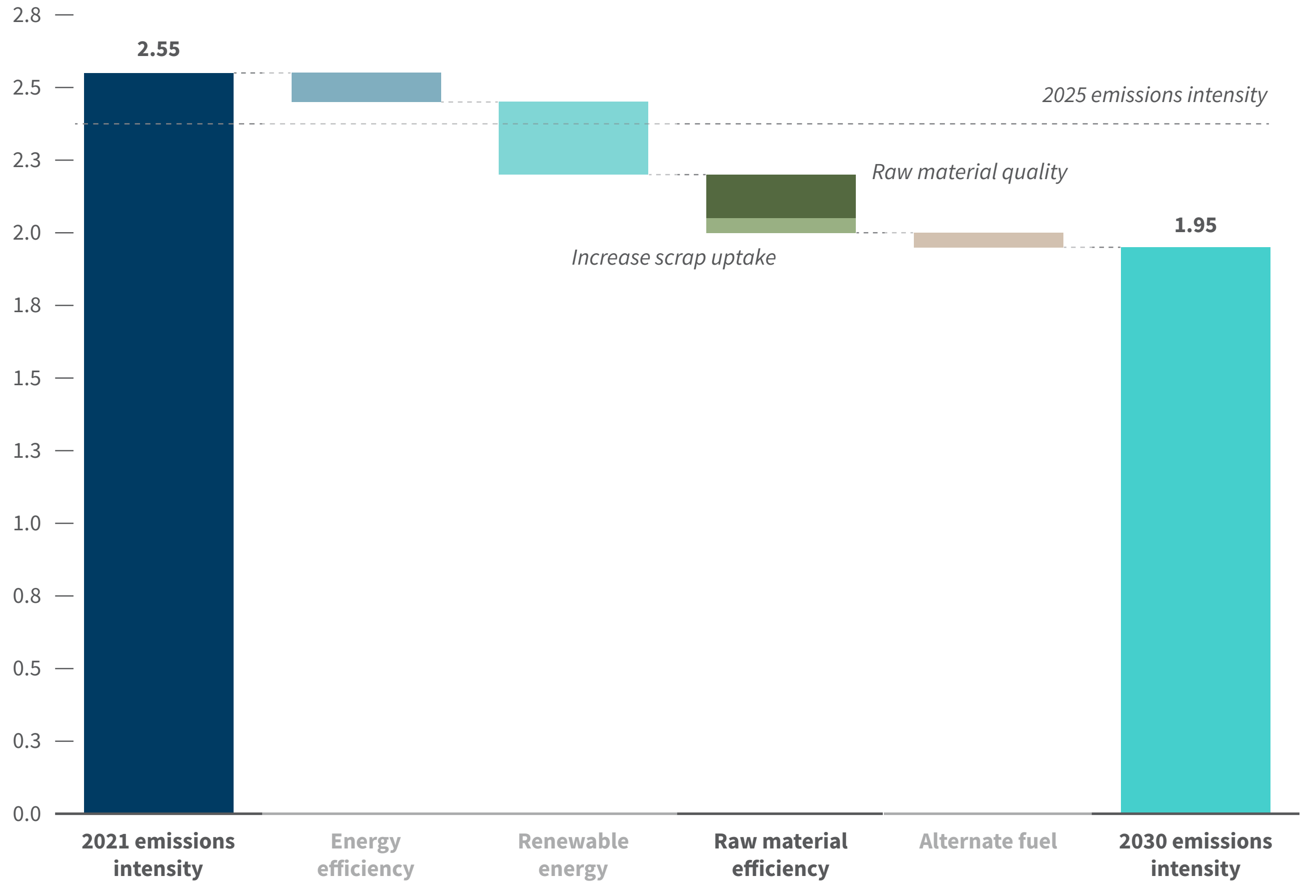
1. Investment alignment
   i. Financing alignment
   ii. Asset pipeline
2. Dependency mapping
   i. Renewable energy
   ii. **Raw material efficiency**
   iii. Alternate fuels
   iv. CCUS

Company overview

Map the extent to which the company is focusing on renewable energy to reduce emissions

Raw material efficiency accounts for 36% of Company X's planned emissions reduction by 2030, with a focus on raw material quality

Contribution of levers to Company X's emissions reduction until 2030 (Scope 1 and 2 tCO_2e/tcs)



Source: *Climate Action Report*, Company X, 2024.

Company assessment

Assess the extent to which the company is investing in increasing its quality of iron ore

Company X is building out considerable beneficiation and pelletisation capacity

Implemented measures

1. **Company X has invested significantly in iron feedstock improvement at EP 1:** EP 1 has India's largest beneficiation plant, boasting a 20 Mtpa capacity. It also has India's largest pellet plant, with a capacity of 8 Mtpa, employing low-pressure gas for pellet induration.
2. **Company X has invested in feedstock quality monitoring:** Climate action centres at EP 8 and EP 6 now use digital analytics to monitor feedstock quality and slag reuse.

Planned measures/targets

3. **Pelletisation plant build-out in Odisha:** By FY26–27, a 30 Mtpa slurry pipeline to a nearby port and an 8 Mtpa Odisha pellet plant will enhance logistics efficiency and raw material security.
4. **Large-scale investment in beneficiation:** Company X has allocated US$470 million to set up beneficiation plants.

Given logistics needs, it is likely that any new beneficiation plants will be set close to Company X's existing iron mines in Karnataka and Odisha.

Source: *Integrated Annual Report*, Company X, 2024–2025; *Integrated Annual Report*, Company X, 2023–2024.

Company overview

Assess the extent to which the company is exploring the use of scrap to decarbonise steel production

Company X plans to increase scrap utilisation significantly and is setting up recycling facilities near key plants in Maharashtra

2.3 Mt scrap recycled by Company X in FY24–25; >90% was from internal sources[i]

4% of scrap is currently used by Company X in production as of FY25[i]

Up to 20% scrap utilisation targeted by Company X[ii]

- Company X has formed a subsidiary that is developing a 0.4 Mtpa steel scrap shredding facility near EP 2, expected to be operational by the end of 2026.[ii]
- Company X is also building a 0.5 Mtpa scrap shredding facility near Chennai that will supply its plants under construction in Karnataka and Andhra Pradesh.

Potential next steps

Company X's scrap utilisation ambition should be benchmarked against targets by other steel companies and India's national targets. The feasibility of increasing scrap utilisation based on Company X's asset base can also help appropriately benchmark the company's efforts.

Source: (i) "SDG Mapping of Company X's Initiatives & Projects," Company X; (ii) *Integrated Annual Report* FY25, Company X.

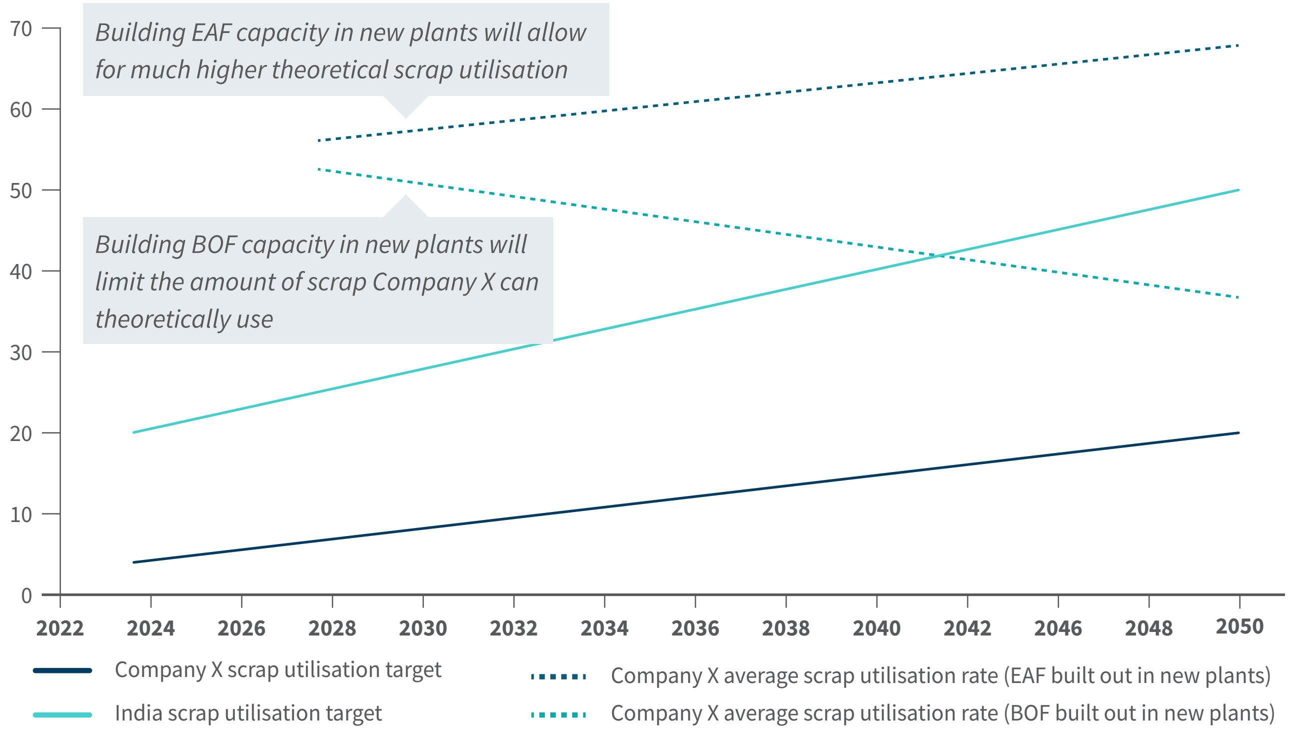
Company assessment

Assess the extent to which the company has headroom to increase scrap utilisation

Company X has the potential to increase its ambition to achieve 50% scrap utilisation in line with national targets

Assuming Company X commits to maximising scrap usage, its average scrap utilisation rate would range between ~40% and 70% depending on whether it prioritises BOF or EAF build-out for announced plants

Company X scrap utilisation trajectories vs. India national target (in % of steelmaking input)



Source: "Government Aiming to Increase Scrap Share in Steelmaking to 50% by 2047 to Aid Green Steel Initiative," *The Hindu*, 2024; *Greening the Steel Sector in India: Roadmap and Action Plan*, MoS, 2024.

Note: Steel production capacity of Company X is split into BOF and EAF and scenarios created based on expansion plans. The theoretical limit for scrap utilisation assumed to be 25% and 100% for BOF and EAF respectively. Scrap input to steel output ratio assumed at 1.25:1.

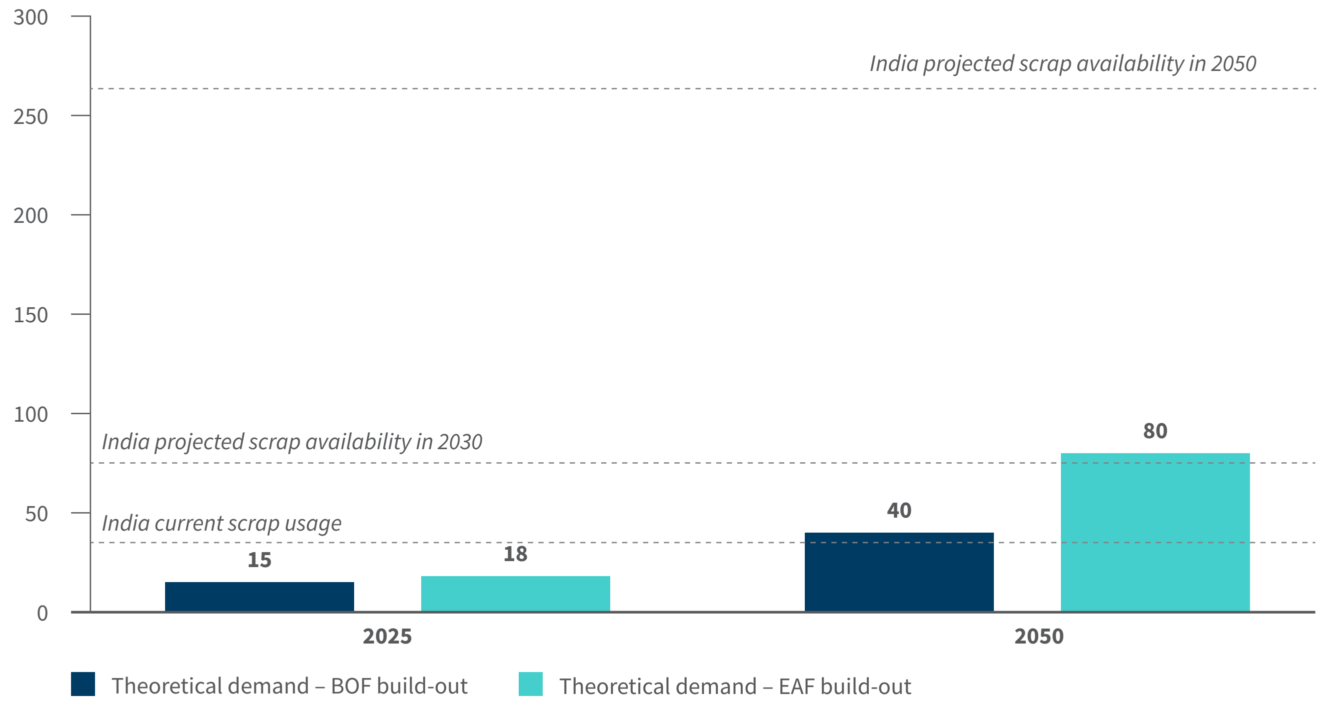
Company assessment

Assess the extent to which the company has headroom to increase scrap utilisation

Scrap availability is likely to prevent Company X from being able to maximise scrap utilisation at its plants

Assuming Company X commits to maximising scrap usage, it would consume approximately 16%–32% of the total scrap available in India in 2050

Company X scrap demand trajectories vs. India availability (in Mt)



Source: "Government Aiming to Increase Scrap Share in Steelmaking to 50% by 2047 to Aid Green Steel Initiative," *The Hindu*, 2024; *Greening the Steel Sector in India: Roadmap and Action Plan*, MoS, 2024.
Note: Steel production capacity of Company X is split into BOF and EAF and scenarios created based on expansion plans. The theoretical limit for scrap utilisation assumed to be 25% and 100% for BOF and EAF respectively. Scrap input to steel output ratio assumed at 1.25:1.

Transition risk and opportunity

Based on the assessment, consider whether the company's efforts pose a transition risk or opportunity

Greater use of scrap in steelmaking offers financiers an opportunity to support the recycling supply chain, but limited scrap availability will remain a constraint

Transition risk

- **Limited long-term impact of raw material quality improvements:** Raw material improvements are important in unlocking energy efficiency and reducing overall resource consumption; however, their impact on emissions is incremental. They are valuable for short-term reductions.

Transition opportunity

- **Scrap is a high-impact and feasible decarbonisation lever that offers a financing opportunity:** Scrap can be paired with EAFs to produce near-zero steel. Banks can finance all parts of the value chain — from scrap collection and processing plants, to scrap procurement for steel companies.

Case Study

In line with its steel sector strategy, which focuses on scrap and renewable energy in the short term before shifting focus to GH2 and deeper decarbonisation — Standard Chartered extended a US$25 million transition trade facility to Tung Ho, a 100% scrap-EAF-based steel producer, to support continuous procurement of scrap.[i]

Source: (i) *Standard Chartered Transition Plan*, Standard Chartered 2024; *Transition Finance Resource Hub*, RMI.

Feasibility

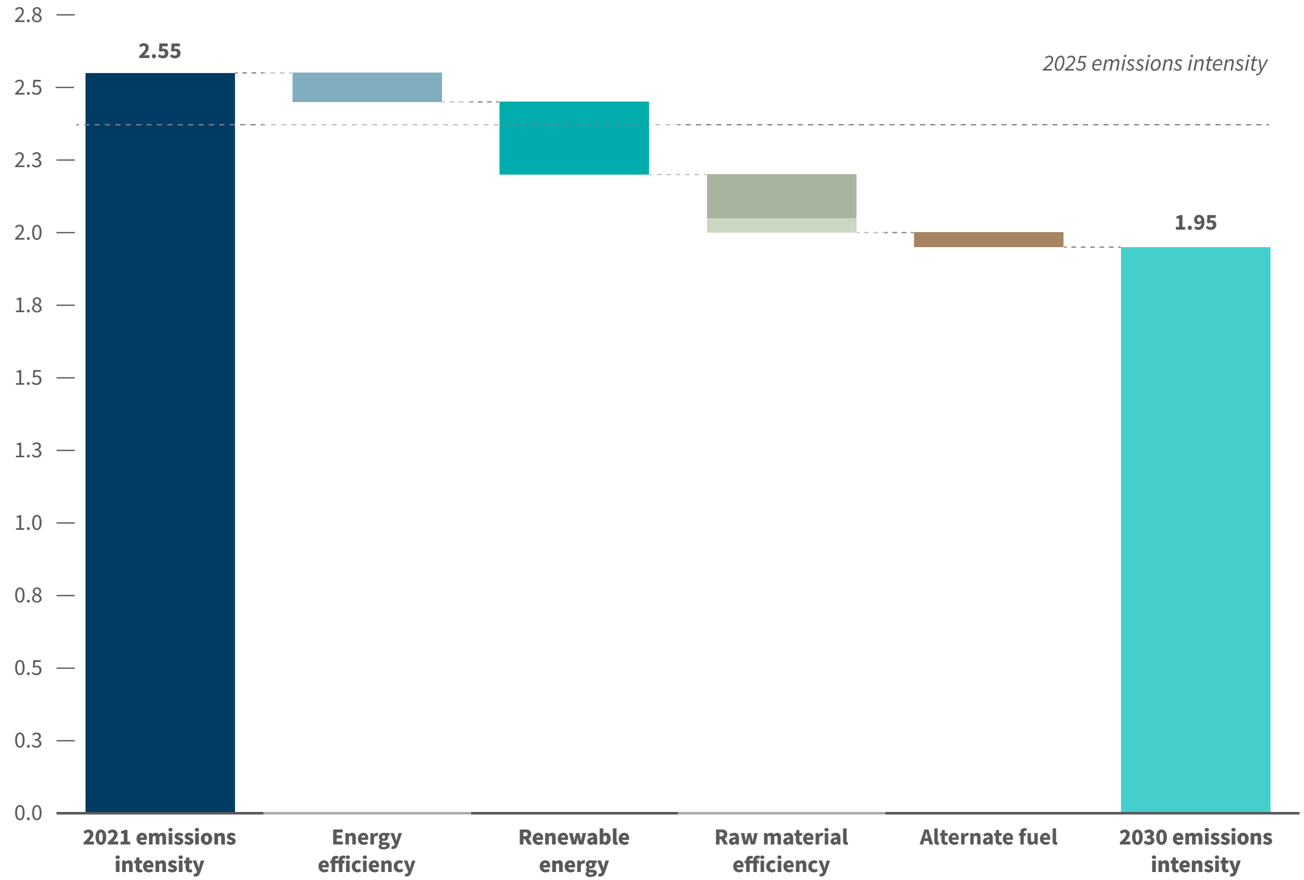
1. Investment alignment
    i. Financing alignment
    ii. Asset pipeline
2. Dependency mapping
    i. Renewable energy
    ii. Raw material efficiency
    iii. Alternate fuels
    iv. CCUS

Company overview

Map the extent to which the company is focusing on alternate fuels to reduce emissions

Alternate fuels are not a significant priority for Company X in the short term, but will be crucial to long-term decarbonisation

Contribution of levers to Company X's emissions reduction until 2030 (Scope 1 and 2 tCO_2e/tcs)



Source: Climate Action Plan, Company X, 2024.

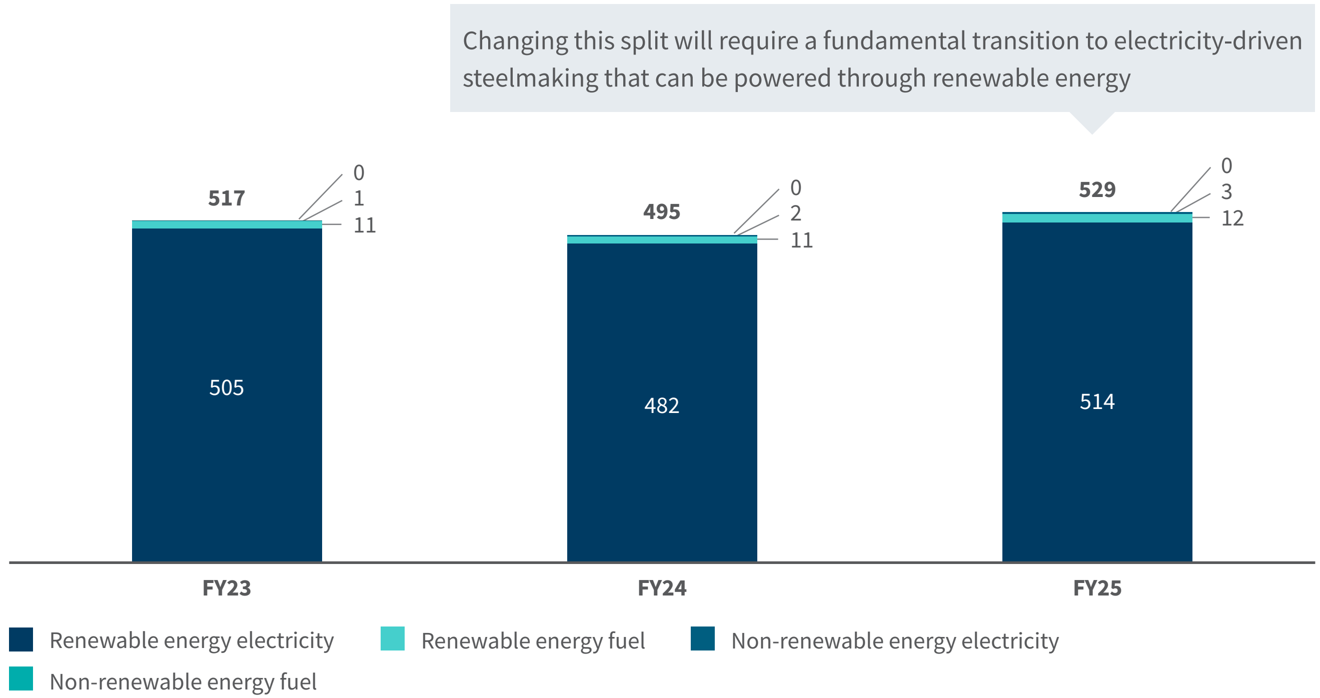
Company overview

Map the company's current reliance on fossil fuels to meet its energy needs

97% of Company X's energy comes from nonrenewable energy sources, primarily due to use of coal as a feedstock in iron and steel production

Although renewable energy electricity consumption has increased significantly, it remains a small share of overall electricity consumption

Total energy consumption by source, FY23–25 (in petajoules)



Source: BRSR reports, Company X, FY23, FY24, FY25.

Company overview

Evaluate the company's current usage of GH2 and the pipeline it is building for the future

Company X has started undertaking pilots on GH2 and scaling up use of natural gas-DRI-EAF steel production

Transitional stage

1. Natural gas injection in BF-BOF, along with use of COREX gas to overcome natural gas availability constraint*
2. 4 Mtpa EP 5 plant being set up to meet EU CBAM requirements; will initially use natural gas for DRI-EAF route

Net-zero steel transition

3. Exploring GH2 blending in BF-BOF and blending GH2 in the Natural gas-DRI-EAF route; EP 1 plant awarded a grant for conducting a pilot by the MoS; a 3,800 tonnes per annum (tpa) GH2 plant has been commissioned

Potential next steps

GH2 commercialisation will take a long time, and a transition to natural gas-DRI-EAF before that will be a critical intermediate step. Understanding how Company X's future pipeline is placed for this transition will be key to better understanding the feasibility of truly using GH2 as a decarbonisation lever.

Source: *Integrated Annual Report*, Company X, 2024-2025.
*COREX gas is generated in the smelting reduction process and these off-gases contain significant amounts of carbon monoxide along with trace amounts of hydrogen, which can be utilised (after processing) as a reduction gas within DRI production, therefore reducing the need to use natural gas.

Company assessment

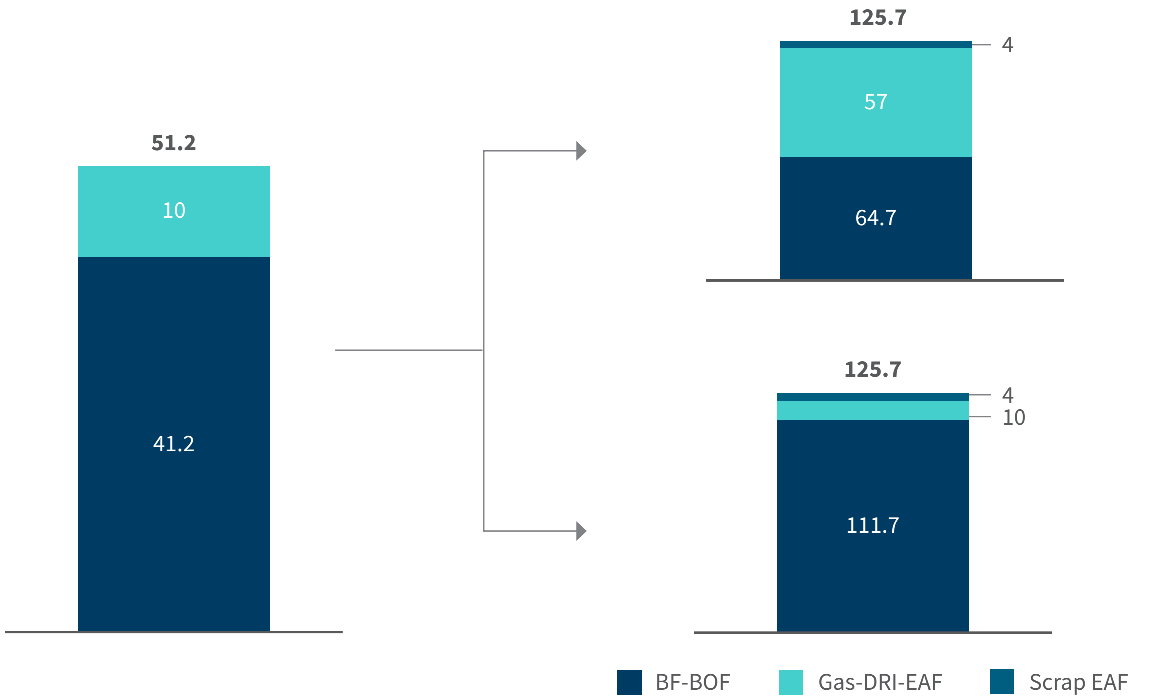
Evaluate the company's potential headroom for GH2 utilisation

Company X's future capacity choices will determine the degree to which GH2 can be utilised for decarbonisation

Even if Company X prioritises low-emissions steel production routes across AP 1, AP 2, and AP 3, <50% of capacity will be natural gas-DRI-EAF

Steel production capacity by technology by FY31 (in Mtpa)

Steel production capacity by technology by FY51 (in Mtpa)

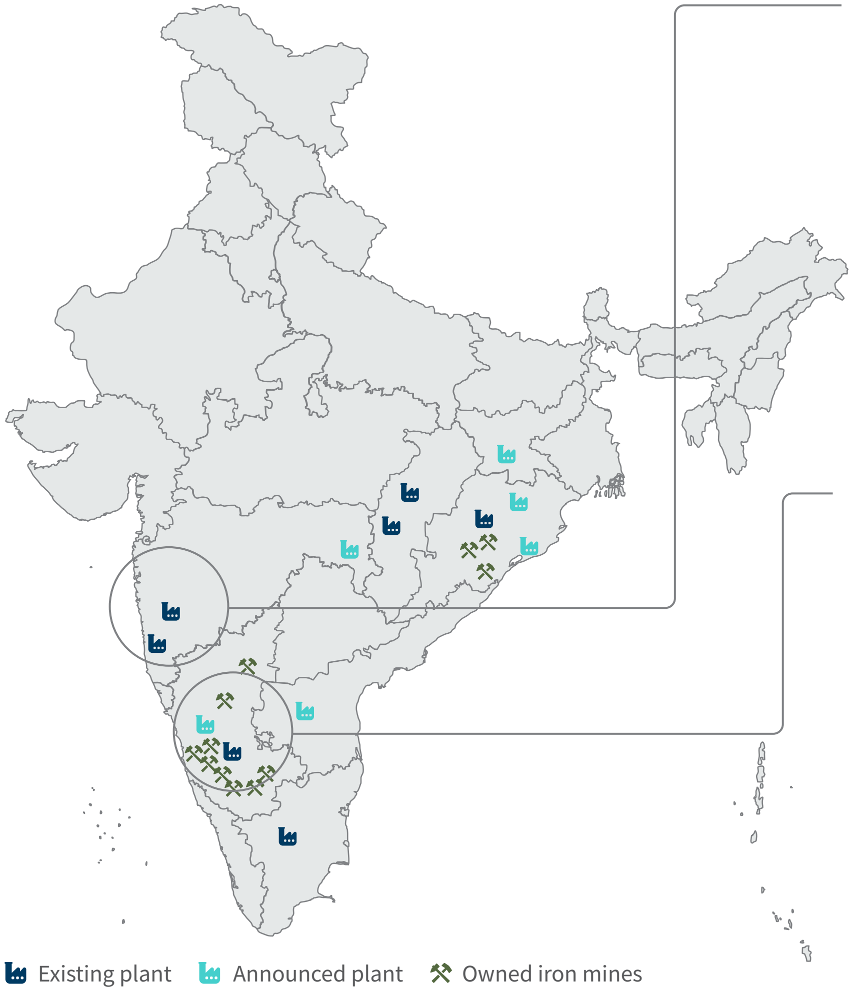


Source: "Iron & Steel Tracker," GEM, 2025.

Company assessment

Evaluate the company's potential headroom for GH2 utilisation

GH2 production in Maharashtra and Karnataka appears to be feasible; however, Company X's reliance on BFs may limit utilisation potential



Maharashtra | ***EP 5, EP 2, AP 1***

- ***Iron production:*** *EP 5 is already a DRI plant, positioning it well to absorb GH2 in the process. EP 2 primarily relies on BF for iron production, limiting GH2 integration.*
- ***Policy environment and levelised cost of hydrogen (LCOH):*** *Maharashtra offers limited renewable energy subsidies for GH2 production but offers a 30% capex subsidy. Average LCOH is US$4.28/kg and is expected to fall to ~US$4/kg by 2030.*[i]
- ***Water scarcity:*** *Maharashtra is significantly water stressed; however, the regions near EP 5 and EP 2 have adequate water availability for GH2 production.*[ii]

Karnataka | ***EP 1, EP 3, AP 2***

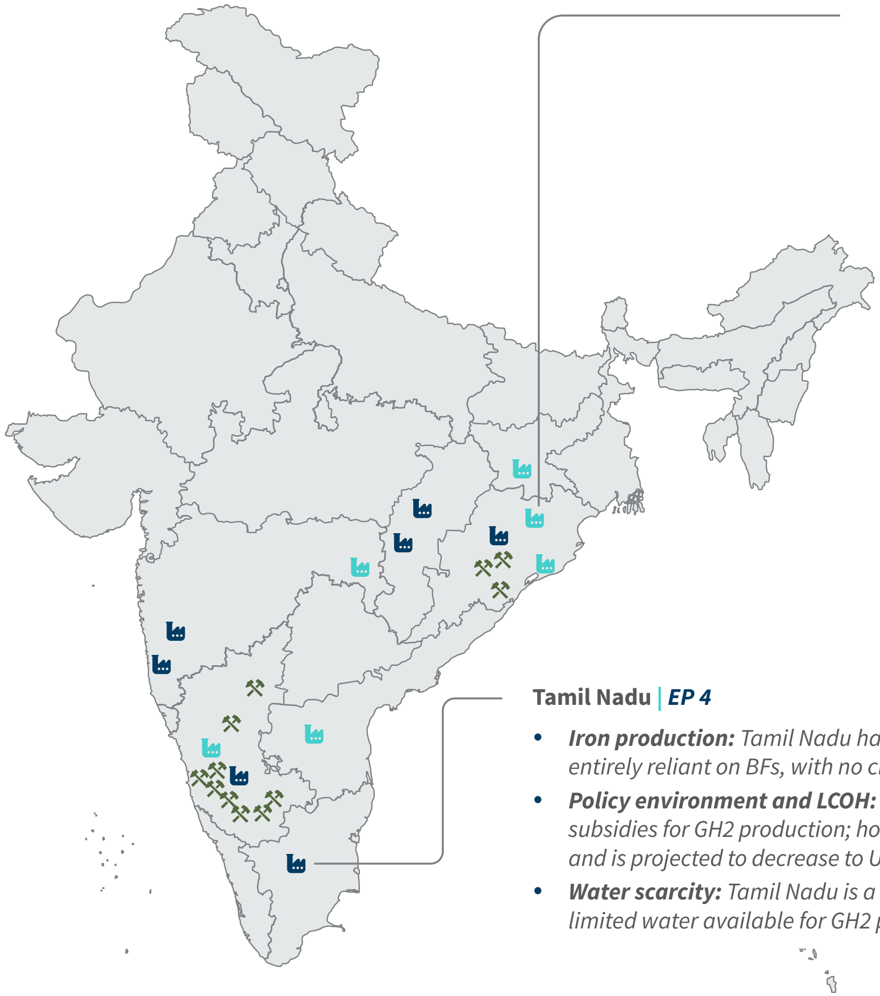
- ***Iron production:*** *EP 1 works and a planned AP 2 plant are well positioned to Company X's iron mines and production sites. However, EP 1 currently relies on BFs for iron production. Company X will need to transition to shaft furnaces to make full use of GH2 in the long run.*
- ***Policy environment and LCOH:*** *Karnataka has not released any policy measures to make GH2 favourable in the state. Nonetheless, there appear to be some areas near Company X with favourable LCOH. The state has an average LCOH of US$4.99/kg, which is projected to decrease to US$3.58/kg by 2030*
- ***Water scarcity:*** *Karnataka is an overall water-stressed state; however, the regions near Company X appear to have sufficient water availability for GH2 production.*[ii]

Source: (i) *Green Hydrogen Production Pathways*, RMI, 2025; (ii) *Unlocking India's RE and Green Hydrogen Potential*, CEEW, 2024; (iii) RMI analysis; (iv) CPI analysis.

Company assessment

Evaluate the company's potential headroom for GH2 utilisation

GH2 utilisation in other states may be limited due to production barriers and reliance on BF for iron production



Odisha | ***EP 8, AP 4, AP 3***

- ***Iron production:*** Well placed relative to iron production sites; however, EP8 is reliant on blast furnaces and rotary kilns, and planned expansions (AP4) also focus on blast furnaces, which limits the scope for GH2 utilisation.
- ***Policy environment and LCOH:*** Odisha offers 100% renewable energy waivers for 20 years and a 30% capex subsidy. As a result, LCOH is one of the lowest at US$3.41/kg but only so long as subsidies persist.[i]
- ***Water scarcity:*** Odisha is quite water scarce and there appears to be limited water available for GH2 production near Company X.[ii]

Tamil Nadu | ***EP 4***

- ***Iron production:*** *Tamil Nadu has limited iron production capacity and EP 4 is entirely reliant on BFs, with no clear plans to expand use of shaft furnaces.*
- ***Policy environment and LCOH:*** *Tamil Nadu has not released significant subsidies for GH2 production; however, LCOH is one of the lowest at US$4.69/kg and is projected to decrease to US$3.55/kg by 2030.*
- ***Water scarcity:*** *Tamil Nadu is a water-stressed state, and there appears to be limited water available for GH2 production near the EP 4 plant.[ii]*

Existing plant | Announced plant | Owned iron mines

Source: (i) *Green Hydrogen Production Pathways*, RMI, 2025; (ii) *Unlocking India's RE and Green Hydrogen Potential*, CEEW, 2024; (iii) RMI analysis.

Transition risk and opportunity

Based on the assessment, consider whether the company's efforts pose a transition risk or opportunity

The move towards GH2 would present a financing opportunity in the medium to long term for bankers

Transition risk

- **Unclear potential for GH2 utilisation in long run:** Company X's plans for GH2 utilisation are limited in the public domain. Though pilot implementation is a strong first step, the build-out of planned BFs, particularly in states that may face barriers to production, can act as a constraint.

Transition opportunity

- **Financing shaft furnace build-out:** Company X will need to build significant shaft furnace capacity as well as EAF capacity across all plants to transition to natural gas and then GH2, offering a significant financing opportunity.
- **Financing GH2 production capacity:** Company X will need to build GH2 production capacity and storage near key plants or secure the same from developers like Company X Green Energy, offering a green financing opportunity.

Case Study

China Industrial Bank (CIB) extended a loan to HBIS Group (Zhangxuan Technology) in 2024 to set up the world's first 1.2 Mt hydrogen metallurgy project, aiming to replace coal with hydrogen as a reductant and reduce carbon dioxide emissions by 70%.[i]

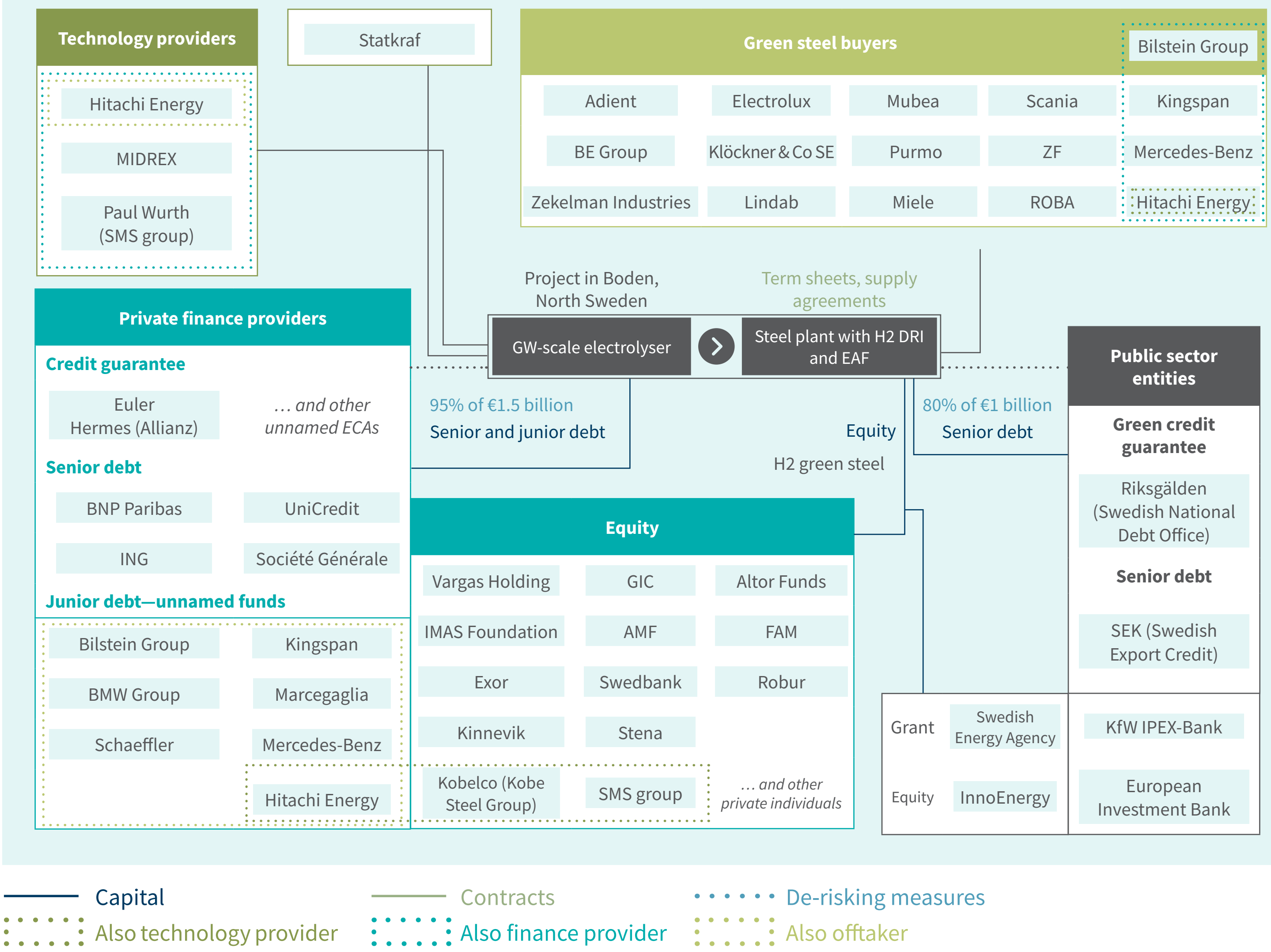
Case Study

SSAB, Sweden's largest steelmaker, secured €2.3 billion to transition its BF-based Lulea steel plant to 100% GH2-DRI-EAF between 2030 and 2045. The financing involves an €808 million syndicated loan backed by the Italian Export Credit Agency, €137 million loan from the Nordic Investment bank, and a €1.3 billion syndicated loan guaranteed by the Swedish National Debt Office.[ii]

Source: (i) "Fostering Green Productivity: CIB Provides Financing Support for the World's First "Hydrogen Metallurgy" Project," CIB, 2024; (ii) "SSAB secures green financing of EUR 2.3 billion," SSAB, 2025, and Lulea steel plant, GEM.

Early GH2 steel projects will require significant de-risking; H2 Green Steel in Sweden offers a good case study of how different stakeholders can come together

Project structure



Source: *Five Lessons for Industrial Project Finance from H2 Green Steel*, RMI, 2023.

De-risking measures

- Funding represents a combination of equity in the H2 Green Steel entity, along with substantial debt in the Boden Project.
- Multiple stakeholders engaged, including downstream buyers to secure offtake, across multiple project elements.
- Grant funding from Swedish state institutions supported overall deal structure.
- Multiple financial institutions participated, creating learnings for similar deals in the future.

Feasibility

1. Investment alignment
   i. Financing alignment
   ii. Asset pipeline
2. Dependency mapping
   i. Renewable energy
   ii. Raw material efficiency
   iii. Alternate fuels
   iv. CCUS

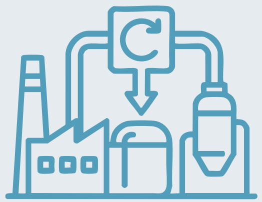
Company assessment

Assess the company's reliance on CCUS as a long-term decarbonisation lever

Company X sees CCUS as a critical lever for meeting its long-term net-zero goal and has begun CCUS pilots

100
tonnes per day

CCUS plant at EP 5 linked to the gas-DRI unit to capture carbon dioxide



100,000
tonnes per annum

Pilot being explored with BHP and CycloneCC technology with EP 1 for implementation in 2026

Company assessment

Assess the feasibility of deploying CCUS at the company's current and planned steel plants

Company X's largest existing and planned steel plants may be isolated from carbon storage sites

EP 2 and AP 4 are within the 25 km distance to gas pipeline threshold used by the MoS to gauge feasibility of carbon dioxide to storage sites; AP 1 and EP 1 risk isolation

Steel plant	Distance measured in km				Comments
	Pipeline	Oil and gas basin	Basalt	Saline aquifer	
EP 2	9	41	214	101	• Within the 25 km range of gas pipeline • Reasonable chance of linking to category I oil and gas basins, with storage potential of 20 Mt
AP 4	8	-	582	5	• Within the 25 km range of gas pipeline • Available for carbon dioxide injection likely around 2050 • Carbon capture and storage (CCS) can be a viable option for decarbonisation at AP 4, however, this will materialise in the long run around 2050, when the capacity at AP 4 will be 13.5 Mt; thus, this is a last resort for Company X to push decarbonisation
AP 1	80	-	49	45	• Isolated from oil and gas basins, and 45–50 km from the nearest untapped saline aquifers and basalt formations, which will potentially become available around 2050 and 2042, respectively • 10 Mt of steelmaking in AP 1 is expected to come online by 2035 onward and 25 Mt by 2040, making it the largest steelmaking site of Company X; thus, a significant portion of decarbonisation effort is needed here
EP 1	79	-	169	142	• Potentially the hardest location to explore carbon storage because the pipeline is far, and the nearest basalt and saline aquifers are 170 and 140 km away, respectively • Going ahead, CCS at EP 1 will need to find a clear utilisation solution rather than storage

Source: "Company X," Carbon Transition Analytics, 2025.

Transition risk and opportunity

Based on the assessment, consider whether the company's efforts pose a transition risk or opportunity

CCUS feasibility needs to be monitored to ensure its decarbonisation potential is realised

Transition risk

- CCUS has strong tailwinds in India, but lack of materialisation may pose transition risk; the company's BF-BOF capacity will require CCUS for decarbonisation. Though there is strong domestic support, its application in the steel sector has yet to be proven at scale globally.

Transition opportunity

- **Financing CCUS initiatives at existing or planned plants:** Banks can support companies in securing financing for plants with associated CCUS infrastructure and financing the infrastructure itself — such as pipelines for transportation to storage sites or financing for offtakers of the steel company's captured carbon dioxide.

Case Study

Ping An Bank extended a US$25 million loan to Bautou Iron & Steel for the first full-chain CCUS pilot project in China in 2022. It aims to support a 2 Mt total capacity, with the first phase achieving 500,000 t. Part of the CO_2 will react with steel slag for carbon sequestration, while a part will be used for enhanced oil recovery (EOR) in an adjacent oil field.[i]

Source: (i) "Ping An Bank Grants First Loan to Pioneering CCUS Project amounted RMB 180 million in China's Steel Industry," Ping An Bank, 2023 and *CCUS Development Progress in China*, UK-China CCUS Centre, UCL, 2022.

Section 5

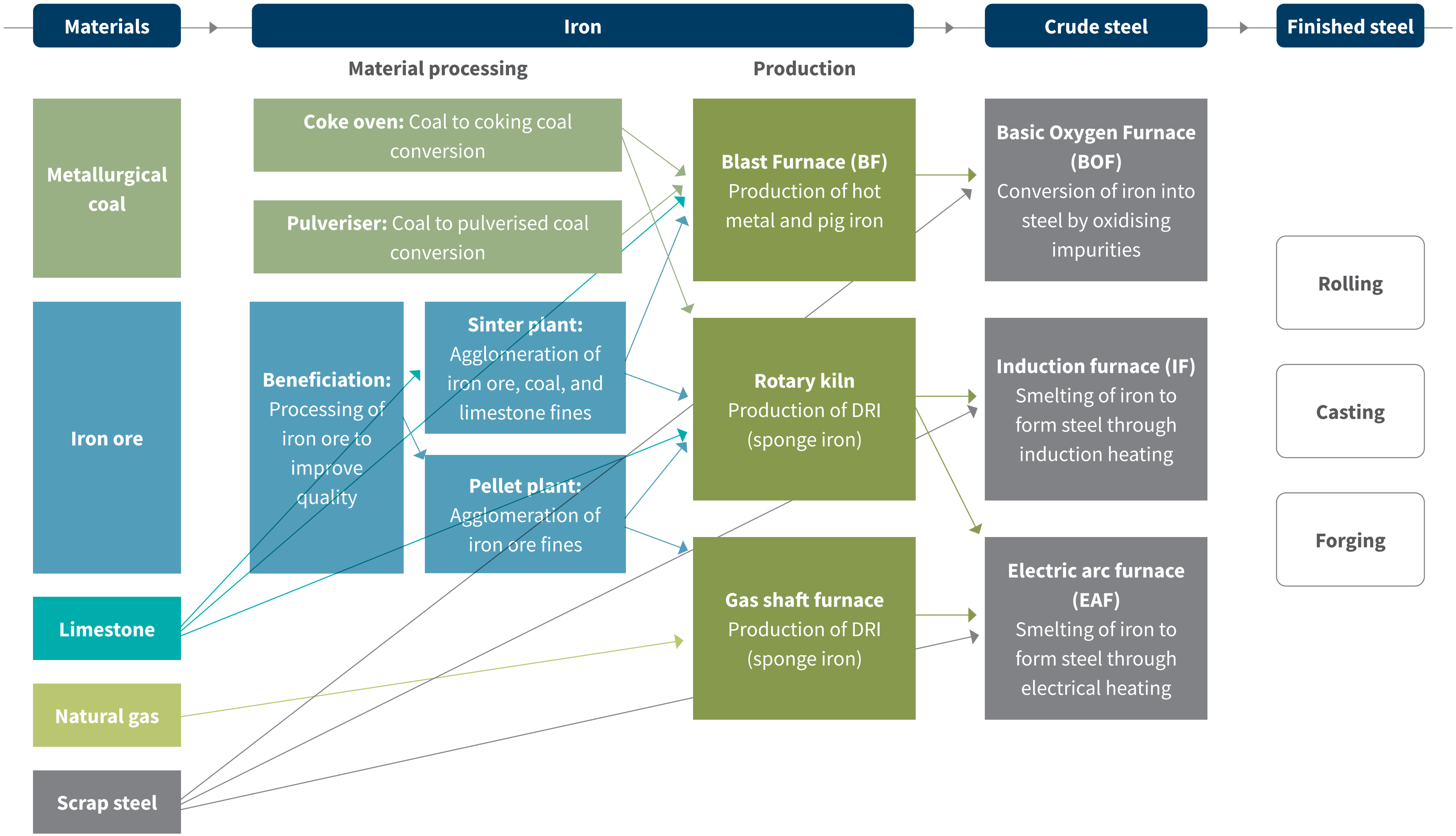
Appendices

Appendix B: Overview of Indian steel sector decarbonisation

This overview of steel sector decarbonisation dynamics does not incorporate updates from NITI Aayog's 2026 sectoral decarbonisation pathways.

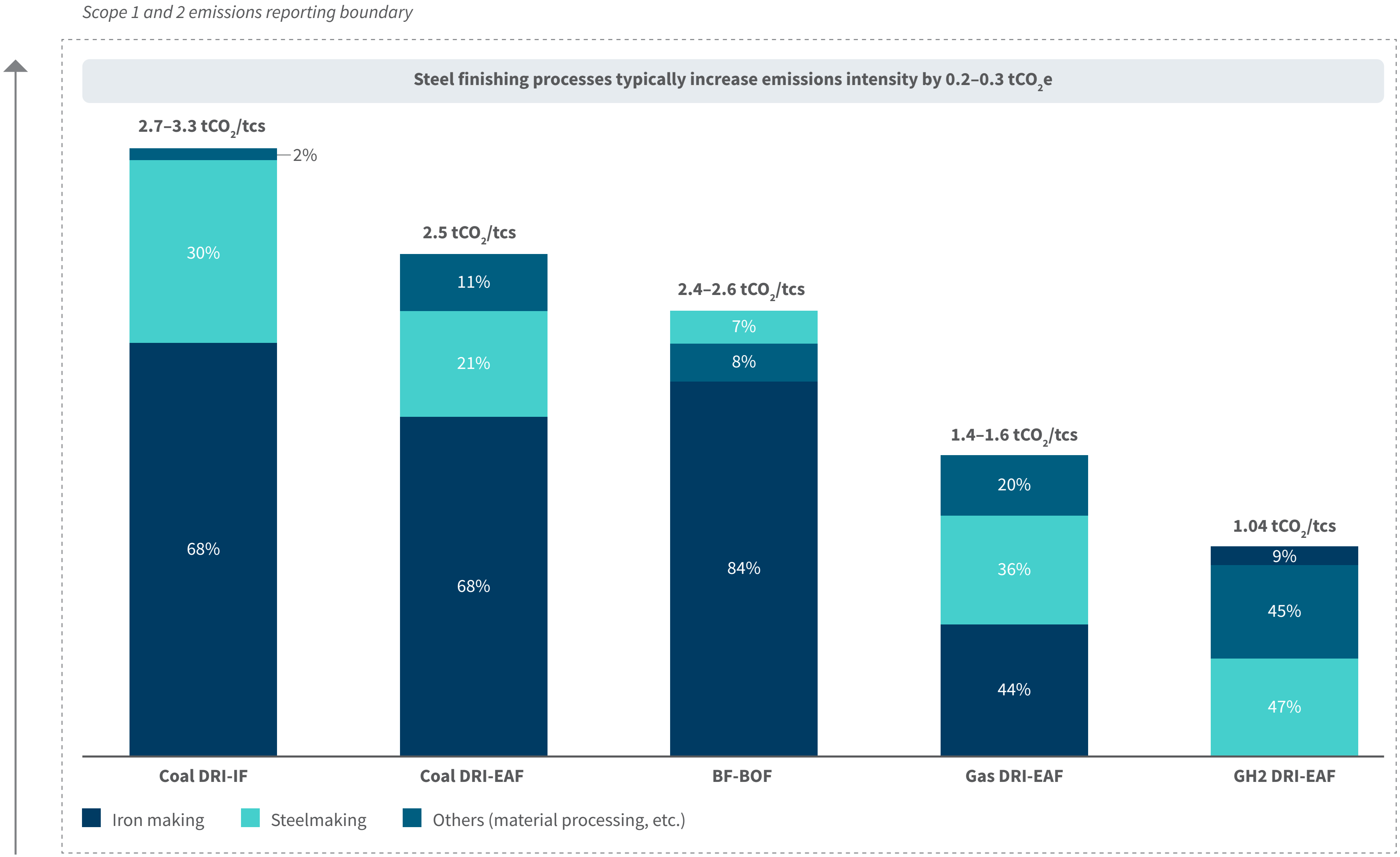
Landscape of India's Steel Sector

Note on steel manufacturing in India | The manufacturing of steel is a complex process, with multiple potential production routes



Scope 1 and 2 emissions from ironmaking are the dominant contributors to crude steel emissions

Scope 1 and 2 emissions reporting boundary



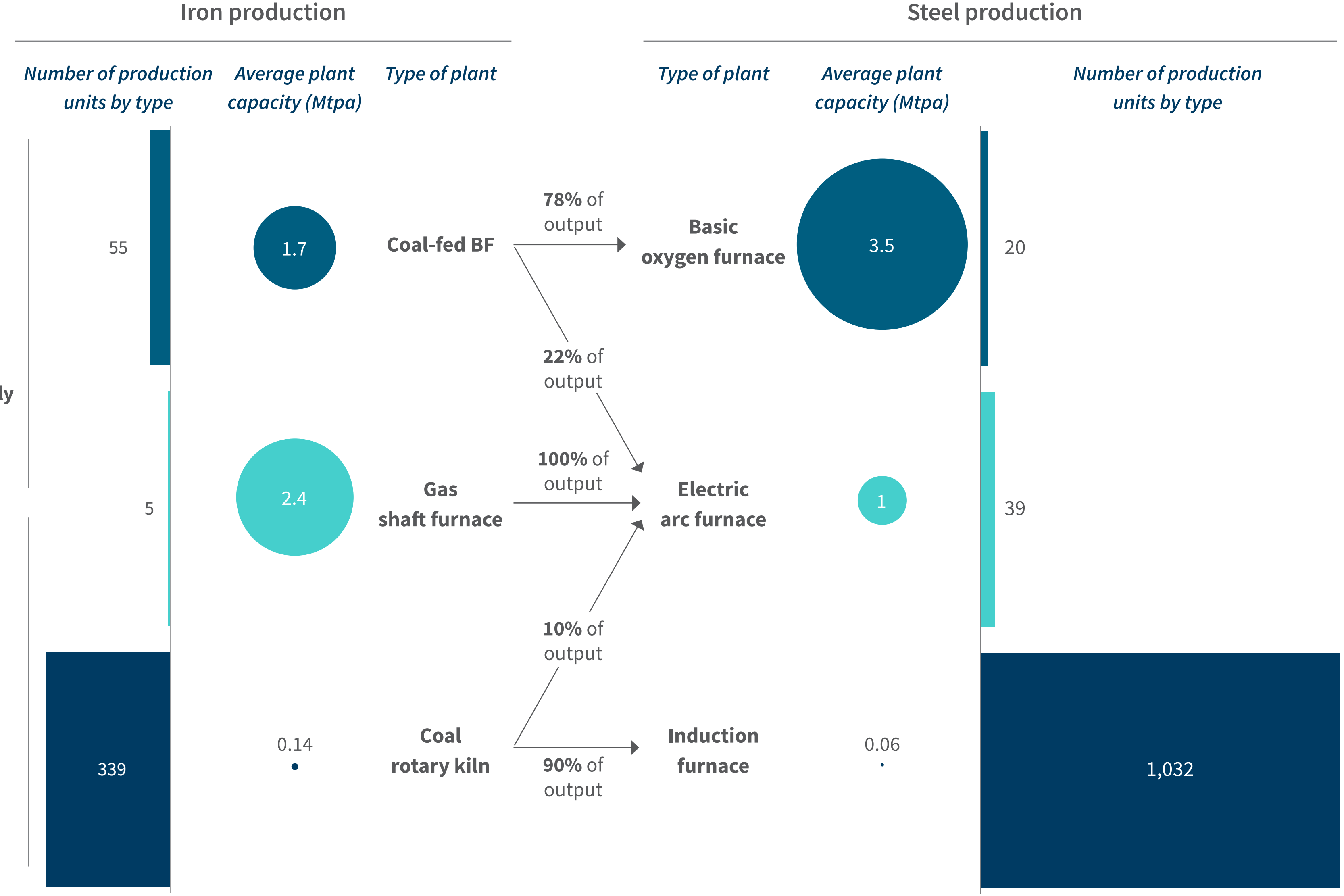
Source: *Evaluating Net-Zero for the Indian Steel Industry*, CEEW, 2023.

Note on steel manufacturing in India | Large producers rely on the coal-fed BF-BOF and Natural gas-DRI-EAF routes, while smaller producers rely on coal-DRI-IF

BF and gas-DRI plants are considerably larger and fewer in number than coal-DRI plants.

Their outputs almost exclusively feed into BOFs and EAFs.

Coal-DRI and IF plants are typically small and are highly dependent on each other.



Source: *Greening the Steel Sector in India: Roadmap and Action Plan*, MoS, 2024.

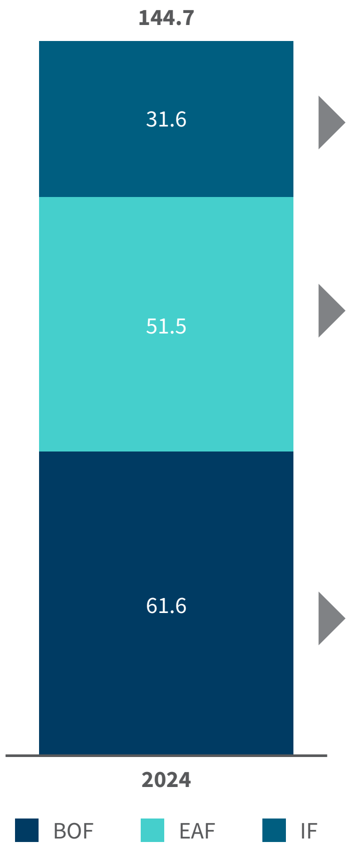
India’s steel sector is highly emissions intensive due to its reliance on iron feedstock produced using fossil fuels

India’s steel emissions intensity is one of the highest in the world

Emissions intensity by region (tCO_2e /tcs)

Indian steelmaking furnaces predominantly use iron feedstock produced through fossil fuel-fed BFs and DRI plants

Steel production by furnace type, 2024 (in Mt)



87% of iron feedstock is produced using coal-fed BFs or coal/natural gas-fed DRI plants

59% of iron feedstock is produced using coal-fed DRI plants

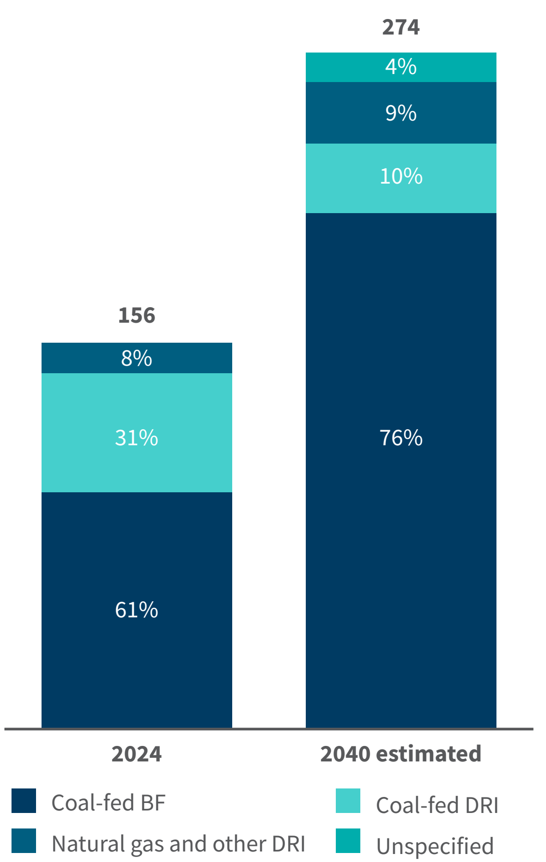
91% of iron feedstock is produced using coal-fed BFs

Source: *Greening the Steel Sector in India: Roadmap and Action Plan*, MoS, 2024; *Steel Climate Impact*, Global Efficiency Intelligence, 2022; *GHG Emissions Intensities of the US Steel and Aluminum Industries at the Product Level*, US International Trade Commission, 2025.

Note on steel transition | India overall is relying on emissions-intensive steelmaking routes to meet its ambitious production capacity targets

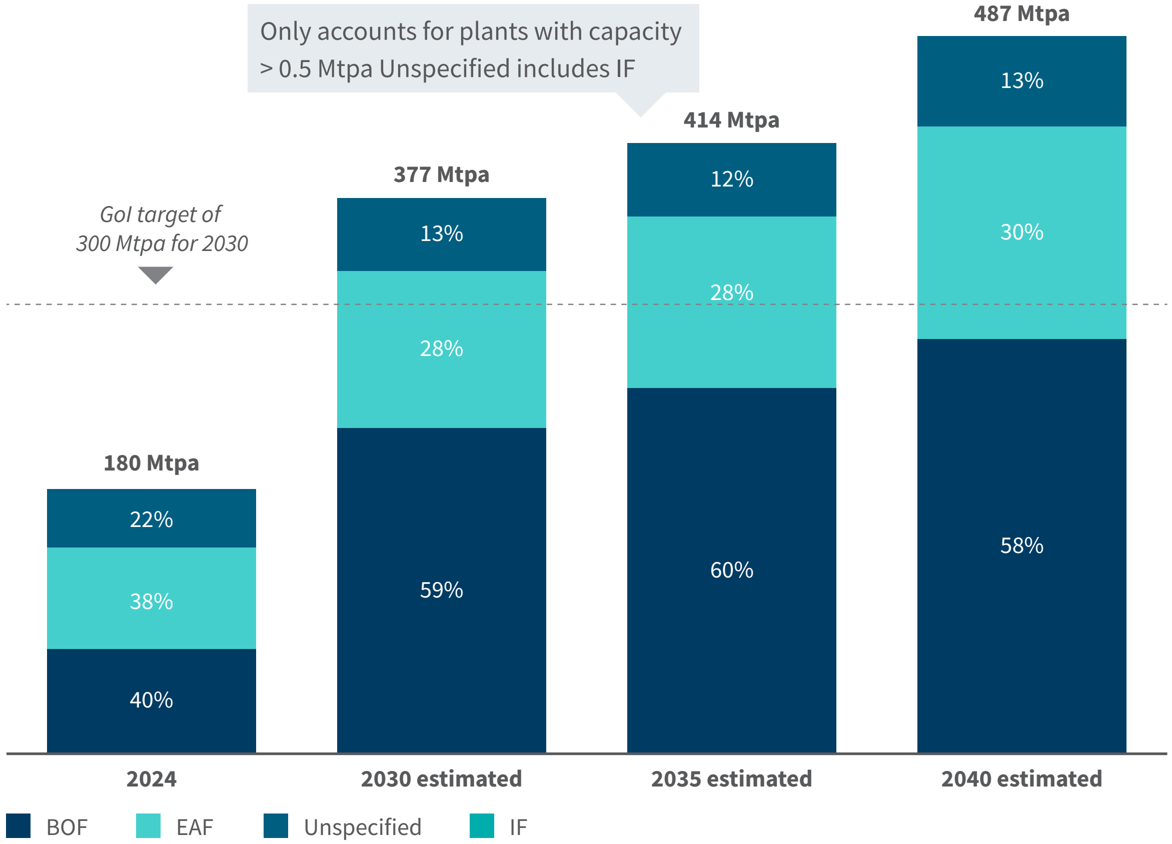
90% of iron capacity in development is likely to be fossil fuel based

Iron production capacity in development by type of plant (% of total)[i]



Considering the National Steel Policy 2017 and announced plans by steelmakers, India's steel production capacity is poised to increase by 2.6x by 2040, 60% of which will be BOF capacity

Projected steelmaking capacity by furnace type (in %)[ii]



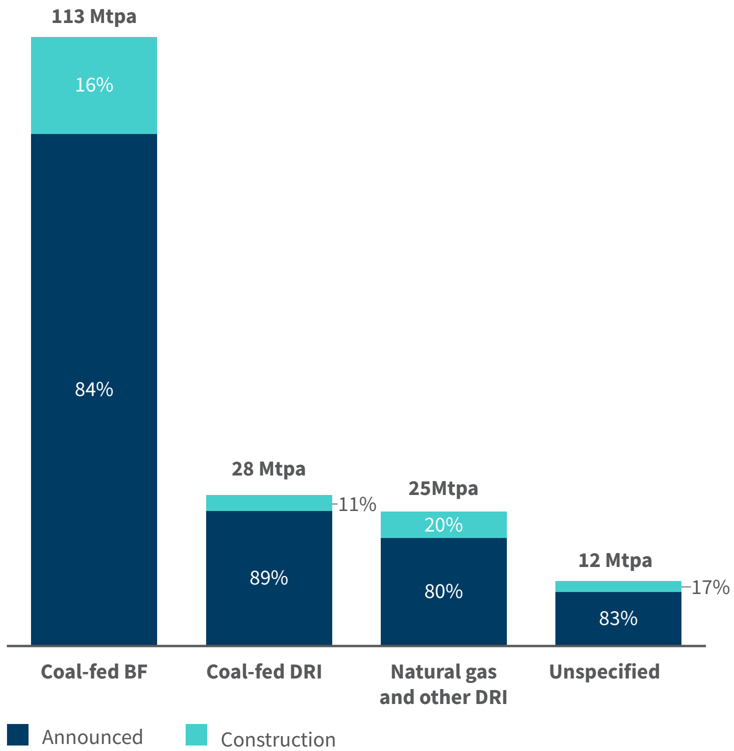
Source: (i) *Pedal to the Metal*, GEM, 2025; (ii) "Iron & Steel Tracker," GEM, 2025; and *Greening the Steel Sector in India: Roadmap and Action Plan*, MoS, 2024.

Note: The Global Iron and Steel Tracker captures ~75% of Indian production capacity. It captures data on every operating, announced, and under-construction plant with capacity of at least 0.5 Mtpa. This accounts for all the large integrated steel plants in India but may not cover the small- and medium-sized fragmented Indian DRI industry, 80% of which is reliant on coal for iron reduction. It classifies induction furnaces as unspecified. Projections are based on GEM data on plants announced and under construction, as well as planned start dates. Where dates are unknown, they are assumed to become operational by 2040. Assumes BF relining takes place as scheduled.

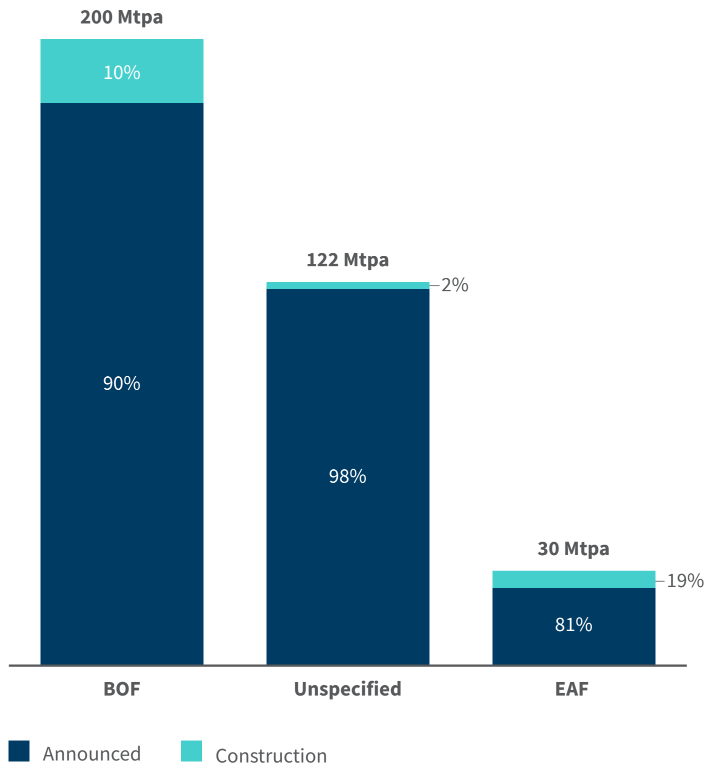
Nonetheless, lenders still have an opportunity to engage and encourage companies to adopt decarbonisation measures

Only 10% of BOFs and 11%–16% of fossil fuel-based iron production capacity slotted for development by 2040 have entered the construction phase

Ironmaking capacity in development by route and status (in %)



Steelmaking capacity in development by furnace and status (in %)



Source: "Iron & Steel Tracker," GEM, 2025 and Pedal to the Metal, GEM, 2025.
Note: The Global Iron and Steel Tracker captures ~75% of Indian production capacity. It captures data on every operating, announced, and under-construction plant with capacity of at least 0.5 Mtpa. This accounts for all the large integrated steel plants in India, but may not cover the small- and medium-sized fragmented Indian DRI industry, 80% of which is reliant on coal for iron reduction. It classifies induction furnaces as unspecified.

Pathways for Decarbonising Steel Production

Steel decarbonisation requires both emissions reduction measures in existing steelmaking routes and a shift in the production process

Pathways for decarbonising steel production

Reduce the emissions intensity of existing routes

Improve **energy efficiency**	Deploy best-available technologies — waste heat recovery, advanced process controls, high-efficiency drives — to cut specific energy use in iron and steelmaking.
Replace coal with **renewable electricity**	Replace captive coal and grid power with solar, wind, and round-the-clock renewable energy hybrids (plus storage) to shrink Scope 2 emissions.
Use **alternative fuels** to reduce role of fossil fuels in iron production	Switch part of the fossil reductant/fuel to lower-carbon options — biochar, natural gas, and GH2 — to curb direct carbon dioxide.
Scale use of **CCUS**	Capture carbon dioxide from BFs, kilns, and reformers for geological storage or conversion to chemicals/fuels.
Increase the efficiency of **raw material** utilisation	Raise scrap utilisation, improve ore beneficiation/pelletisation, and valorise slag to cut virgin-ore demand, energy use, and waste.

+

Transition away from conventional routes

Transition BF-BOF and coal-DRI-EAF routes to the **green hydrogen DRI-EAF** route. Natural gas DRI can be used as a transitional stage.

Shift iron production from BFs and coal-DRI (rotary kilns) to emerging technologies such as electrowinning, HIsarna hydrogen plasma smelting reduction, and molten oxide electrolysis.

Source: Greening the Steel Sector in India: Roadmap and Action Plan, MoS, 2024.

Without the use of CCUS, measures to reduce emissions intensity of conventional routes will have limited impacts

A switch to renewable energy to power electric steelmaking and the use of CCUS to decarbonise coal-based iron production are the most impactful decarbonisation levers

Contribution to emissions reduction: **High** | **Medium** | **Low**

	Energy efficiency	Renewable energy	Alternate fuels (adoption of GH2, biochar)	CCUS
BF-BOF	12%	13%	5%	59%
Coal-DRI-IF	3%	27%	6%	55%
Coal-DRI-EAF	8%	36%	~1%	34%
Gas-DRI-EAF	3%	55%	22%	17%
Feasibility timeline	**Immediate**	**Immediate**	**Medium-long (2040–50)**	**Medium-long (2040–50)**

CCUS is currently the only measure capable of achieving deep decarbonisation in these routes. In its absence, all other measures may risk locking in high-carbon assets.

Without clear plans to shift to green hydrogen, deploying levers for natural gas-DRI-EAF also risks locking in carbon-emitting assets.

Source: *How Can India Decarbonize Steel Production Industry*, CEEW, 2023; *Greening the Steel Sector in India: Roadmap and Action Plan*, MoS, 2024.
Note: For coal-DRI-EAF and gas-DRI-EAF, no hot metal contribution from BFs is assumed. In reality, there may be hot metal output flowing into EAFs along with sponge iron from coal-based rotary kilns and gas-based shaft furnaces.

The feasibility of deploying any given lever for steel decarbonisation is influenced by a multitude of factors (1/2)

Improve energy efficiency

Ability to cover up-front cost	Energy efficiency measures enable producers to reduce operational costs; however, their up-front costs may be prohibitive. This requires affordable financing from commercial banks and through government schemes.
Plant configuration	Choice and feasibility of energy efficiency measures are determined by the location and plant configuration, the age and remaining lifetime of the non-energy-efficient asset, and the type of iron or steelmaking technology used.

Replace coal with renewable electricity

Choice of renewable energy pathway	Producers can procure renewable energy through a range of options including on-site or off-site configurations that are self-owned or procured through third-party developers.
Type of renewable energy setup	Producers can opt for a variety of systems, including solar/wind stand-alone, solar-wind hybrid systems, or any of the previous paired with appropriate battery and/or pumped hydro storage.

Use alternative fuels to reduce role of fossil fuels in iron production

Feasibility of GH2 use	GH2 utilisation in steel will depend on (1) the cost of GH2 being reduced, (2) the ability to produce GH2 close to iron production, and (3) the ability to shift to natural gas DRI as a transition fuel to support infrastructure build-out.
Feasibility of biochar use	Biochar utilisation in steel will depend on (1) the availability of a year-round supply of raw material, (2) the ability to produce steel-grade biochar, and (3) the technical feasibility of biochar utilisation across routes.

The feasibility of deploying any given lever for steel decarbonisation is influenced by a multitude of factors (2/2)

Increase the efficiency of raw material utilisation

Improve iron ore quality

Iron ore quality can be improved through beneficiation. Scaling capacity requires (1) availability of capital, (2) availability of water, (3) stability of power supply, and (4) proximity to mines to reduce logistics costs.

Improve iron feedstock quality

Iron feedstock quality can be improved through pelletisation. Scaling capacity requires (1) increase in beneficiation capacity in order to increase the purity of iron, and (2) higher price of iron on the open market, which directly affects the feasibility of stand-alone pellet production.

Increase scrap utilisation

Scrap utilisation in steel will be driven by (1) the availability of domestic scrap and/or ability to import scrap from other countries, and (2) the availability of scrap recycling capacity in India to provide high-quality feedstock to steel producers.

Scale use of CCUS

Ability to capture carbon

The ability to capture carbon from steel plants depends on (1) the technical feasibility of carbon capture across different routes, (2) the efficacy of carbon capture technologies to reduce emissions, and (3) the cost of carbon capture.

Ability to utilise carbon

Captured carbon can be sold for utilisation across a range of industries such as food and beverage and chemicals and fuels post-conversion. Uptake will depend on the feasibility of conversion and achieving cost parity with existing production methods.

Ability to sequester carbon

Captured carbon can be sequestered in storage sinks; however, the feasibility of doing so is dependent on the ability to monetise stored carbon either through realising economic benefits from the storage site or by recovering cost via the carbon credit market.

The feasibility of adopting energy efficiency measures for a steel producer depends on the suitability of the plant's configuration and the producer's ability to cover the up-front investment

1 Plant characteristics

Type of technology being deployed	• **Type of plant/furnace** determines the choice of energy efficiency measure, as well as the potential environmental and economic benefits.
Age and remaining asset life	• **Ageing assets** underperform, increasing the potential savings accrued from replacing them with energy-efficient ones. • **End-of-life** assets due for replacement offer the best opportunity to promote energy-efficient assets.
Location and configuration	• **Physical space/layout** determines the extent to which equipment can be installed or retrofitted. • **Location** determines fuel and electricity prices, directly influencing the potential savings from installing energy efficiency technologies.

2 Ability to cover up-front cost

Payback period of energy efficiency measures	• **Up-front cost:** Energy efficiency measures can help reduce the cost of production through lowered energy requirements. However, the up-front cost of these technologies is likely too high, particularly for small producers.
Availability of low-cost financing to bridge up-front cost	• **Government schemes** can help reduce the up-front cost of energy efficiency measures through affordable loans and subsidies. • **Commercial financing** from banks is needed to scale energy efficiency measures across the country. • **CCTS** and mandatory emissions reductions may incentivise large players by allowing for monetisation of emissions savings.

Source: *Greening the Steel Sector in India: Roadmap and Action Plan*, MoS, 2024; Low-Carbon Technology Packages for Mini Steel Plants, UNDP, 2023.

Plant Characteristics | Energy efficiency measures only unlock incremental improvements across routes; waste heat and process gas recovery have the highest impact

Percentage of emissions reduction unlocked*		BF-BOF	Coal-DRI-IF	Coal-DRI-EAF	Natural gas-DRI-EAF
		12%	3%	9%	3%
Feedstock and reductant preparation	*Optimise the condition of ore, coal, or scrap before reaction*	• Coal-moisture control • Iron ore pellet use in burden • Segregated sinter charging and deeper bed • Stamp charging of coke ovens	• Iron ore pellets in rotary kiln feed • Scrap densification/ shredding		• High-grade pellets for shaft furnace • Scrap densification/ shredding*
High-efficiency combustion and reaction	*Optimise heat delivery and chemicals reductions*	• Pulverised coal injection (PCI) • High-efficiency coke oven gas ignition burners • Partial fuel substitution in coke making • Oxygen burners for ladle preheat • Regenerative reheating furnace burners	• Induction/hybrid reheating for long steel products	• Improved EAF design • Coherent jet gas injection	• Improved EAF design • Coherent jet gas injection • Oxy-fuel lancing
Waste heat and process gas recovery	*Capture and reuse energy that would otherwise be lost*	• Sinter waste heat boilers • Coke dry quenching • Top-pressure recovery turbine • Hot-stove flue-gas WHR • BF and converter gas recovery	• WHR boilers on rotary kiln off-gas	• Waste heat recovery boilers on rotary kiln off-gas • EAF off-gas waste heat recovery	• EAF off-gas waste heat recovery
Electrical and mechanical efficiency	*Cut auxiliary electricity demand and losses*	• Variable speed drives (VSDs) on pumps, fans, conveyors, etc.	• VSD on kiln shell fans scrap handling, etc.	• VSD on rotary kiln blowers, IF auxiliaries, etc.	• VSD on EAF dusting, compressor motors, etc.
Crosscutting digitalisation	*Use intelligent control systems to optimise operations*	• Automated coke-oven combustion control • Energy management system (EMS) • Digital-twin optimisation of BF	• EMS • Advanced process control	• EMS	• EMS • Advanced process control in shaft furnace

Green shading (legend): *Highest impact on emissions reductions in that route* — highlighted cells: BF-BOF waste heat and process gas recovery; Coal-DRI-IF waste heat and process gas recovery; Coal-DRI-EAF high-efficiency combustion and reaction; Natural gas-DRI-EAF waste heat and process gas recovery.

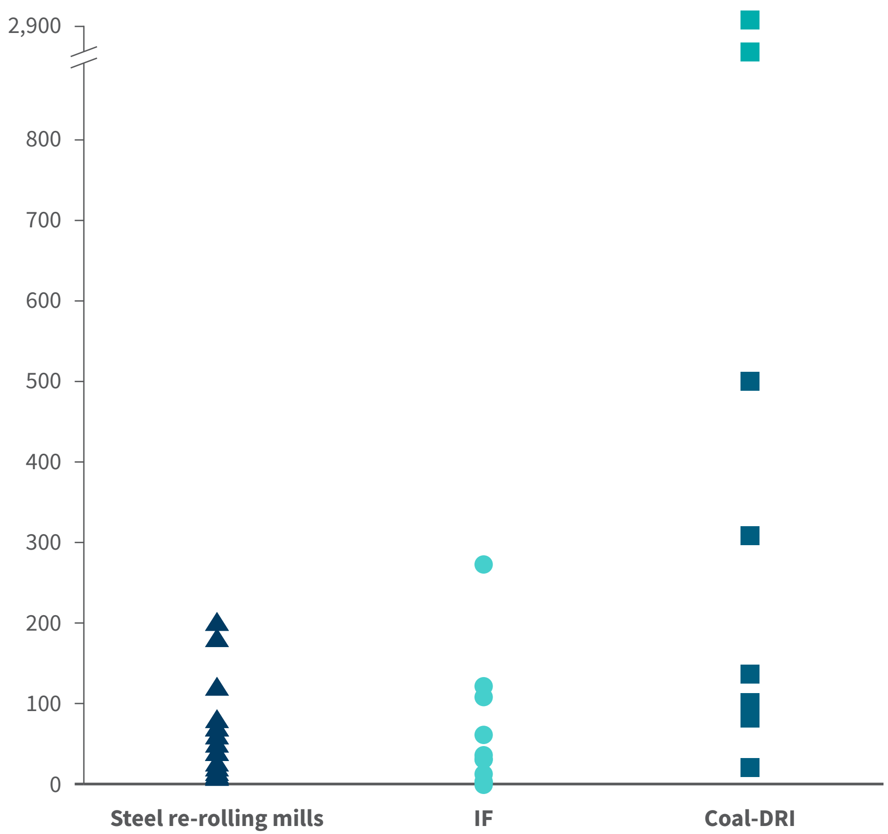
Source: *How Can India Decarbonize Steel Production Industry*, CEEW, 2023; *Achieving Green Steel Roadmap*, TERI, 2022; *Low-Carbon Technology Packages for Mini Steel Plants*, UNDP, 2023; *Energy-Efficient Technology Options for Direct Reduction of Iron Process*, TERI, 2021.

*Assumes that BF hot charge not being passed into the IF or EAF in the coal-DRI EAF or gas-DRI-EAF. Doing so raises energy efficiency contribution to 12% for coal-DRI-EAF and to 8% for gas-DRI-EAF.

Upfront Cost | Uptake of energy efficiency by small players will depend on commercial banking to overcome the high up-front cost of most energy efficiency measures

Small players may struggle to meet the investment needed for energy efficiency technologies, particularly coal-DRI producers

Average up-front cost of types of energy efficiency measures for 10 t induction furnace and 100 tpd coal-DRI plant (in INR lakhs)[i]



Only a handful of banks, largely public, offer dedicated energy efficiency financing schemes; the government is stepping in to bridge the gap

Banks with schemes

State Bank of India	Bank of India
Central Bank of India	Bank of Baroda

Government schemes

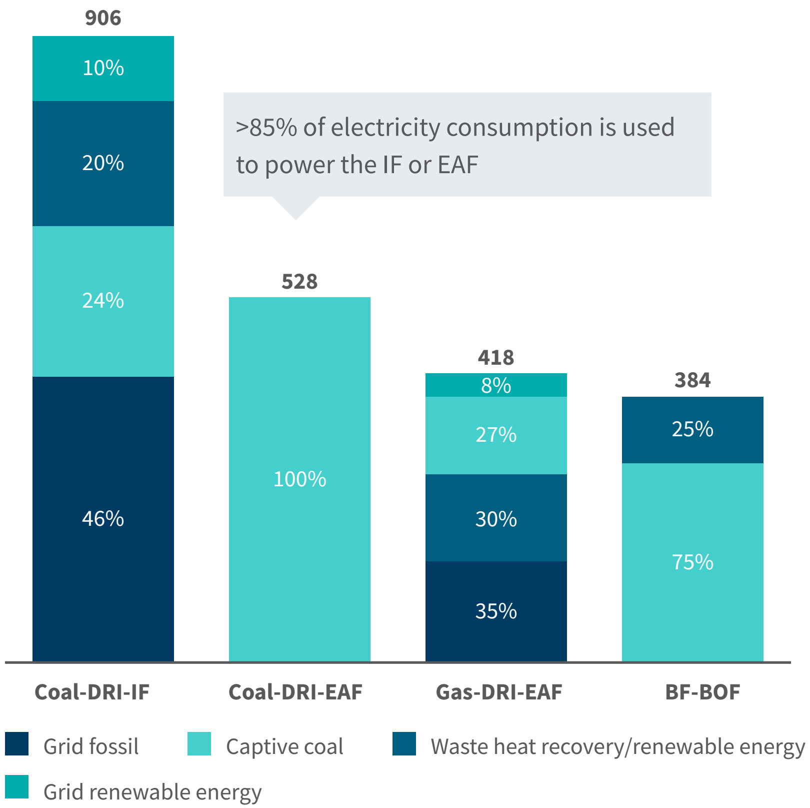
Bureau of Energy Efficiency	Bureau of Energy Efficiency (BEE) is implementing the INR1,000 cr Assistance In Deploying Energy Efficient Technologies In Industries And Establishments (ADEETIE) scheme to support MSMEs, including steel and iron producers, in reducing energy efficiency through energy audits, technical assistance, and interest subvention of 3%–5%.
Small Industries Development Bank of India (SIDBI)	SIDBI offers concessional loans of INR 10 lakh–INR 150 lakh through the End to End Energy Efficiency scheme using bilateral credit lines.[ii] It also delivers the MSME GIFT scheme, offering a 2% interest subvention for green technology and a credit guarantee to encourage commercial lenders to extend financing.[iii]

Source: (i) *Low-Carbon Technology Packages for Mini Steel Plants*, UNDP, 2023 and *Financing Decarbonisation of the Secondary Steel Sector in India*, TERI, 2023; (ii) "Union Minister for Power and Housing & Urban Affairs, Shri Manohar Lal launches ADEETIE Scheme to Accelerate Industrial Energy Efficiency in India," PIB, 2025; (iii) *4E scheme overview*, SIDBI.

Abatement potential | Integration of renewable energy is a necessary decarbonisation lever but has a limited impact on BF-BOF and coal-DRI-IF

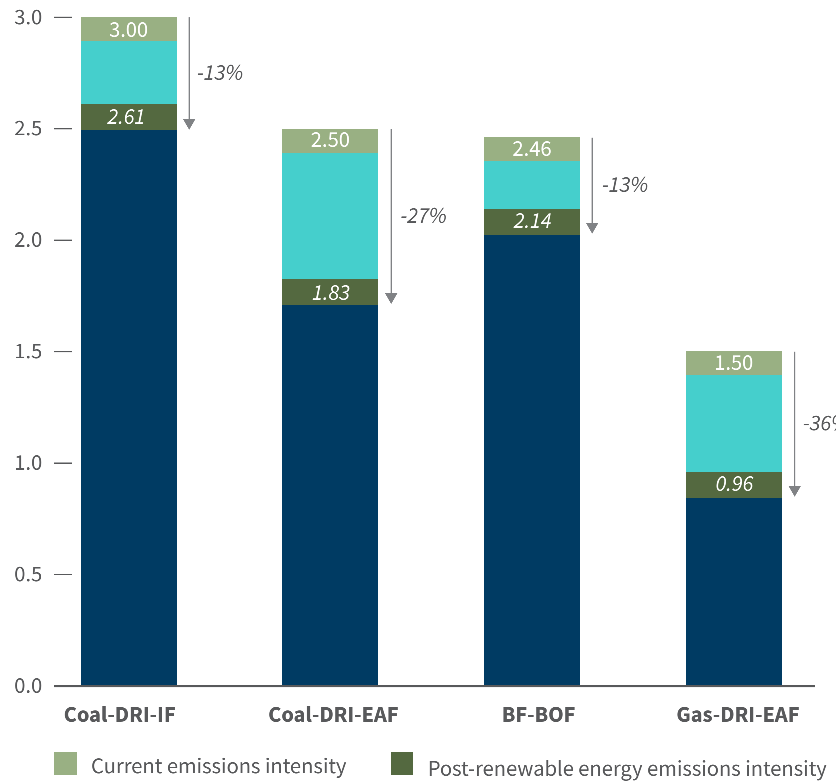
All routes rely heavily on fossil fuel-based power; large players operating BF-BOFs are almost entirely reliant on captive coal

*Electricity intensity of steel routes and electricity source (in kWh/tcs)[i, *]*



Replacing this with renewable energy only cuts BF-BOF emissions intensity by 13%; major cuts in natural gas-DRI-EAF only build on an already low base

*Change in emissions intensity by route after captive coal/grid shifts to renewable energy (tCO_2e/tcs)***



Source: (i) *How Can India Decarbonize Steel Production Industry,* CEEW, 2023; and Greening the Steel Sector in India: Roadmap and Action Plan, MoS, 2024.
*Separated grid renewable energy and grid fossil using current RPO compliance rate of 18.56% in steel-rich states.
**Emissions intensities and percentage reductions are based on the assumption that hot metal from BF is also included in the coal-DRI EAF and natural gas-DRI-EAF routes.

Feasibility driver | The choice of the renewable energy procurement pathway depends on (i) cost, (ii) land availability, (iii) exposure to regulation, and (iv) reliability

1 Cost competitiveness

Up-front cost to steel producer

Any requirement for the producer to pay an up-front cost might decrease its willingness or ability to transition.

Total recurring landed cost of power

The end tariff paid by the steel producer for the power supply.

2 Land availability

The availability of space to install a renewable energy plant that is sufficient to meet power demand.

3 Exposure to regulation

The extent to which the landed cost of power is influenced by central and state-level charges.

4 Reliability

The ability to fulfil the plant's electricity demand. This is influenced by the type of renewable energy plant.

Feasibility driver | Captive and third-party open access renewable energy procurement pathways offer the highest feasibility and flexibility to steel producers

		Up-front capital	Recurring cost	Land availability	Reliability	Exposure to regulation
Green power market	*Purchase of renewable energy directly through power exchanges.*	No up-front investment	Expensive, with high variability in prices	No land needed for procurer	Can technically meet full power because no physical power is being transmitted	Historical regulatory uncertainty
Renewable energy certificates	*Purchase of the environmental attributes of renewable energy. Each REC represents 1 MWh of renewable energy.*	No up-front investment	Expensive, with high variability in prices	No land requirement for procurer	Can technically meet full power because no physical power is being transmitted	REC rules revised often, creating significant uncertainty
Captive open access	*Plant set up by an individual or group anywhere in India to meet its own consumption needs.*	Limited up-front cost (≥26% equity), which can be shared with others	Long-term control over tariff because owned for self-consumption	Land required; however, can be sited anywhere in India	Can technically meet full power requirement, provided adequate storage and load matching	Regulations regarding transmission charges, wheeling charges, and power banking change frequently and can retrospectively impact projects; this can make or break project economics
Third-party open access	*Consumers with load ≥1 MW can procure renewable energy from any third-party developer anywhere in India.*	No up-front cost needed because developers recoup cost through PPA tariff	Considerably lower tariffs than alternatives, with long-term price stability	Land required; however, developer will take responsibility of siting, thus no burden for the steel producer	Can technically meet full power requirement, provided adequate storage and load matching, but dependent on developer credentials	
On-site captive	*Renewable energy generation capacity at the site of steel production. Can be fully owned by the producer or be owned by a third party.*	High up-front cost if self-owned. Third-party-installed on-site captive would require no up-front payment.	Lowest cost for the steel producer	The land requirement to meet full power demand is too high, limiting potential	Highly reliable, and with appropriate storage and configuration can meet 24/7 plant demand	Limited exposure
Green tariff from DISCOM	*Renewable energy procurement from the state DISCOM.*	No up-front investment	Green tariffs are far more expensive than alternative options	No land requirement for procurer	Can be used to meet 24/7 power supply	Exposure to variation in tariff prices and DISCOM financial health

High feasibility concern | Some feasibility concern | No feasibility concern

Source: RMI analysis.

Feasibility driver | However, captive and third-party open access are also particularly sensitive to changes in central and state-level policies

	Central transmission charges and losses*	State transmission charges and losses	State wheeling charges and losses	Cross-subsidy charges	Additional surcharges	Banking charges
	Charged for use of interstate transmission lines	**Charged for use of intrastate transmission lines**	**Charged to cover broader cost of transmission and distribution**	**Charged to C&I consumers to subsidise cost for others**	**Charged by state DISCOMs to offset fixed cost of long-term PPAs**	**Cost of parking excess renewable energy with DISCOM for later use**
Green power market	✓ (Inconsistent application) Waived for projects commissioned by June 2025	✓ (Applicable) Only for seller and buyer in different states	✓ (Applicable) Only for seller and buyer in different states	✓ (Applicable)	✓ (Applicable)	✓ (Applicable)
Renewable energy certificate						
Captive open access	✓ (Inconsistent application) Waived for projects commissioned by June 2025	✓ (Inconsistent application) Applicable but often waived	✓ (Inconsistent application) Applicable but often waived	✓ (Inconsistent application) Applicable but often waived	✓ (Inconsistent application) Applicable but often waived	✓ (Applicable)
Third-party open access	✓ (Inconsistent application) Waived for projects commissioned by June 2025	✓ (Applicable) Charges vary for intra- or interstate transmission	✓ (Applicable) Charges vary for intra- or interstate transmission	✓ (Applicable)	✓ (Applicable)	✓ (Applicable)
On-site captive				✓ (Inconsistent application) Not applicable but charged in some states		
Green tariff from DISCOM				✓ (Applicable) Bundled in tariff	✓ (Applicable) Bundled in tariff	

Non-exhaustive

Many states have not fully aligned with the Green Energy Open Access Rules (2022), creating regulatory inconsistency

✓ Applicable ✓ Inconsistent application

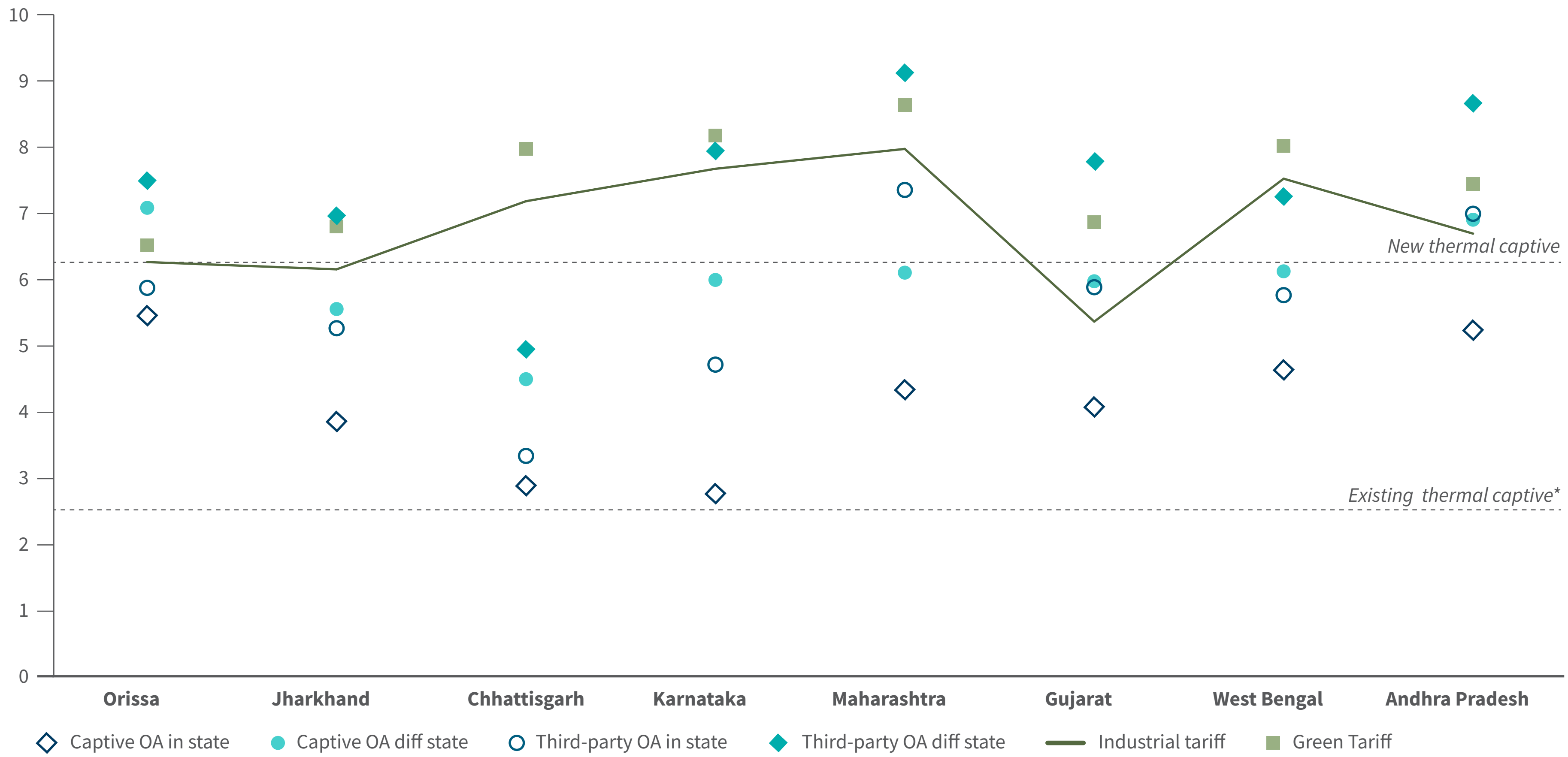
Source: "*Open Access Tools and Resources*," CEEW.

*Waivers on central transmission charges (interstate transmission system charges) decline as project commissioning date increases: 100% waiver for project commissions before June 2025; 50% for those between June 2026 and June 2027; 25% for June 2027–June 2028; and no waiver post-June 2028.

Feasibility driver | Nonetheless, open access is cheaper than sourcing power via a new captive thermal plant or the industrial tariff in most states

As per the MoS's Green Steel Action plan, Chhattisgarh and Karnataka offer some of the lowest renewable energy procurement costs for steelmakers opting for captive OA or third-party open access in the state

Landed cost of electricity by procurement pathway in main steel-producing states (in INR/kWh)



Source: *Greening the Steel Sector in India: Roadmap and Action Plan*, MoS, 2024.
Note: Assumes only variable and fixed recurring costs. Treats capex as sunk cost.

Two near-net-zero alternative fuels can help replace fossil fuels in the iron reduction process: GH2 and biochar

GH2

Green hydrogen is produced through electrolysis of water powered through renewable energy. It is a direct substitute for natural gas, and can also partially replace coal in the BF-BOF route.

Natural gas can serve as a transitional alternative fuel and reductant as GH2 becomes commercially and technically viable.

Biochar

Biochar is black carbon produced from biomass like wood and plant residue. Through pyrolysis, biochar acts as a stable form of carbon that can be used as a direct replacement of coal.

Green Hydrogen

Abatement potential | GH2 can be a game changer, but it requires a commitment to fundamentally change the way steel is made

Green hydrogen can replace fossil fuels as a reductant and energy source in steelmaking, primarily at the iron production stage; however, conventional routes are largely incompatible, requiring the development of new technologies

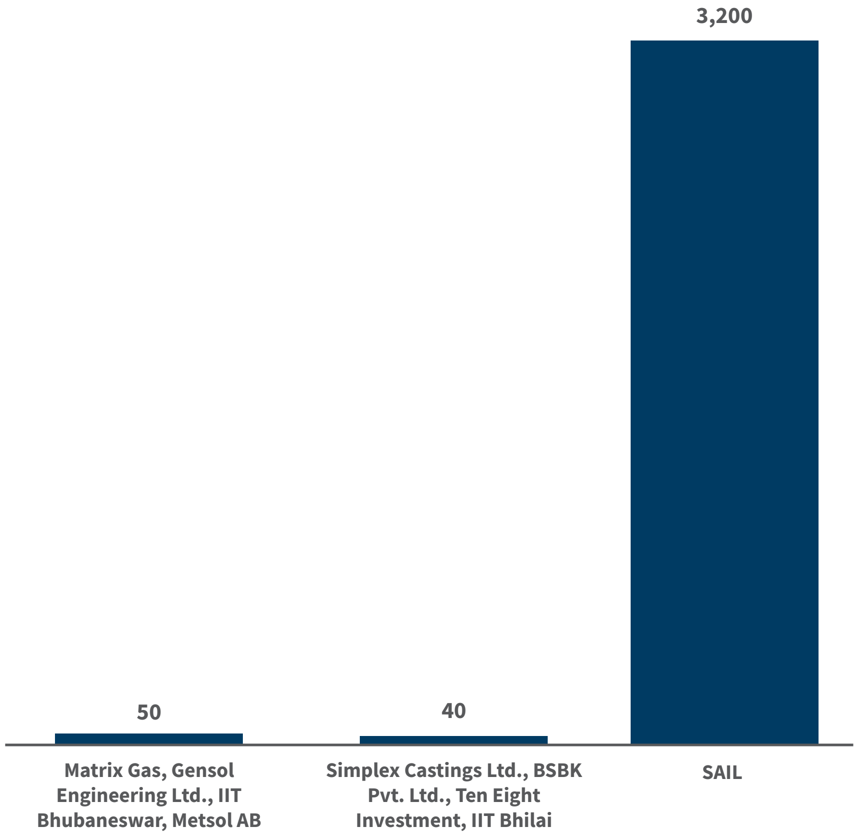
	Where we are						Where we need to be		
	GH2 potential	**Method for green hydrogen use**	**Current theoretical GH2 utilisation limit**[i]	**Emissions reduction potential**	**Technological readiness**	**Cost of modification**		**Technological readiness**	**Barriers to address**
BF-BOF	*Limited*	*Replacement of coke/PCI in BF with GH2 injection*	*25%–30% displacement of coke/PCI. Limited by chemistry of reduction process and need for specific thermal balance and gas flow in furnace*	*21% maximum*[ii]	*TRL 5; pilots have shown technical feasibility*	*INR135 cr for 0.4 Mt unit*	***Full hydrogen shaft furnace-EAF***	*TRL of 6-8; multiple pilots underway globally by major steel producers like Thyssenkrupp and ArcelorMittal* *Commercial feasibility may be reached by 2035 if pilot plants operate as expected*	• **Supply of DRI-grade ore:** *Requires high-quality iron ore, which is limited in supply globally* • **Cost of GH2:** *Requires GH2 prices to fall significantly and the development of appropriate logistics*
Coal-DRI-IF/ EAF	*Not feasible*	*Direct use of hydrogen in DRI rotary kilns is not technically feasible; requires a swap to gas shaft furnace DRI*	-	-	-	-			
Gas-DRI-EAF	*High*	*Natural gas in shaft furnaces can be blended with GH2*	*30% blend possible without retrofit; 60%–70% blend with revamp or in latest MIDREX/ HYL furnaces.*	*~75% for 60% GH2 blend*[iii]	*TRL 6; injection pilots underway*	*INR870 cr for 0.88 Mt unit*			

Source: (i) Greening the Steel Sector in India: Roadmap and Action Plan, MoS, 2024; (ii) "Modeling and Simulation of Hydrogen Injection into a Blast Furnace to Reduce Carbon Dioxide Emissions," *Journal of Cleaner Production*, 2017; (iii) *Greening Steel*, CEEW, 2021.

Pilots to test feasibility of green hydrogen in steelmaking are currently underway

MoS has been allocated INR455 cr for pilots. Three projects have already been sanctioned, with four more in the pipeline.

Pilot projects sanctioned by the MoS by entity and production capacity (t/day)[i]



Source: (i) Press release, PIB, 2025; (ii) *Greening the Steel Sector in India: Roadmap and Action Plan,* MoS, 2024.

Pilots are also being conducted by steelmakers and researchers independently

TATA Steel	TATA Steel injected ~6 kg/tonne of hot metal of GH2 for four days into a BF, resulting in 10% coke reduction and 7%–10% emissions intensity reduction.[ii]
Jindal Stainless Limited	Jindal Stainless Limited is utilising GH2 for downstream stainless steel production. It has set up the world's first off-grid GH2 plant for the stainless steel industry.
Institute of Minerals and Materials Technology	IMMT has demonstrated use of a hydrogen plasma smelting reduction at laboratory scale. It uses hydrogen as the source of heat energy to smelt iron ore.

Feasibility driver | The feasibility of adopting GH2 in steel will be driven by (1) reduction in production costs, (2) proximity to ironmaking, and (3) use of natural gas

1 Reduction in production costs

Reduction in renewable energy cost

Determined by the type of renewable energy set up, the type of renewable energy procurement pathway, and the location of the renewable energy plant.

Reduction in electrolyser cost

Determined by availability of domestic manufacturing and technology improvements.

Reduction due to capex/ production-linked subsidies

Ability to tap into central subsidies like PLI, and make use of state-specific incentives.

2 Proximity to ironmaking

Hydrogen is difficult to transport and store due to its extremely low volumetric energy density and highly flammable nature.

Production will need to be co-located with or closely linked to ironmaking/steelmaking sites to make integration feasible.

3 Ability to use natural gas as a bridge fuel

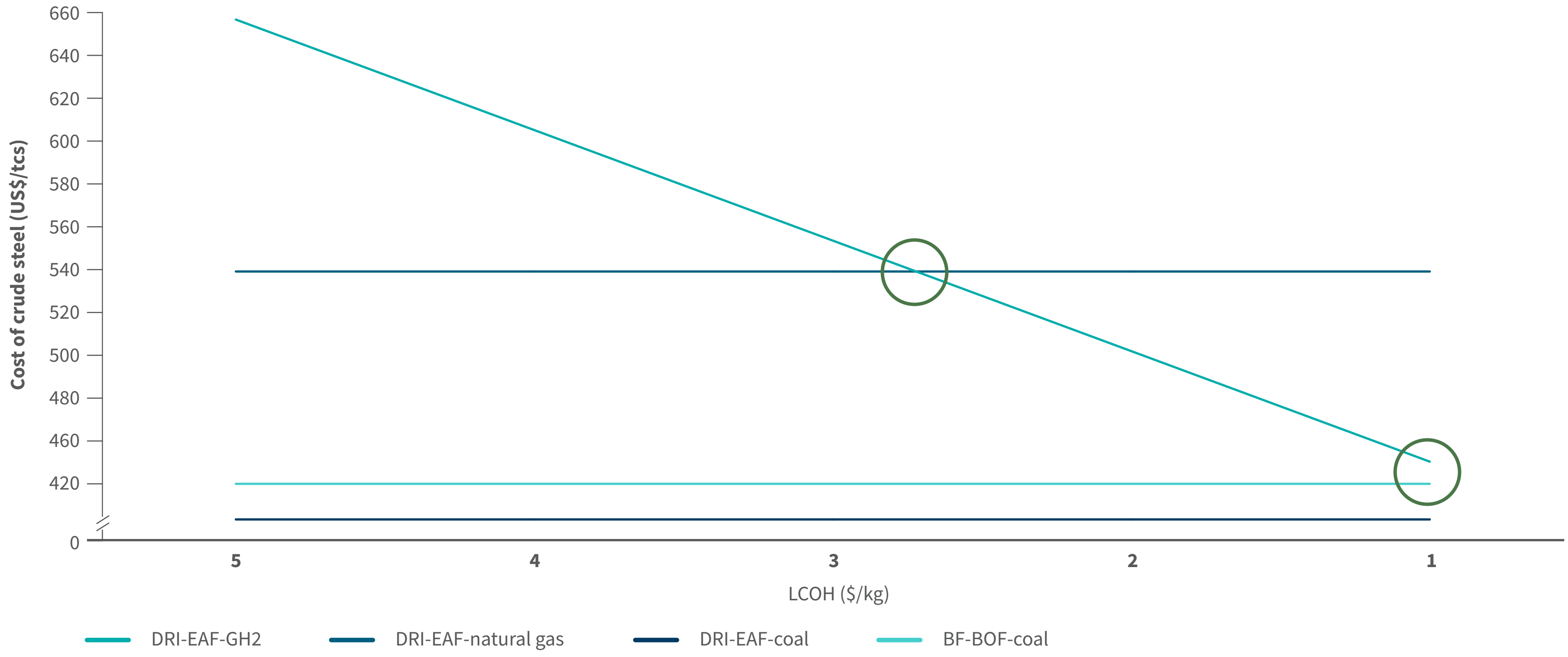
Capacity must shift from BFs and rotary kilns to gas shaft furnaces. Use of natural gas as a bridging fuel may make this transition smoother.

This will be influenced by the availability and cost of natural gas in India.

Source: *Greening the Steel Sector in India: Roadmap and Action Plan*, MoS, 2024; *Green Hydrogen Production Pathways for India*, RMI, 2025; *Promise to Purchase*, RMI, Bain, and CII, 2025.

Feasibility driver | The cost of GH2 will need to fall to ~US$1/kg to make GH2 DRI-EAF cost competitive with coal-based BF-BOF and DRI-EAF/IF

Variation of levelised cost of steel production (in US$/tcs) for production routes by levelised cost of GH2 (in US$/kg)

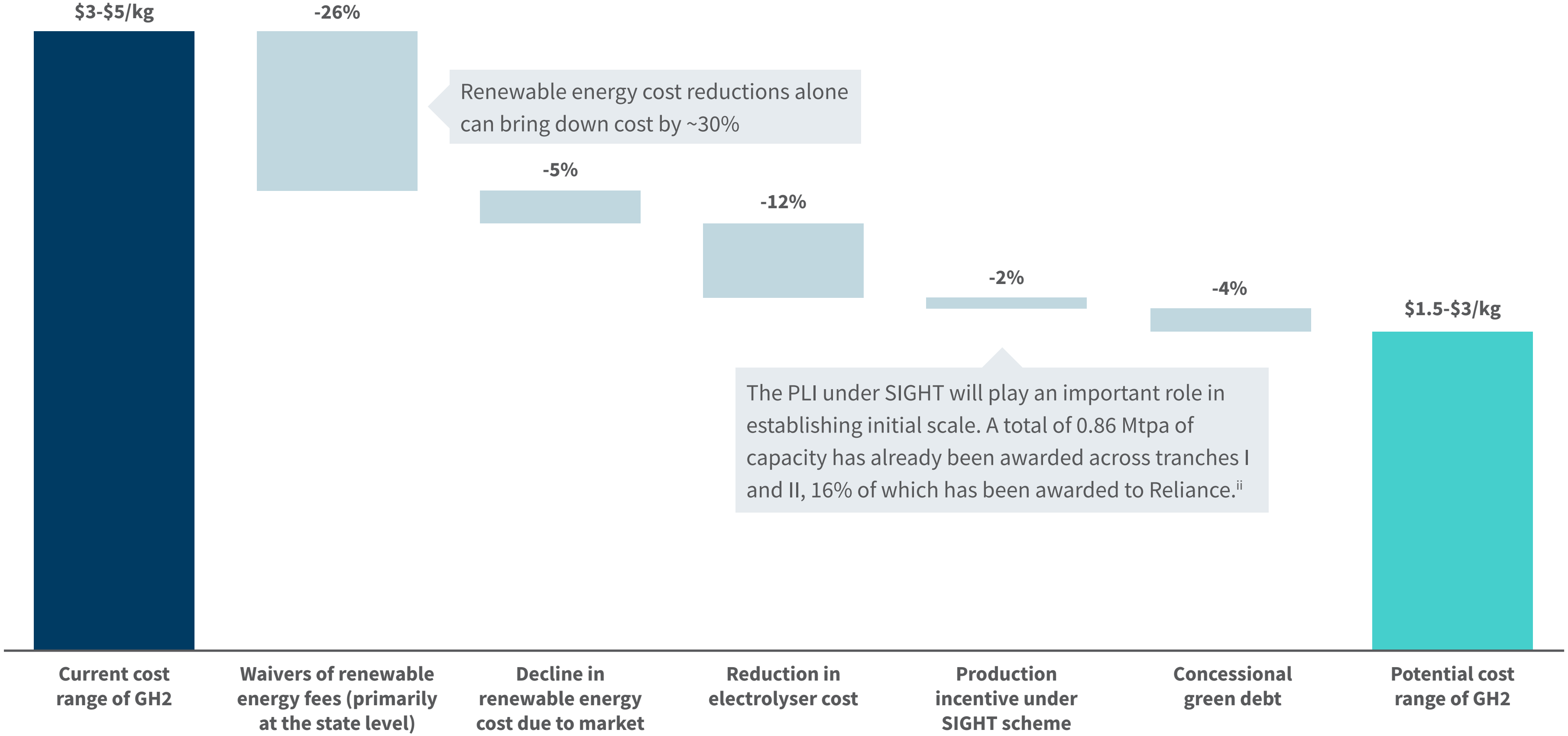


Source: RMI analysis.

Feasibility driver | Waivers of central and state renewable energy fees, and reduction in electrolyser costs, can significantly reduce cost of GH2 production

Waivers for renewable energy charges, primarily at the state level, can bring down the cost of GH2 by 26%, with a further 12% cost reduction anticipated due to electrolyser cost reductions

Impact of policies and market forces on the cost of GH2 (US$/kg)[i]



Source: (i) *Financing Green Hydrogen*, CEEW, 2024; (ii) "SECI Awards 450,000 MT Annual Capacity Under SIGHT Tranche-II for Green Hydrogen Production," JMK Research & Analytics, 2025.

Feasibility driver | Nonrenewable-energy-rich states have released significant incentives to reduce renewable energy costs for GH2 production

States have added additional waivers alongside the India-wide Inter-State Transmission System charge waiver for GH2 and green ammonia projects commissioned on or before 31 December 2030.

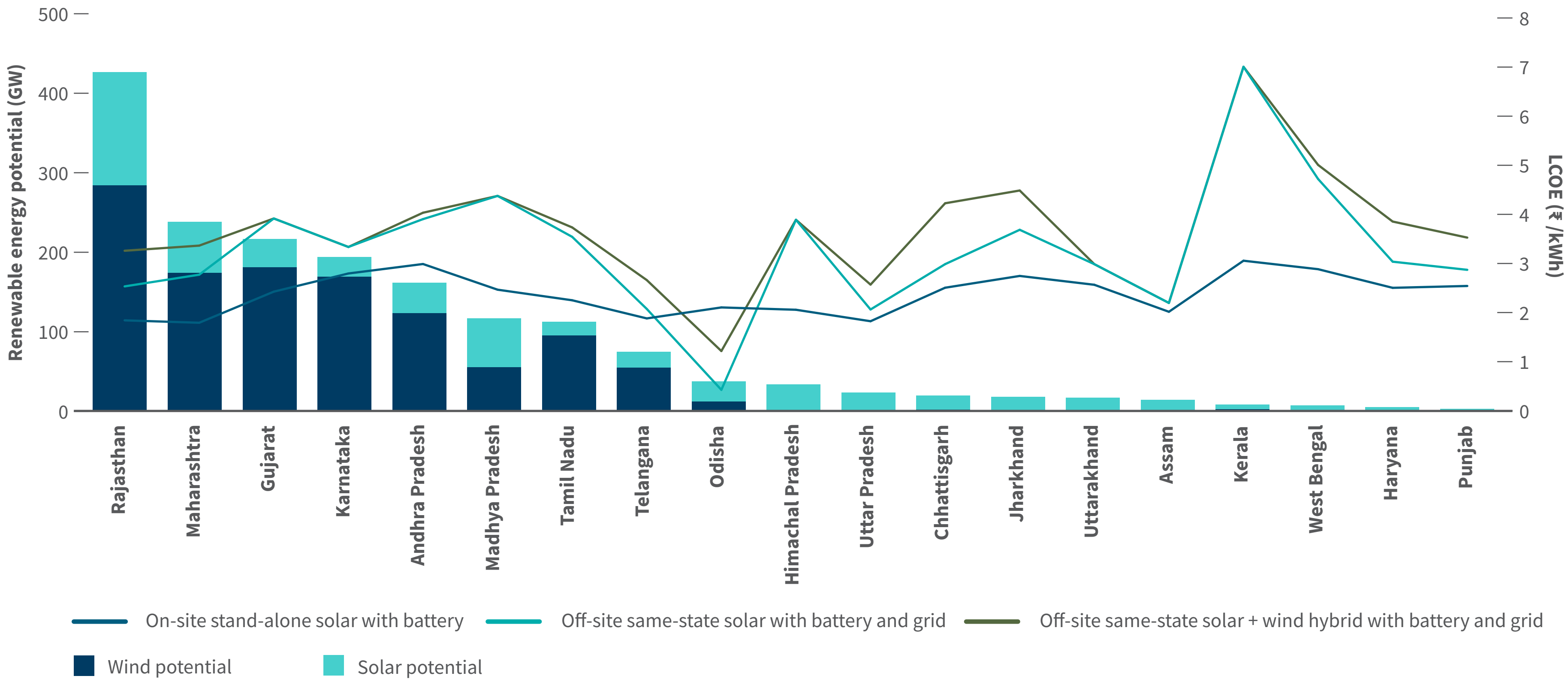
State	Renewable energy potential (1,000 MW)	Degree of Incentive*	State transmission utility charges	Wheeling charges	Cross-subsidy surcharge	Additional surcharge	Electricity duty	Additional waivers
Odisha	38	High	100% for 20 years		100% for 20 years	100% for 20 years	100% for 20 years	Reimbursement of power tariff of INR3/unit (US$0.036/unit)
Assam	14	High	100% for 20 years	100% for 20 years	100% for 20 years	100% for 20 years	100% for 20 years	
Punjab	3	High	50% for 30 years	50% for 30 years	100% for 30 years	100% for 30 years	100% for 10 years	
Haryana	5	Medium	100% for 10 years	100% for 10 years	100% for 10 years	100% for 10 years	100% for 10 years	
Uttar Pradesh	23	Medium	100% for 10 years	100% for 10 years	100% for 10 years		100% for 10 years	
Rajasthan	427	Medium	50% for 10 years	50% for 10 years	100% for 10 years	100% for 10 years	50% for 10 years	
Telangana	75	Medium	100% for 10 years		100% for 5 years	100% for 5 years	100% for 10 years	Reimbursement of power tariff of INR 3/unit (US$0.036/unit)
Andhra Pradesh	162	Low	25% for 5 years		100% for 5 years		100% for 5 years	
West Bengal	8	Low					100% for 5 years	
Tamil Nadu	113	Low					100% for 5 years	
Maharashtra	238	Low					100% for 5 years	
Himachal Pradesh	34	Low	100% through 31 December 2026				100% through 31 December 2026	

Source: *Green Hydrogen Production Pathways for India*, RMI, 2025; *Statewise renewable energy potential*, NITI Aayog, 2025.
*Degree of incentive calculated as a function of the amount of waiver and the percentage of a GH2 typical lifetime of 30 years covered by the incentive. Each state was given a score of 1–3 for each fee waiver category, and scores were summed and categorised to give overall degree of incentive.

Feasibility driver | Waivers allow nonrenewable-energy-rich states to make themselves competitive and offer low renewable energy costs for GH2 production

States like Odisha, Assam, and Uttar Pradesh have been able to make renewable energy prices competitive for GH2 producers despite low natural renewable energy resource potential

Landed cost of power across procurement pathways (in INR/kWh) and renewable energy potential by type (1,000 MW)

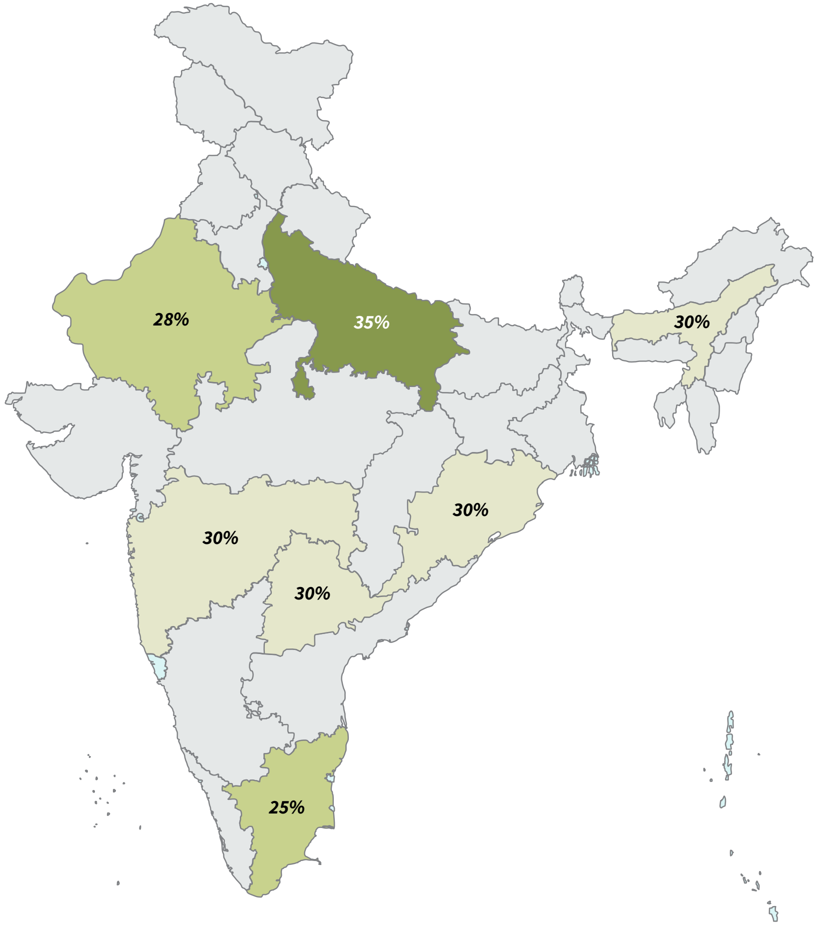


Source: *Greening the Steel Sector in India: Roadmap and Action Plan*, MoS, 2024; *Green Hydrogen Production Pathways for India*, RMI, 2025; *Promise to Purchase*, RMI, Bain, and CII, 2025.

Feasibility driver | State-level capex subsidies stacked on top of existing renewable energy waivers significantly reduce the cost of GH2 production

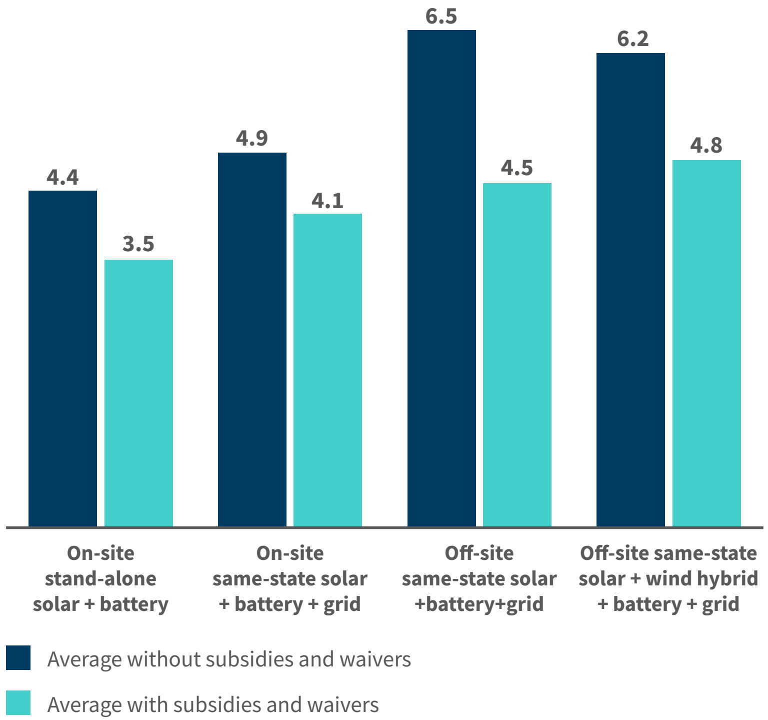
A handful of states offer meaningful subsidies on the capex associated with GH2 projects

Percentage of up-front capex subsidy provided by states for GH2 projects



Together with renewable energy waivers, these subsidies can reduce the cost of GH2 production by 16%–30%

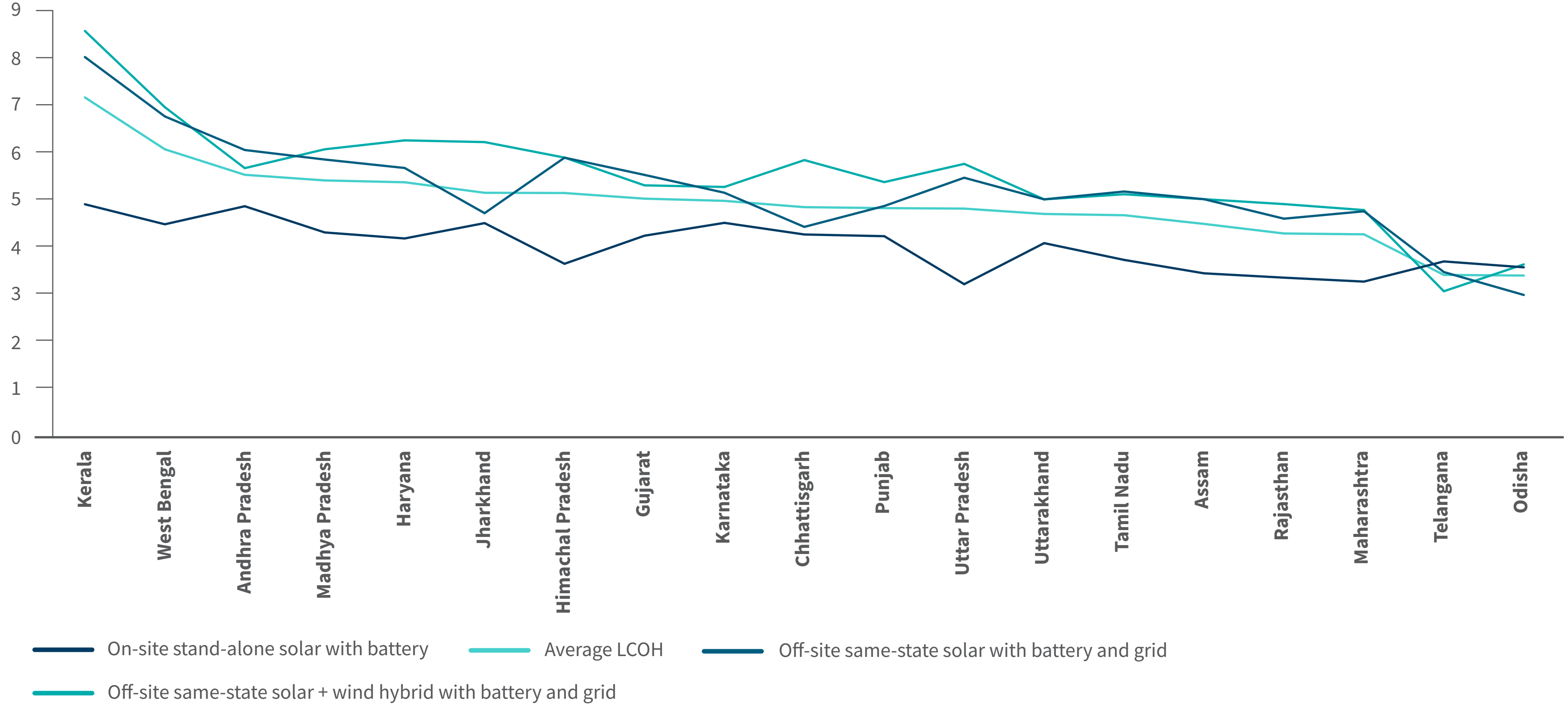
India average LCOH by type of renewable energy setup with and without subsidies (in US$/kg)



Source: *Green Hydrogen Production Pathways for India*, RMI, 2025.

Feasibility driver | As a result, Odisha and Telangana currently offer the lowest cost of GH2 production in India

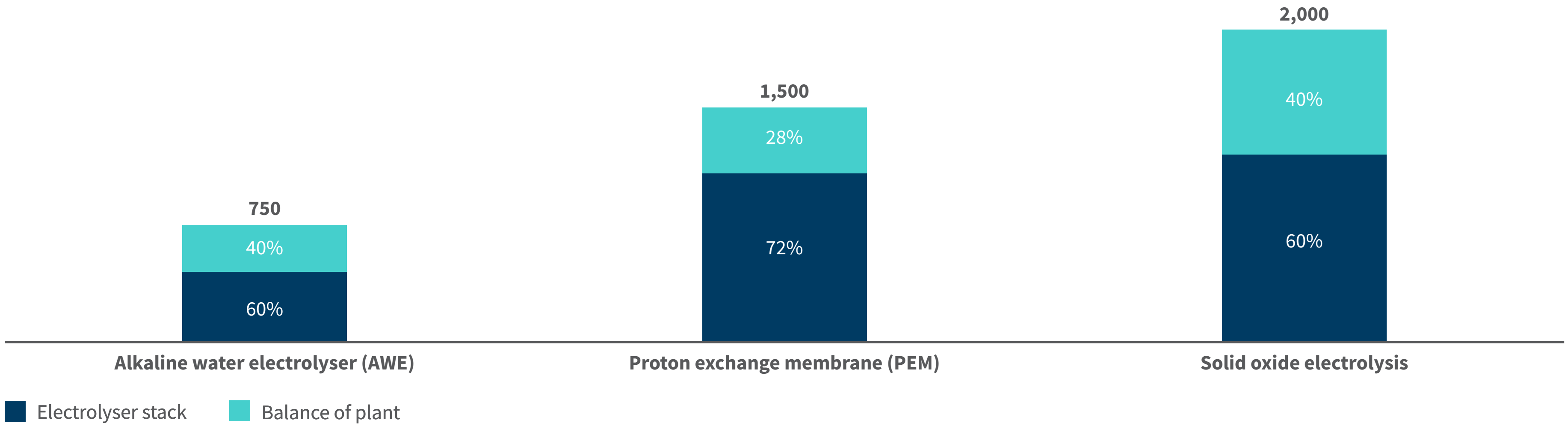
LCOH of GH2 by state by RE set-up in 2024 after counting capex and opex subsidies (in US$/kg)



Source: *Green Hydrogen Production Pathways for India*, RMI, 2025.
Note: Uttarakhand and Himachal Pradesh offer low-cost GH2 production, but their hilly terrain makes project development challenging.

Feasibility driver | Alkaline electrolysers are currently the cheapest and most common way to produce hydrogen, and are predominantly manufactured in China

International price of electrolyser by type, 2024 (in US$/kW)[i, *]



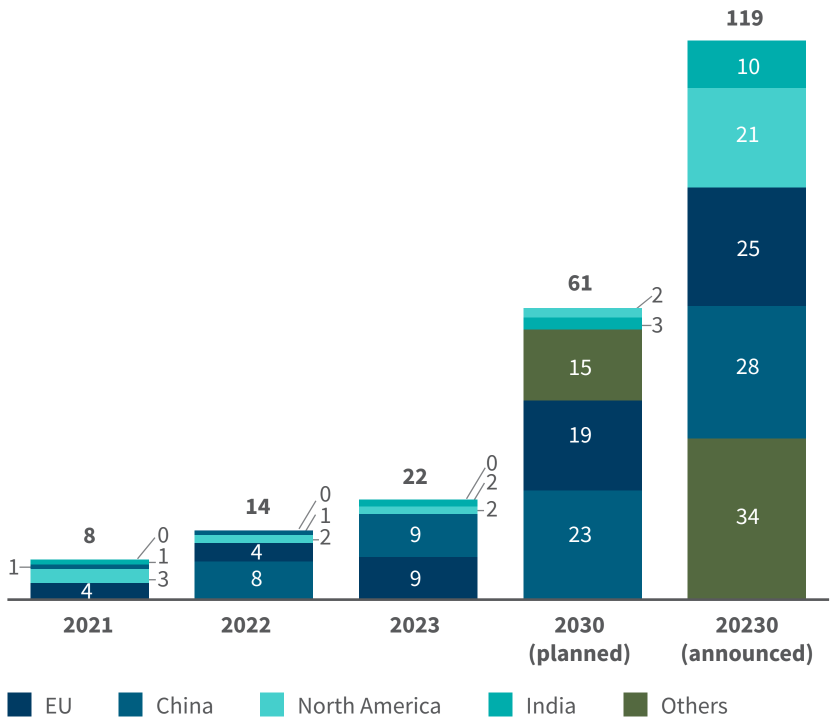
	Alkaline water electrolyser (AWE)	Proton exchange membrane (PEM)	Solid oxide electrolysis
Description	Splits water in a liquid potassium-hydroxide electrolyte between porous nickel electrodes separated by a diaphragm.	Uses a solid polymer membrane that conducts protons while separating product gases.	Uses an oxide-ion-conducting membrane to electrolyse steam (and optionally carbon dioxide). Capable of splitting sea water.
Suitability	Long stack life and limited use of rare metals. Less suited for variability of renewable energy and less efficient than alternatives.	More efficient than AWE. Well suited to variability of renewable energy; however, relies on rare metals like iridium and platinum, whose prices can be volatile.	Highly efficient.
Technological readiness	Highly mature. Manufacturing concentrated in China.	Mature, primarily manufactured and used in Europe.	Still in early development.

Source: (i) *How Can India Indigenise and Boost Domestic Green Hydrogen Electrolyzer Manufacturing in India?*, CEEW, 2024.
*Electrolyser stack: electrolyser machinery including electrodes, ion-conducting membrane, and end plates. Balance of plant: all components that support stack functions such as pipes, safety systems, heat exchangers, power supply, and hydrogen compressor.

Feasibility driver | Indigenisation of electrolyser manufacturing at scale will be critical for bringing down costs, with SIGHT providing the initial stimulus

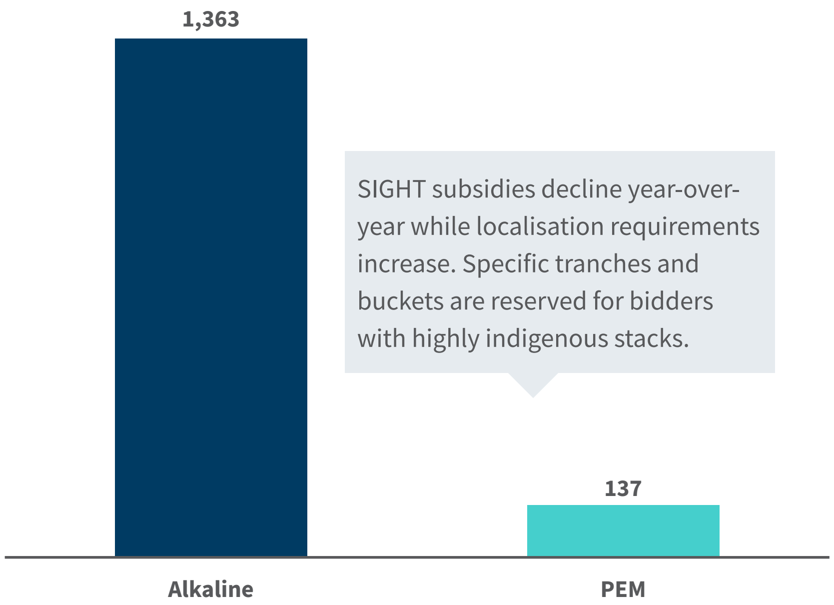
India currently has limited electrolyser manufacturing capacity, but plans to set up 3 GW of capacity by 2030

Global electrolyser manufacturing capacity, 2021–30 by region (in GW/annum)



Through the SIGHT scheme, 1.5 GW/year has already been awarded, 90% of which is alkaline electrolyser focused

*Electrolyser production capacity allocation by company and electrolyser type under SIGHT tranche I[1,] * (in MW/annum)*

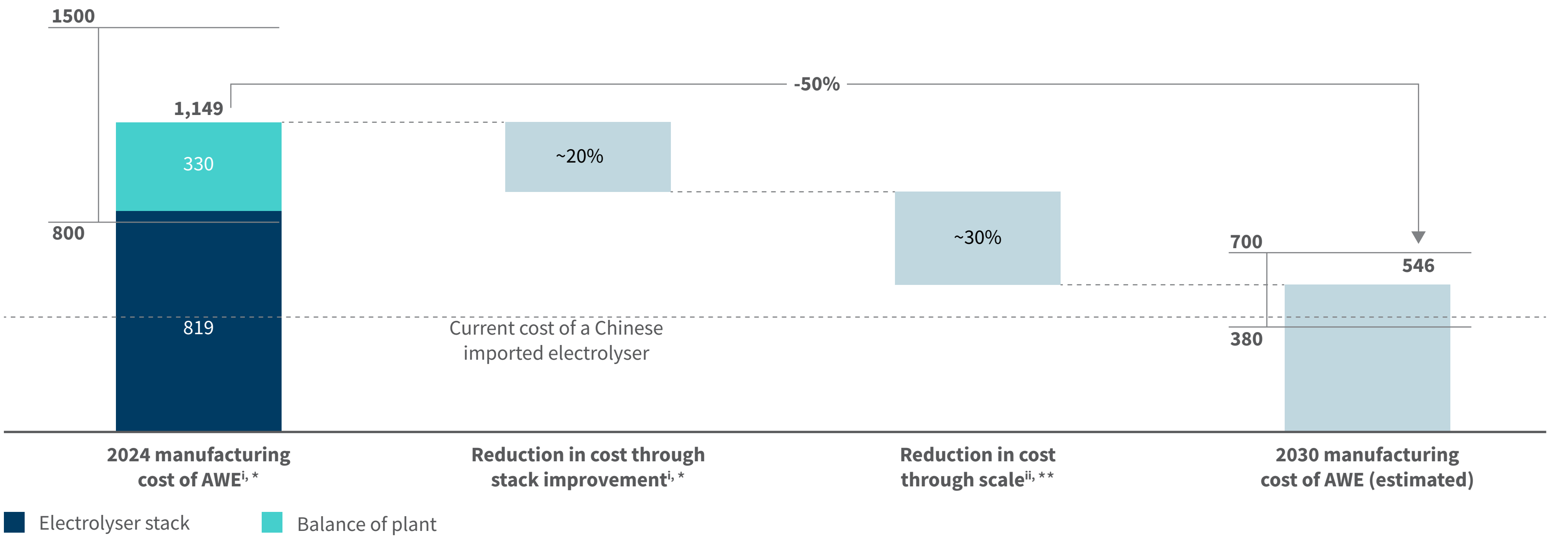


Source: *How Can India Indigenise and Boost Domestic Green Hydrogen Electrolyzer Manufacturing in India?*, CEEW, 2024.

Feasibility driver | Through indigenisation, technology improvements, and scale, the cost of electrolysers can decline significantly

80%–85% of the alkaline electrolyser cost can be indigenised, significantly reducing cost; a 50% reduction can be unlocked by 2030 through technology improvements that reduce raw material needs and via economies of scale

Alkaline electrolyser price change due to technology improvements and scale (in US$/kW)



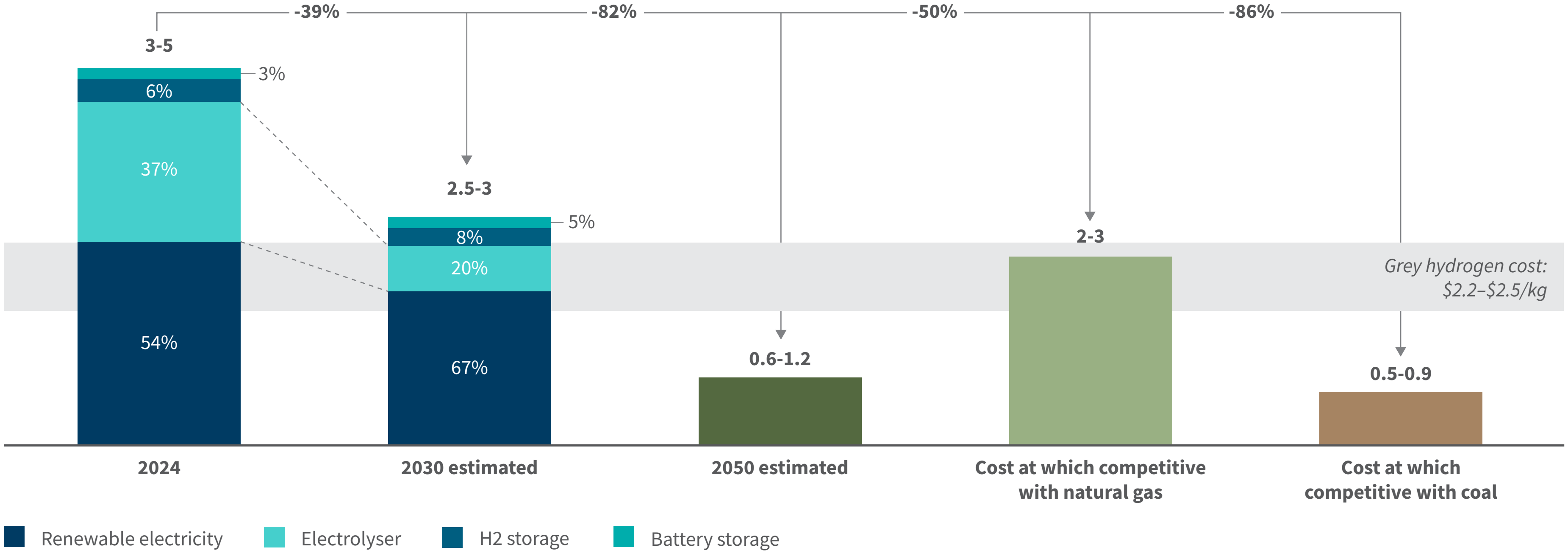
80% of the cost can already be fulfilled through indigenous components, with a further 5% potential. However, rare earth metals like nickel and membrane materials like Zircon currently cannot be manufactured in India, potentially acting as a bottleneck.

Source: (i) *How Can India Indigenise and Boost Domestic Green Hydrogen Electrolyzer Manufacturing in India?*, CEEW, 2024; (ii) *Working on Costs: Efforts to Make Green Hydrogen Commercially Viable*, Renewable Watch, 2021.
*Assumes annual production of 1,000 units of 1 MW capacity each.
**Scale-up assumes increase from 1 to 20 MW.

Feasibility driver | GH2 is unlikely to be cost competitive with coal and natural gas for steelmaking in the short to medium term

GH2 prices are expected to decline by 39% by 2030, reaching US$2.5–US$3/kg. This makes GH2 uncompetitive with natural gas for DRI-EAF and coal in BF-BOF in the short to medium term. However, estimates suggest costs may fall to US$1/kg by 2050.

Average LCOH by cost component, 2024-50 (in US$/kg) vs. the LCOH needed to break even with natural gas and coal



Source: *Greening the Steel Sector in India: Roadmap and Action Plan*, MoS, 2024 ; *Green Hydrogen Production Pathways for India*, RMI, 2025; *Promise to Purchase*, RMI, Bain, and CII, 2025 and *Harnessing Green Hydrogen*, NITI Aayog, RMI, 2021.

Feasibility driver | GH2 is incredibly challenging to transport and store, necessitating close linkage between production and consumption sites

GH2's low volumetric energy density, physical properties, and flammability impose significant constraints on transport and storage infrastructure

01 Low volumetric energy density

- Hydrogen's volumetric energy density is lower than alternative fuels like natural gas, requiring a significant amount to be compressed under high pressures for cost-effective transportation and storage.
- In liquid form, it has to be cooled to cryogenic temperatures, which is energy intensive and technically complex.

02 Material properties

- Hydrogen molecules are extremely small and can slip into the lattice of transportation materials, weakening and embrittling them.
- Molecules can also slip through minute cracks, creating significant risk of leakage.

03 Flammability

- Hydrogen is highly flammable with low ignition energy, particularly under high pressure.

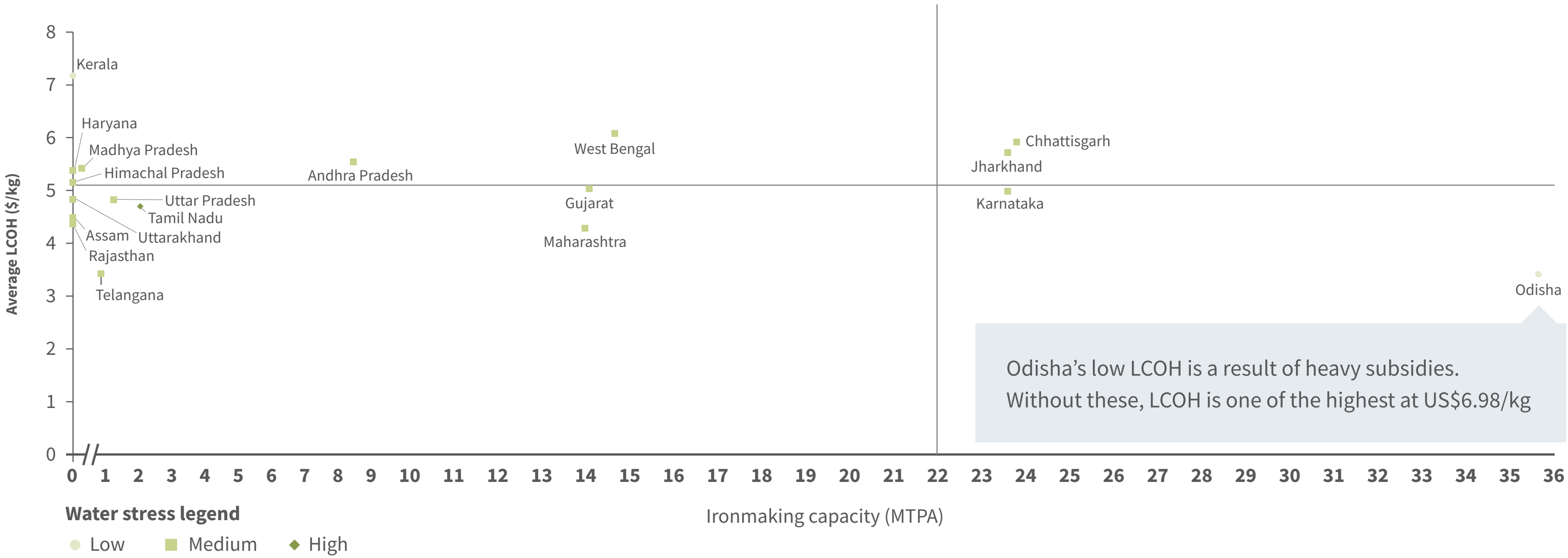
Hydrogen storage and transportation infrastructure is highly specialised and advanced, making it technically complex and costly. Reducing distance and time between production and consumption is thus the most cost-effective way to ensure integration in steelmaking.

Source: Energy Tracker Asia, 2023.

Feasibility driver | However, iron-producing states are not the most cost-effective for GH2 production, potentially acting as a bottleneck to steel use

Absent state-level subsidies, the cost of producing GH2 is among the highest in major iron-producing states such as Odisha, Jharkhand, Chhattisgarh, and Karnataka. Many of these states are also highly water stressed, which can hinder GH2 production at scale.

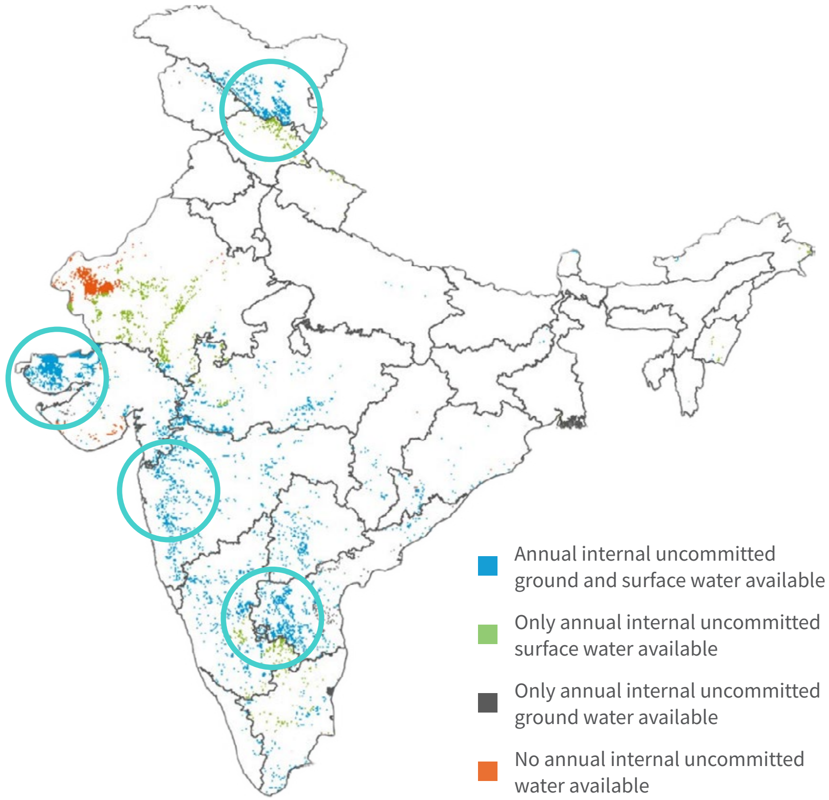
Comparison of state-wise iron capacity, average LCOH, and level of water stress



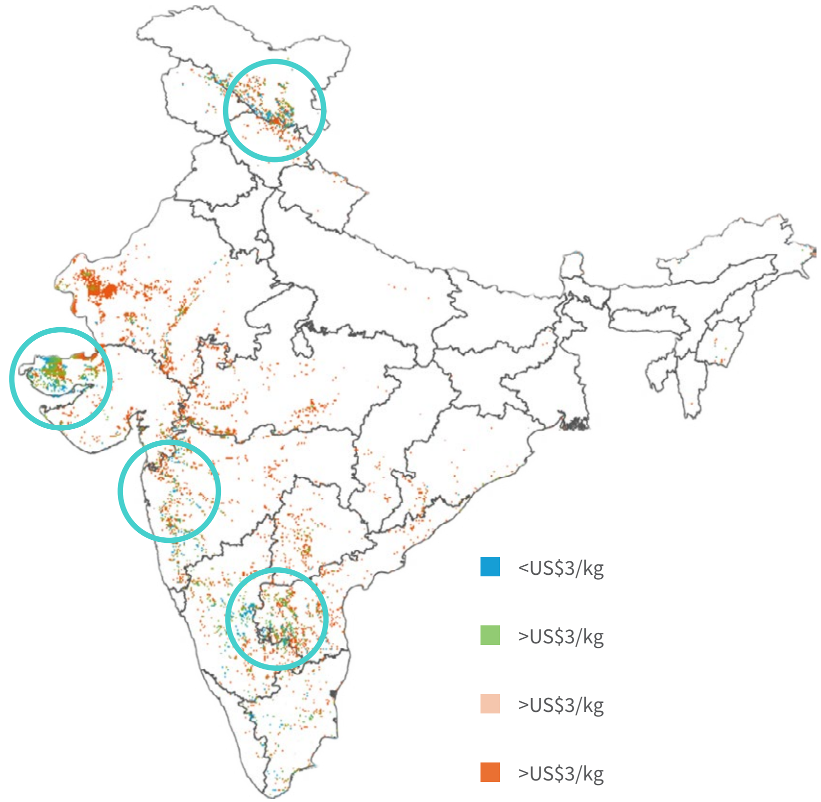
Source: *Greening the Steel Sector in India: Roadmap and Action Plan*, MoS, 2024; *Green Hydrogen Production Pathways for India*, RMI, 2025; and "Per Capita Water Availability," NITI Aayog, 2025.
*Water scarcity for state calculated by considering district-wise per capita water scarcity level as per NITI Aayog. Each scarcity level was assigned a score from 1 (no stress [>1,700 m3]) to 4 (absolute scarcity [<500 m3]) and each district's score was calculated based on the same. The score for the state was the average of the district scores, which was then assigned to three broad buckets of water stress.

Feasibility driver | However, there may be distinct pockets across India where GH2 production may be feasible

Water available for GH2 production is concentrated in south and southwest India



LCOH is quite high across a majority of sites in India, but there are distinct pockets where wind-solar hybrids can reduce costs

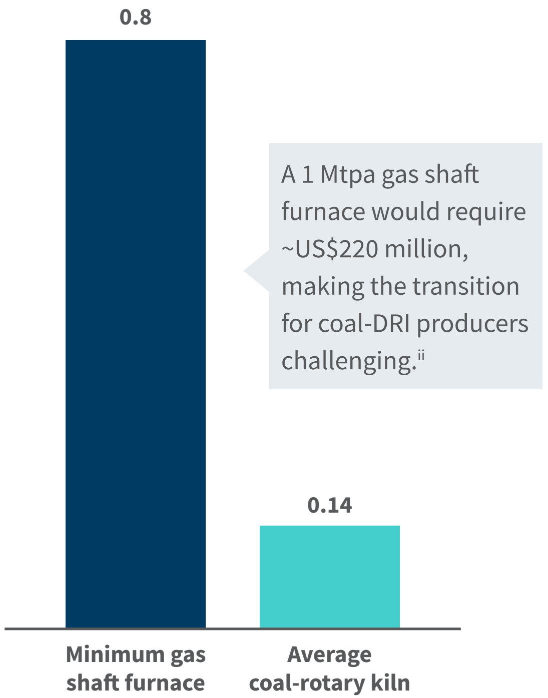


Source: *Unlocking India's RE and Green Hydrogen Potential*, CEEW, 2024.

Feasibility driver | Natural gas can be a transitional fuel; however, the cost of shaft furnaces and availability and price of natural gas may be major bottlenecks

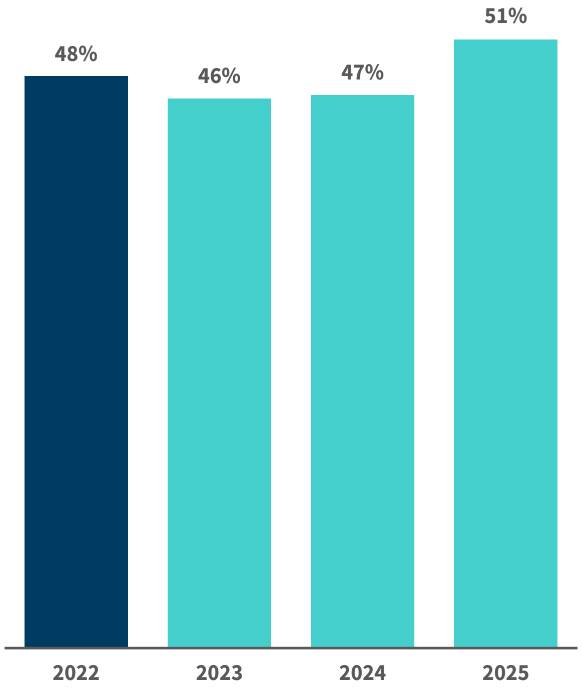
The capital expenditure required for gas-based shaft furnaces may be prohibitive for small producers.

Minimum gas shaft size vs. average rotary kiln size (in Mtpa)[i]



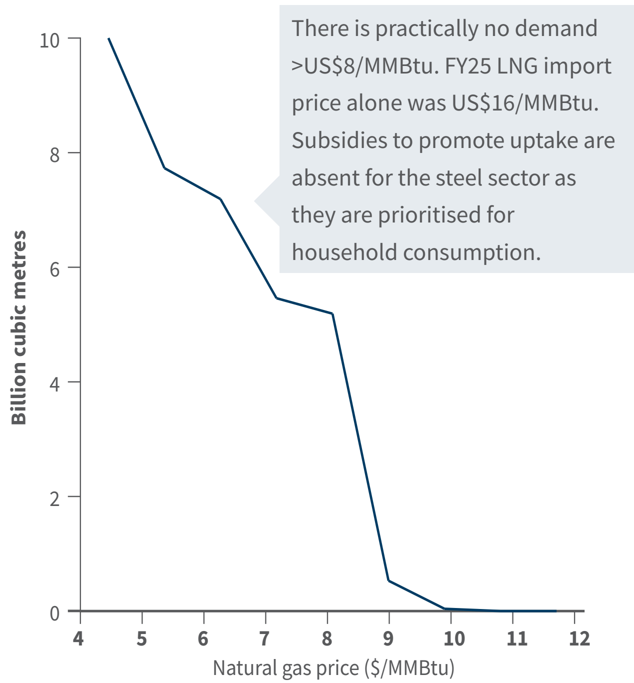
India is still highly dependent on imports of natural gas ...

India's natural gas import dependency (% of consumption fulfilled through imports)



… however, the current cost of imported LNG is much higher than steel sector tolerance

Demand curve for natural gas in steel sector (in billion cubic metres) at various LNG import prices



Source: (i) *Greening the Steel Sector in India: Roadmap and Action Plan*, MoS, 2024; (ii) *Financing Decarbonisation of the Secondary Steel Sector in India*, TERI, 2023.

Biochar

Abatement potential | Biochar can substitute for coke in blast furnaces and for non-coking coal in rotary kilns, and may also replace pulverised coal injection (PCI) in blast furnaces

Biochar can partially substitute for coal-based inputs across several steelmaking routes, subject to technical and operational constraints. Its highest potential is in helping small producers of steel through coal-DRI reduce their emissions intensity by replacing coal as a reductant. Biochar can also be used to replace coal in thermal power plants.

	Biochar potential	Use of biochar	Theoretical utilisation limit	Technological readiness	Potential emissions intensity reduction
Iron ore processing	*Limited*	*Can replace coke/anthracite in pelletisation without any major modification*	*20%–25% substitution is possible*	*TRL 7–8; already demonstrated in Indian plants*	*5%–13% for sintering and pelletisation*
BF-BOF	*Limited*	*Can be used for enhancing quality of coke and replacing PCI in BFs*	*Substitution for coke is limited to 2%–10%* *100% PCI replacement potential*	*TRL 6; demonstrations underway; pilot in Brazil succeeded in full PCI replacement*	*17%–24% for PCI replacement*
Coal-DRI	*High*	*Can directly replace noncoking coal in rotary kilns*	*50%–60% replacement is possible*	*TRL 6–7; demonstrated in countries including Brazil*	*59%–60%*
Gas-DRI	*Limited*	*Biomass-derived syngas can replace natural gas in the gas shaft furnace*	*30%–40% replacement is possible*	*TRL 4–5; experimentation is still underway*	-
EAF	*Minimal*	*Can replace coking coal as charge carbon and foaming agent or as electricity source for EAF*	*100% coal replacement is possible without modification*	*N/A*	*1%–3%*

The GHG Protocol and Worldsteel consider biochar to be carbon neutral; however, the EU CBAM requires further checks to ensure biochar was sourced sustainably and adds emissions from biochar-related activities like pyrolysis and transport.

Source: *Greening the Steel Sector in India: Roadmap and Action Plan*, MoS, 2024; *Green Hydrogen Production Pathways for India*, RMI, 2025.

Feasibility driver | (1) Availability of raw material, (2) ability to process and produce steel-grade biochar; and (3) ability to utilise at the plant level

1

Availability of raw material

Biochar needs to be available in sufficient quantities to meet steel demand. This includes the availability of raw plant material and linkages with the iron and steel production sites.

2

Ability to process and produce steel-grade biochar

Plant material must be processed into biochar that has the physical and chemical properties needed for use in iron reduction or in thermal power plants.

3

Ability to utilise at the plant level

Iron-producing plants must be able to use biochar, which may require retrofits and preparation of storage and handling facilities on site.

Source: *Greening the Steel Sector in India: Roadmap and Action Plan*, MoS, 2024; *Green Hydrogen Production Pathways for India*, RMI, 2025; *Promise to Purchase*, RMI, Bain, and CII, 2025.

Feasibility driver | Unlocking biochar will require significant developments across the value chain; individual producers may be able to secure local supply

Integration of biochar in steel production depends on three feasibility drivers, which require pieces to fall into place across the value chain

	Collection	Preparation	Transportation	Utilisation
1. Availability of biochar	• Crop residue is only available for 15 days between Rabi and Kharif • It's challenging to aggregate residue across small farms • Without minimum support prices, it's more economical for farmers to burn farm residue	• Without large-scale storage and support for smaller aggregators, it is impossible to ensure year-round supply	• Biochar's low bulk density and mismatch between biochar-producing states and iron/steelmaking states can make transportation costs prohibitive	
2. Ability to process and produce steel-grade biochar		• India needs investments in large-scale production facilities • There is a lack of standardisation of biochar grading to ensure suitability for iron production		
3. Technical feasibility of utilisation				• Retrofitting of existing plants, including new injection systems and handling and storage upgrades, is required; however, there is a lack of clear guidance

Source: "Spatial Variation of Biochar Production Potential from Surplus Crop Residues in India," Current Research in Environmental Sustainability, 2025; *Greening the Steel Sector in India: Roadmap and Action Plan*, MoS, 2024.

Abatement potential | Changing the raw material inputs for iron and steel production can reduce energy requirements and bring down emissions intensity

Improving raw material quality

Reduce the energy requirements for reduction, thereby improving overall process efficiency. It can also make the transition to GH2 DRI-EAF more feasible.

Increasing use of steel scrap

Steel scrap can be directly used as feedstock in an IF or EAF, completely cutting out the need for iron feedstock and bringing down emissions intensity significantly. It can also be used in BOFs, albeit to a limited extent due to technological constraints.

Feasibility driver | High-quality iron ore and feedstock lower the energy requirement for iron production

	Improvement of iron ore quality	Improve iron feedstock for furnaces and kilns
01 What is the issue?	Indian ores have low iron content on average, with only 12% counted as high-grade iron ore (>65% iron). This reduces the efficiency of BFs and acts as a bottleneck to GH2 DRI steelmaking.	Some 70% of India's mine output is small fines. These cannot be fed into furnaces as is and must be aggregated. In absence of aggregation capacity, India exports a portion of its iron ore fines rather than utilising them domestically.
02 What is the solution?	Beneficiation increases iron content of ore by removing impurities like alumina and silica through mechanical and chemical processes.	Pelletisation converts fine iron ore into uniform balls, which boost the productivity of furnaces.
03 What is India's progress?	Beneficiation capacity is likely to reach 170 Mt by 2030. Most existing capacity is in Odisha, Jharkhand, and Chhattisgarh, mirroring the iron-production belt. However, facilities are chronically underutilised.	India had a pellet production capacity of 136.7 Mtpa in 2024, of which actual production was 61% of capacity. Consultations suggest that India is unable to produce high-basicity pellets, limiting full exploitation of metallurgical benefits.
04 What drives feasibility?	1. **Capital intensity:** Beneficiation requires greater up-front and recurring investment than simple crushing and screening operations. 2. **Water availability:** Beneficiation requires large quantities of water; however, most iron-producing states are water stressed. 3. **Energy availability:** Power shortages are frequent in remote iron ore mines, disrupting the beneficiation process. 4. **Proximity to mines:** Plants tend to be outside the mining area, making logistics more expensive and challenging.	1. **Requirement for beneficiation to make iron ready for pelletisation:** Impurities in iron ore need to be removed prior to pelletisation to avoid low-quality feedstock in iron furnaces. 2. **Impact of iron price in open markets:** Pellet manufacturers may procure iron ore from the market, exposing themselves to price fluctuation and incurring significant transportation costs. Integrated steel plants may also prefer sintering due to lower costs and ability to recycle in-plant waste like coke breeze and flue dust.

Source: *Greening the Steel Sector in India: Roadmap and Action Plan*, MoS, 2024; *Green Hydrogen Production Pathways for India*, RMI, 2025.

Abatement potential | Scrap holds the highest potential when paired with induction furnaces and electric arc furnaces

Scrap is currently used in some shape or form to produce ~21% of India's steel, most prominently in the fragmented IF-based steelmaking sector

	Scrap utilisation potential	Use of scrap	Current scrap utilisation rate	Theoretical utilisation limit	Emissions reduction potential
BF-BOF	*Limited*	*Added as charge into the BOF alongside hot metal/pig iron*	*9%*	*20%–25%. BOF design is built for hot metal. High scrap ratios lead to suboptimal outcomes.*	*30% emissions intensity reduction at 20% scrap utilisation*
Coal-DRI IF	*High*	*Can be added with DRI or as stand-alone feedstock*	*41%*	*100% is possible in IF; however, it requires higher-quality scrap.*	*70% emissions intensity reduction at 80% scrap utilisation in coal-DRI IF*
Gas DRI EAF	*High*	*Can be added with DRI or as stand-alone feedstock*	*13%*	*EAF can run on 100% scrap and can accept a wide range of scrap qualities.*	*39% reduction in emissions intensity. Full scrap-EAF has an emissions intensity as low as 0.3 tCO_2/tcs.*

Global average scrap usage in steel production is 31%, with regions such as Turkey at 85%, the United States at 68%, the European Union at 57%, and Russia at 42%. Even large primary steel producers such as Japan (39%) and China (34%) achieve higher scrap utilisation than India.

Source: *Greening the Steel Sector in India: Roadmap and Action Plan*, MoS, 2024; *The Net-Zero Steel Pathway Methodology Project*, Worldsteel, 2021; *The Rebar Opportunity*, RMI India Foundation, Lodha, BMTPC, 2025.

Feasibility driver | (1) Availability of scrap, (2) ability to establish supply chain for recycled scrap, and (3) deployment of scrap-friendly assets

1 Availability of raw steel scrap

The availability of raw steel scrap is the dominant factor determining the feasibility of scrap-based steelmaking. Steel scrap can directly replace iron feedstock in steelmaking furnaces. In EAFs, it has a near 1:1 ratio with regard to scrap input and crude steel output.

2 Supply chain for recycled steel scrap

Raw steel scrap needs to be recycled to remove impurities and make it suitable to be fed into steelmaking furnaces. Doing so at scale requires a formalised and efficient supply chain.

3 Use of scrap-based steelmaking assets

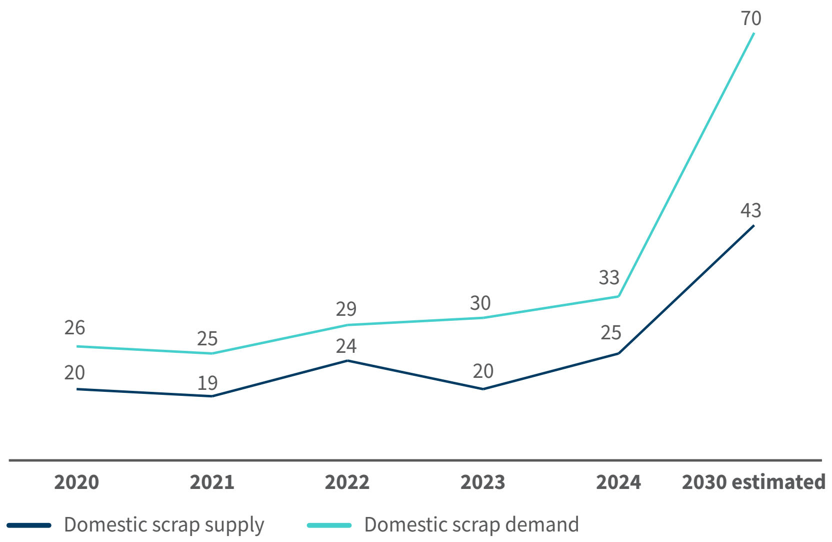
BOFs have limited potential to utilise scrap. In contrast, EAFs and IFs can technically operate 100% on scrap, though the latter requires higher-grade inputs.

Source: *Achieving Green Steel Roadmap*, TERI, 2022; *Decarbonising the Indian Steel Industry*, RMI, 2023; "Steel Scrapping Policy," MoS, 2019; *Greening the Steel Sector in India: Roadmap and Action Plan*, MoS, 2024.

Feasibility driver | Low availability of raw scrap and a fragmented and informal recycling ecosystem act as significant bottlenecks to scaling scrap usage

Domestic and imported steel scrap availability is unlikely to be sufficient to meet scrap demand

Domestic scrap production and demand, 2020–30 (in Mt)[i]



In 2024, 33 Mt of scrap was used in steelmaking, of which India imported 8 Mt

To maximise scrap utilisation, India will need to significantly increase collection and recycling capabilities

Scrap collection

- Recycling of end-of-life automotives has been identified as a good source of scrap: MoEFCC's End of Life Vehicle Policy and MoRTH's vehicle scrapping policy lay out a series of incentives and procedures to increase material recovery. However, implementation is uneven across states.

Scrap recycling

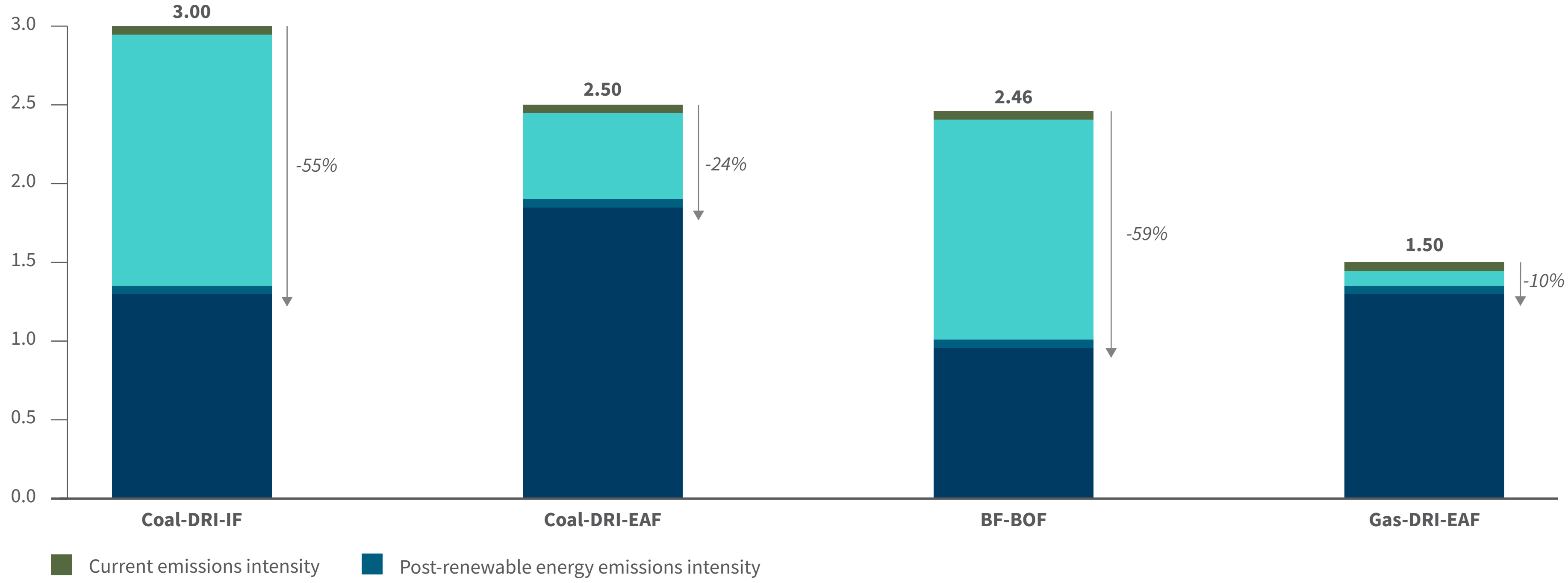
- Scrap recycling needs to be formalised: 90% of steel recycling is informal and fragmented, resulting in poor-quality scrap and challenges in establishing supply. The steel scrapping policy (2019) acknowledges the need to formalise the sector and increase the number of recycling facilities.
- Recycling capabilities need to increase drastically: To meet India's needs, steel recycling needs to triple.

Source: (i) *The Rebar Opportunity*, RMI India Foundation, Lodha Foundation, and BMTPC, 2025; *Decarbonising the Indian Steel Industry, RMI*, 2023; *steel scrapping policy*, MoS, 2019; *Greening the Steel Sector in India: Roadmap and Action Plan*, MoS, 2024; "*Govt aiming to increase scrap share in steel making to 50% by 2047: Scindia*," Business Standard, 2024.

Abatement potential | CCUS is critical for decarbonising coal-dependent steelmaking routes, particularly coal-DRI and BF-BOF

CCUS unlocks a >50% emissions intensity reduction across coal-DRI-IF and BF-BOF and is the key decarbonisation lever for these routes

Decrease in emissions intensity by route after CCUS deployment (tCO₂e/tcs)



Source: *How Can India Decarbonize Steel Production Industry*, CEEW, 2023; and *Greening the Steel Sector in India: Roadmap and Action Plan*, MoS, 2024.
Note: Percentage share derived from marginal abatement cost curves in the previous section. Calculated as emissions intensity reduction from renewable energy divided by starting emissions intensity. Emissions intensity post-renewable energy is an indicative number.

Feasibility driver | The feasibility of using CCUS in steel depends on the ability to capture and monetise carbon through utilisation or long-term sequestration

1

Ability to capture carbon

Carbon dioxide is captured directly at the emissions source (point capture) or from surrounding ambient air (direct air capture). The technical and financial feasibility of doing so depends on where in the steel-producing process the carbon capture plant is installed.

2

Ability to monetise carbon through utilisation

Captured carbon dioxide can be sold for use in sectors like food and beverage or for conversion into green fuels and chemicals potentially. Demand for captured carbon dioxide and commercial effects on the cost of steel need to be carefully assessed.

3

Ability to sequester carbon and monetise storage

Carbon dioxide can be sequestered in geological sinks. The cost of doing so and the potential for revenue realisation from the storage sites or through carbon credits may be considered.

Source: *Achieving Green Steel Roadmap*, TERI, 2022; Decarbonising the Indian Steel Industry, RMI, 2023; steel scrapping policy, MoS, 2019; *Greening the Steel Sector in India: Roadmap and Action Plan*, MoS, 2024.

Feasibility driver | CCUS faces significant bottlenecks that pose questions about the likelihood of it being a feasible decarbonisation lever for steel

Ability to capture carbon

- **Carbon capture technologies are at a high level of technological readiness:** They've been utilised since the 1960s in oil and gas. Multiple systems are at TRL 8–9.
- **CO_2 capture from iron and steel plants is challenging:** Off-gas only contains 15%–20% carbon dioxide. After this point, the cost of capturing carbon increases significantly. Out of all routes, BF-BOF is most suitable with 17%–23% carbon dioxide concentration in flue gas.
- **Capture costs are expected to decline:** Cost may fall from US$40/t$CO_2$ to US$20/t$CO_2$ by 2030.
- **Effective capture efficiency is limited:** Theoretical capture rates are 80%–85%, while actual rates are 50%–60%, both due to on-site inefficiencies and inability to address significant Scope 3 emissions.[i] When deployed with BF or coal-DRI, this can result in locked-in emissions.

Ability to monetise carbon through utilisation

- **Production of green chemicals and fuels requires high-quality raw materials:** More than 99% carbon dioxide purity and GH2 is required to produce most chemicals and fuels, increasing cost and complexity.
- **There are few domestic original equipment manufacturers offering conversion technologies:** This significantly increases the cost and effort needed to establish CCU projects.
- **Production cost of chemicals and fuels is likely to remain prohibitive, limiting demand for carbon in these industries:** For most products, the cost of GH2 would need to drop to <US$1/kg from US$4.5/kg to be competitive with current production costs.[ii] Achieving US$1.5–US$2/kg by 2030 is more likely.[ii]

OR

Ability to sequester carbon and monetise storage

- **Although most steel plants are close to geological sinks, the ability to transport is currently limited:** Only 21% of BFs are within 25 km of existing or planned gas pipelines, which provide ready infrastructure for carbon dioxide transport.
- **Execution of CCS projects can take over a decade:** Replication of best practices is challenging because each storage site is unique.[iii]
- **Carbon abatement costs are currently prohibitive:** CCS has an abatement cost between ~US$85 and US$140/tCO_2 for high-feasibility saline aquifers. EOR and enhanced coal-bed methane recovery (ECMR) offer revenue potential, with ECMR already net profitable on a pilot basis.

Headwinds *Tailwinds*

This reflects the current understanding. However, domestic policy support for CCUS — including the INR20,000 crore allocation in the Union Budget 2026–27 and ongoing pilots led by DST — may improve the prospects for large-scale deployment.

Source: (i) *Steel CCUS Update: Carbon Capture Technology Looks Ever Less Convincing*, IEEFA, 2024; (ii) *Green Hydrogen Production Pathways for India*, RMI,2025; (iii) *How Can CCUS Decarbonise India's Industrial Sector?*, CEEW, 2025.

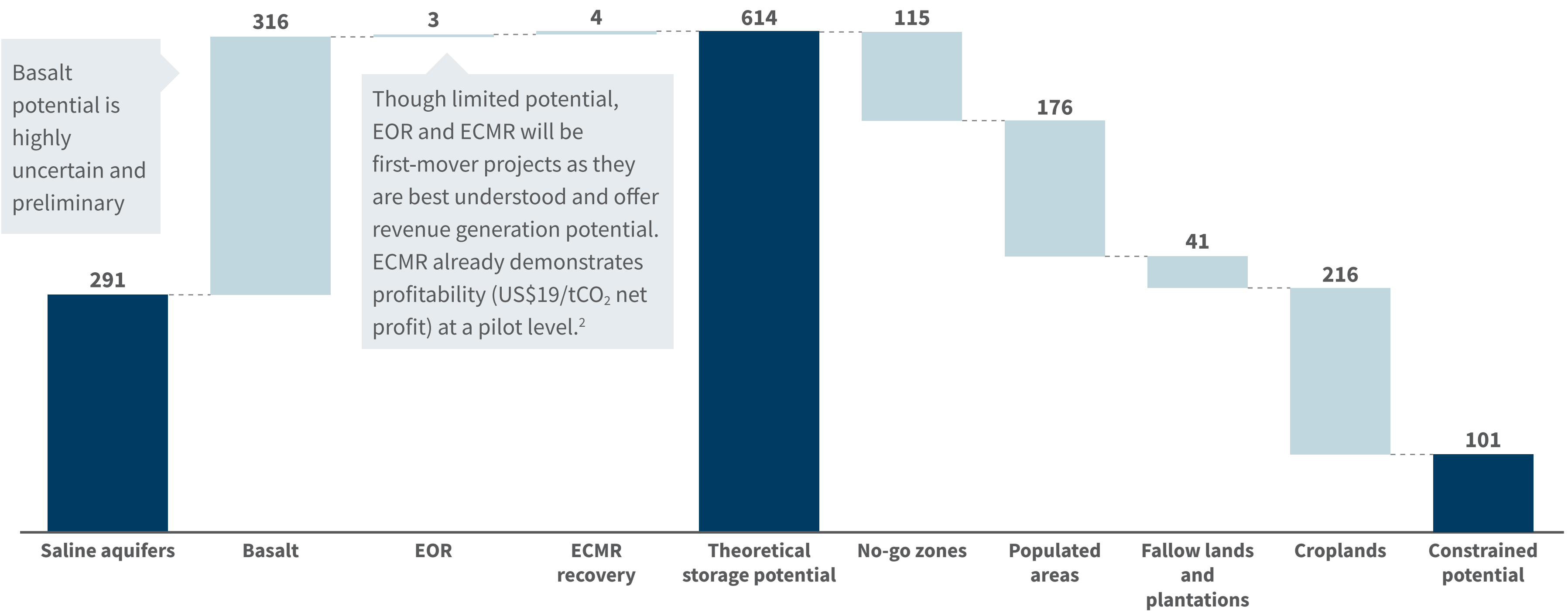
Feasibility driver | India has a theoretical carbon storage potential of ~614 Gt; however, above-ground constraints may reduce this significantly

Saline aquifers and basalt have the highest carbon dioxide storage potential; however, basalt storage requires further assessment

Theoretical carbon dioxide storage potential by type of storage site (in Gt CO_2)

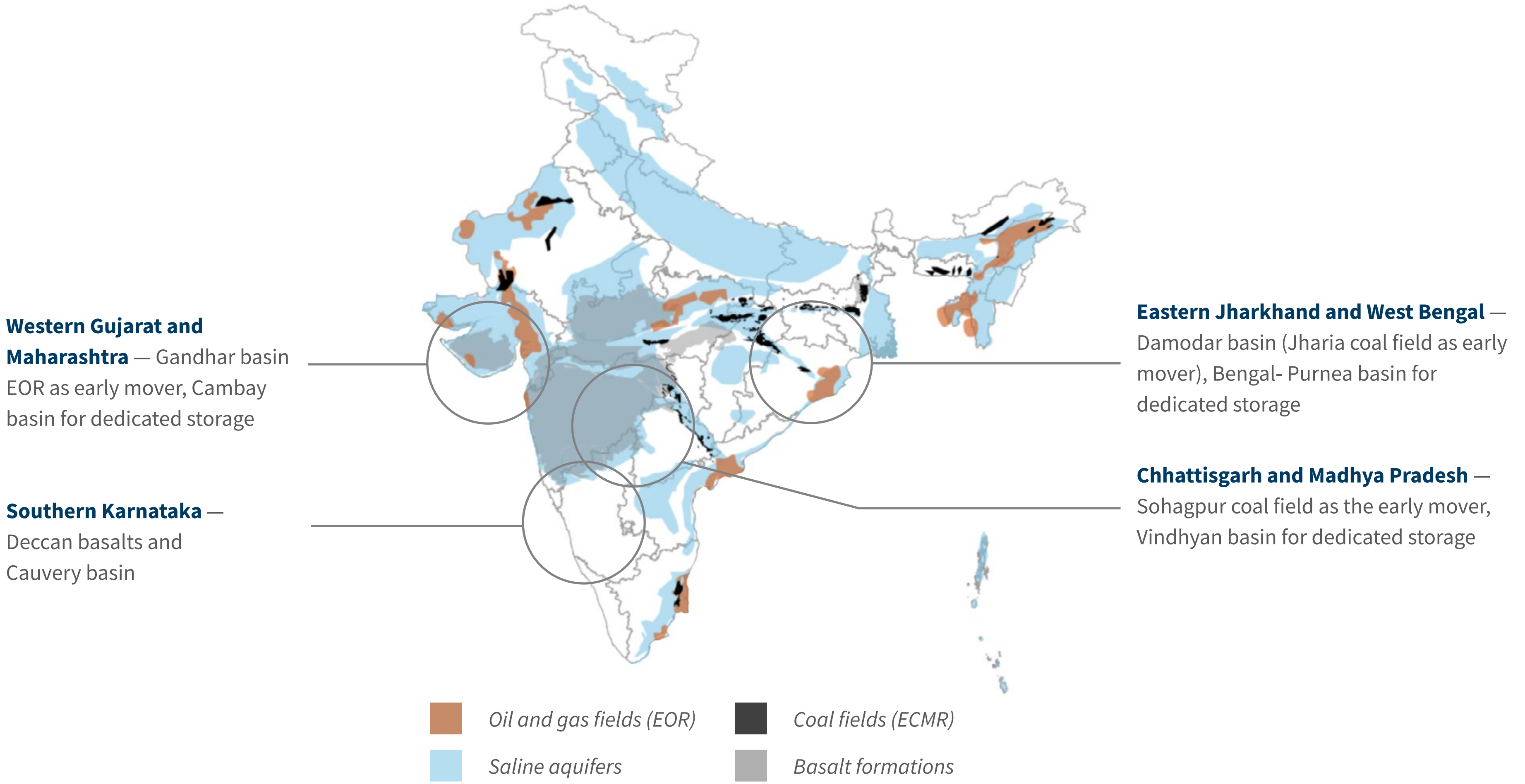
Presence of farmland and human settlements may constrain the availability of carbon dioxide storage

Impact of constraints on carbon dioxide storage potential (in Gt CO_2)



Source: *How Can CCUS Decarbonise India's Industrial Sector?*," CEEW, 2025; *Greening the Steel Sector in India: Roadmap and Action Plan*, MoS, 2024; and *Assessing India's CO2 Storage Potential*, CEEW, 2023.

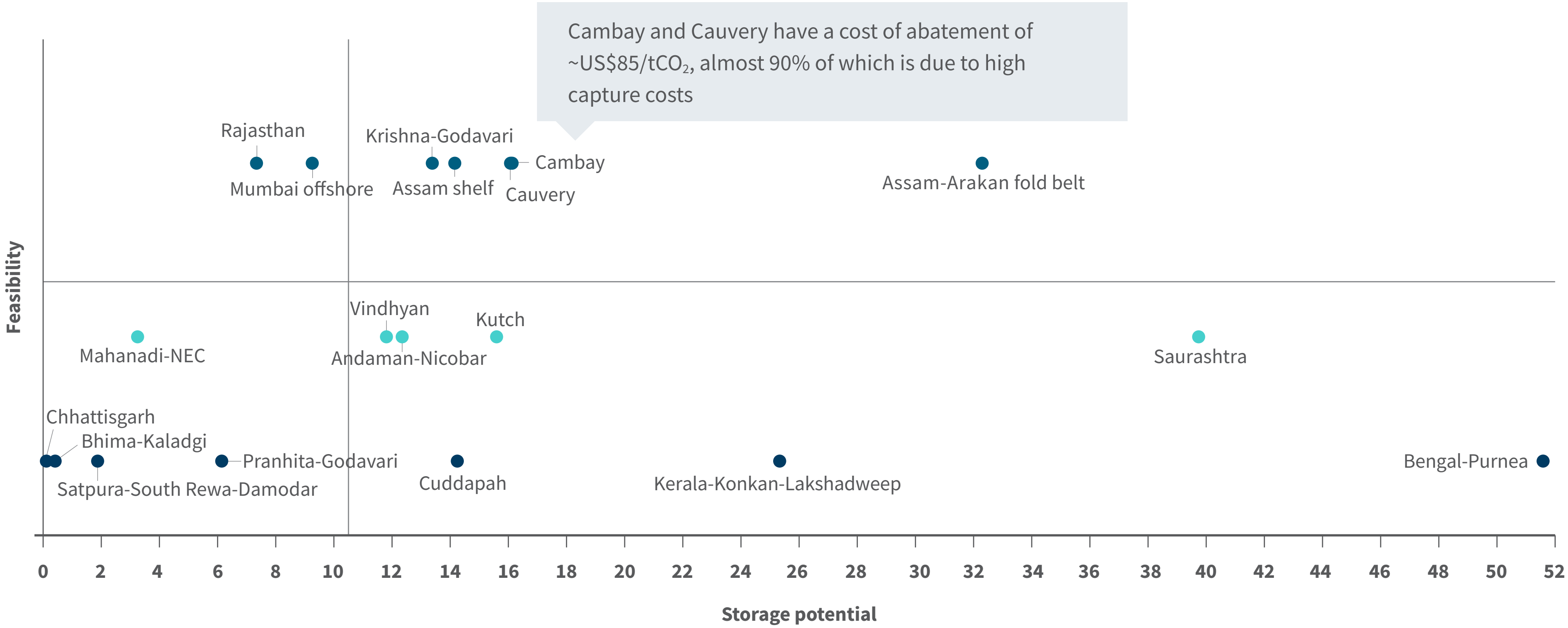
Feasibility driver | Prominent storage basins like the Cambay, Cauvery, Bengal-Purnea, and Vindhyan are available for use by iron and steel producers



Source: *How Can CCUS Decarbonise India's Industrial Sector?*, CEEW, 2025; *Greening the Steel Sector in India: Roadmap and Action Plan*, MoS, 2024.

Feasibility driver | Currently, only the Cauvery and Cambay saline aquifers are at a high level of feasibility

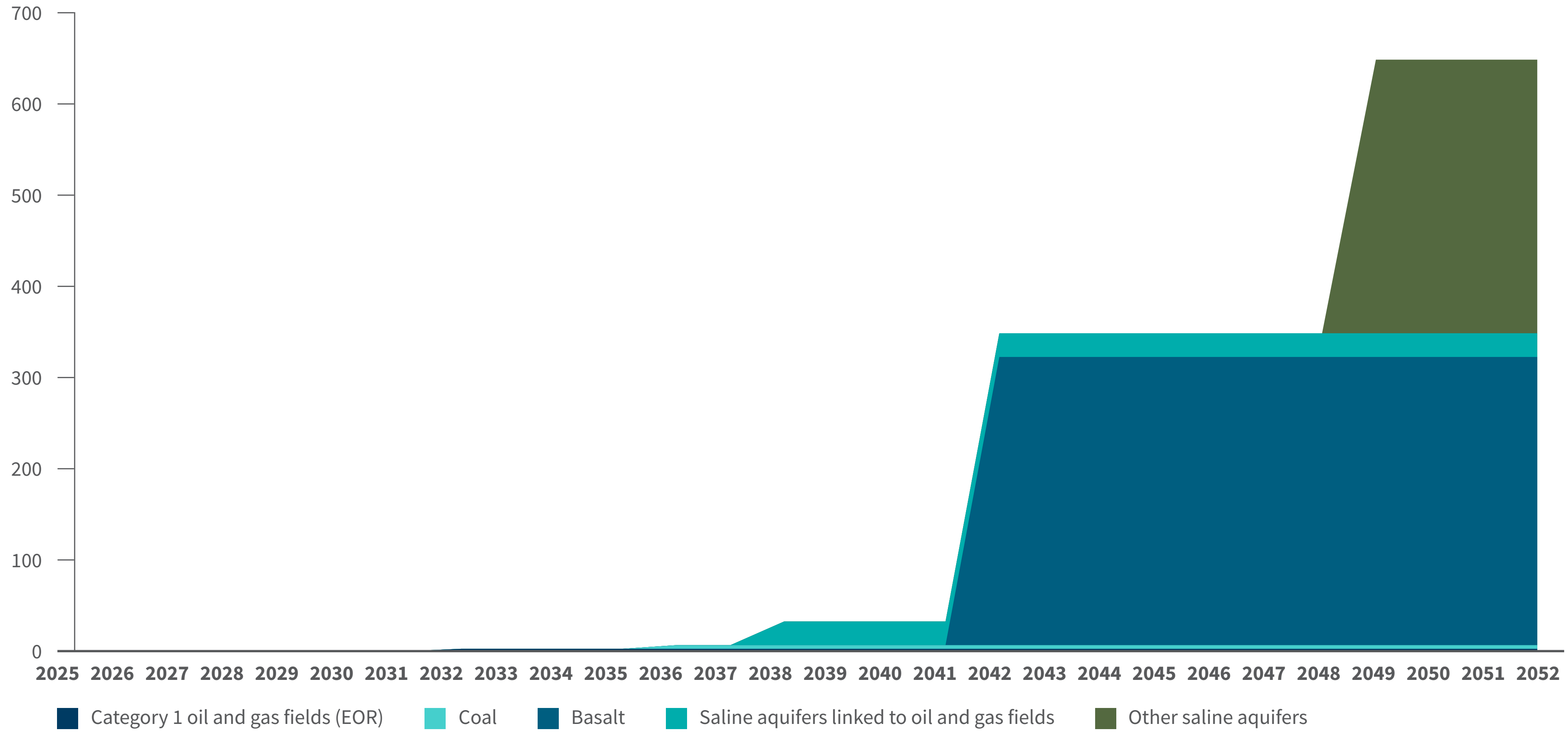
Saline aquifer storage sites in India by size (in Gt) and feasibility



Source: *Draft 2030 Roadmap for Carbon Capture Utilisation and Storage (CCUS) for Upstream E&P Companies*, Ministry of Petroleum and Natural Gas, 2022.

Feasibility driver | CCS that does not enable greater emissions through EOR and ECMR is only likely to materialise at scale around ~2040

Cumulative carbon dioxide storage potential by type of storage (in $GtCO_2$) and timeline of realisation

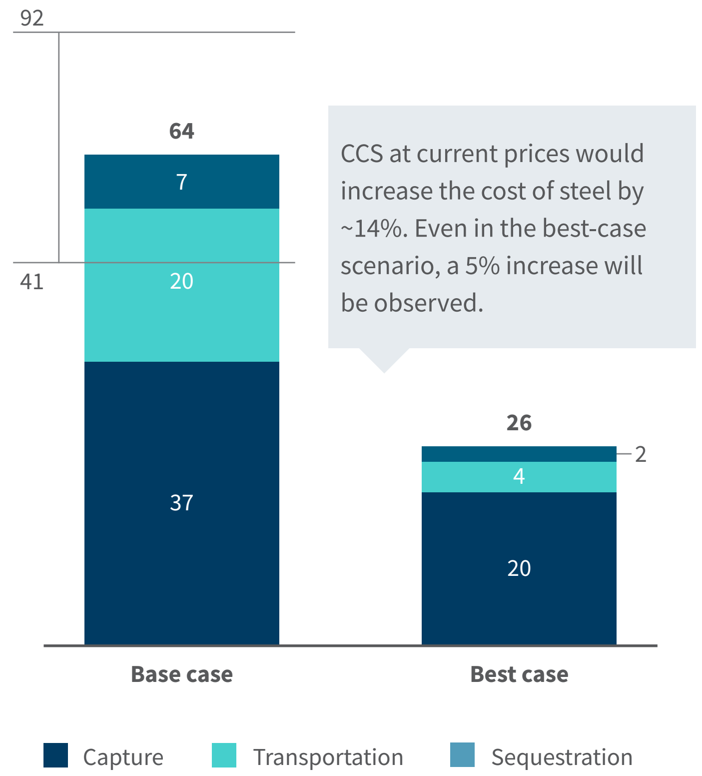


Source: *Assessing India's CO_2 Storage Potential*, CEEW, 2023.

Feasibility driver | Overall, CCUS is currently prohibitively expensive and a reduction in costs is uncertain

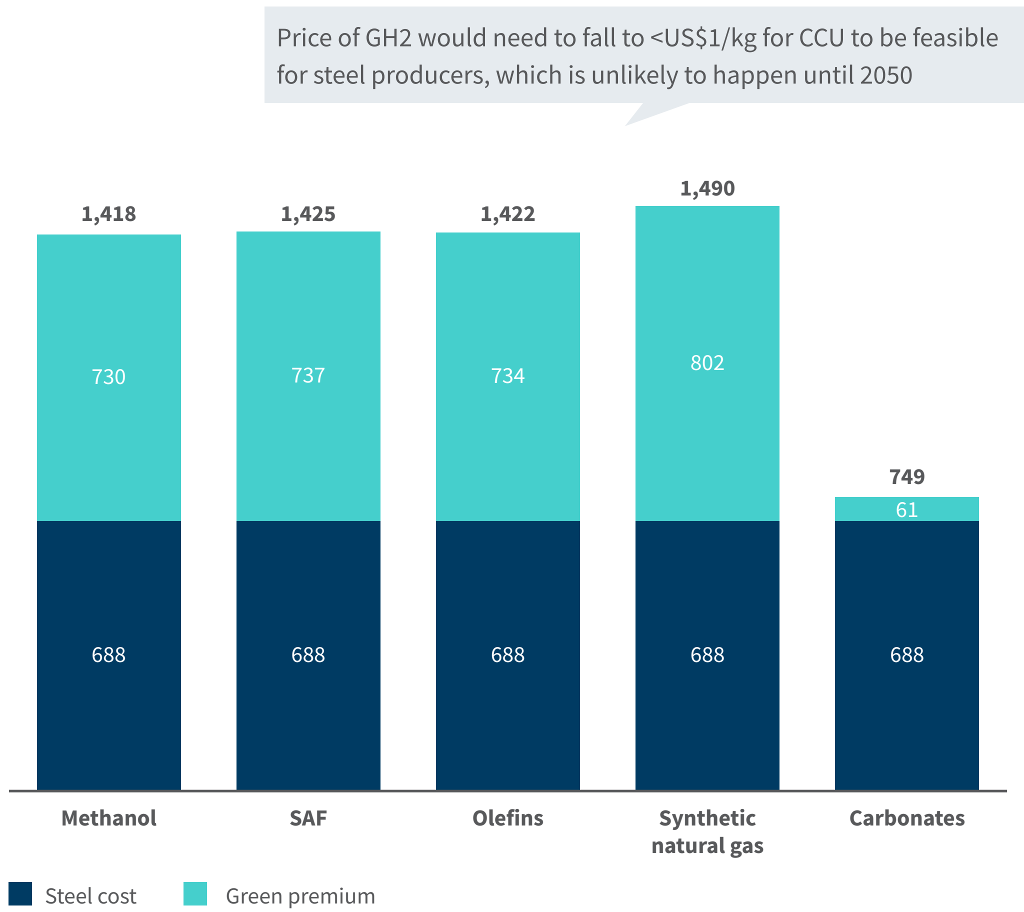
CCS costs are currently prohibitive and would increase the cost of steel by ~14%

CCS cost (US$/t$CO_2$) base case and best case scenario[i]



CCU may be more technically feasible, but will be commercially unfeasible unless GH2 costs come down significantly

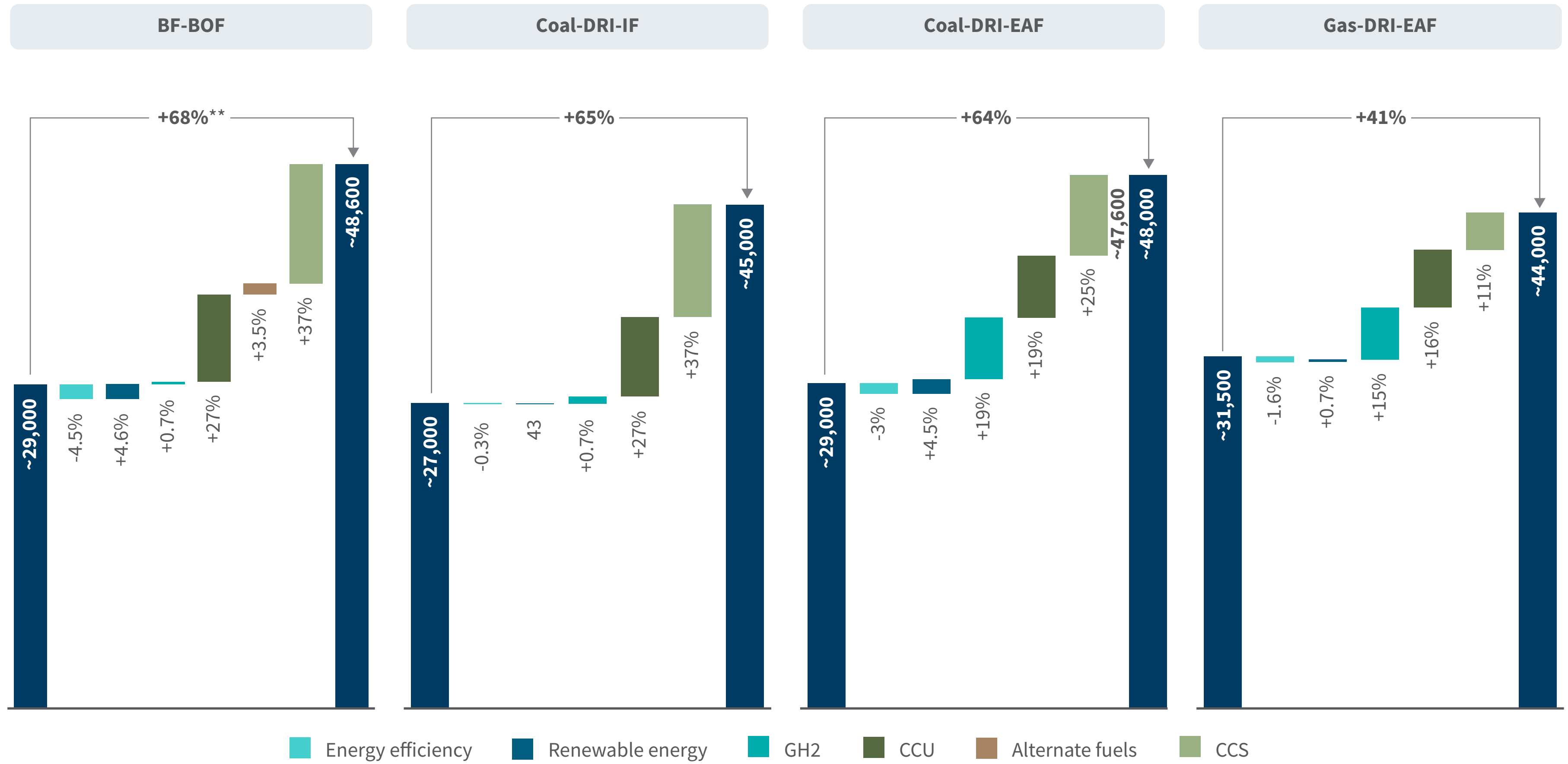
Cost of steel using CCU (US$/tcs)[i, ii, *]



Source: (i) *Greening the Steel Sector in India: Roadmap and Action Plan*, MoS, 2024; (ii) *How Can CCUS Decarbonise India's Industrial Sector?*, CEEW, 2025.
*Assumes GH2 cost of US$ 4.3/kg.

Deploying decarbonisation levers at current prices will significantly raise the cost of steel in current routes; CCUS drives a majority of the cost increase

*Change in cost of steel production due to deployment of decarbonisation levers by conventional steelmaking routes (in INR/tcs)**



Source: *How Can India Decarbonize Steel Production Industry*, CEEW, 2023.
*Percentage contribution calculated by taking the absolute incremental increase in cost as each lever stacks and dividing by base cost.
**Calculated sequentially based on stacked cost increments and may not sum exactly to the total increase due to rounding.

There are also some novel routes for steel production being developed globally; however, these are still early in their development

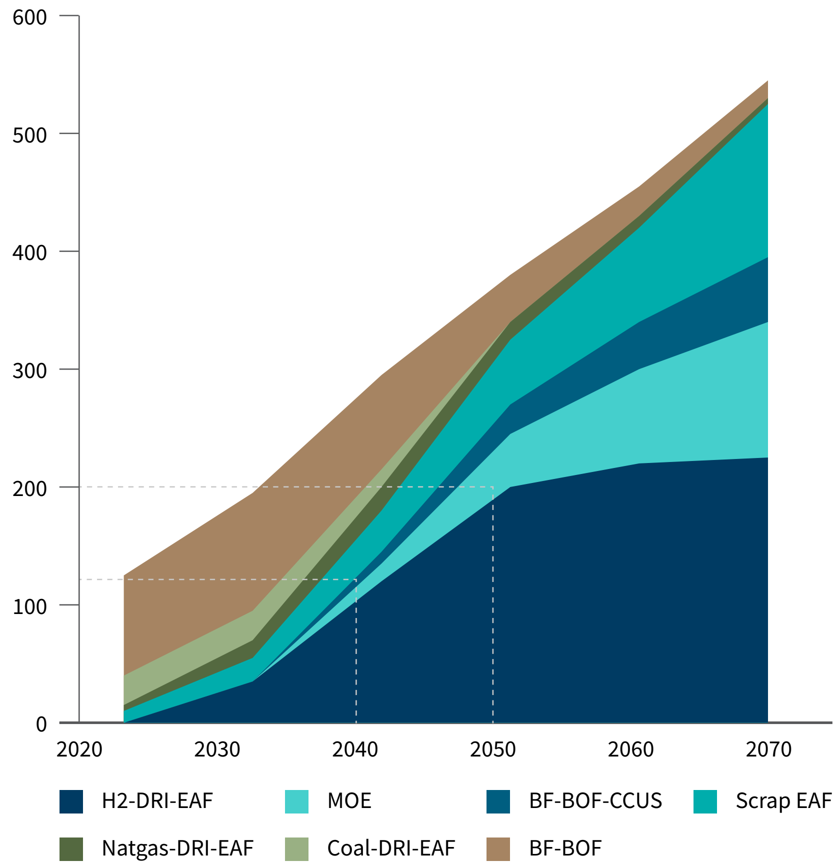
	Short description	TRL	Key developers	Emissions profile	India example
100% hydrogen-based direct reduction with EAF (H-DRI-EAF)	Uses green hydrogen to reduce iron ore, followed by melting in an EAF	TRL 6– 8	HYBRIT (LKAB, SSAB, Vattenfall), H2 Green Steel	Near zero with fossil-free hydrogen and renewable electricity	None reported at industrial scale; interest growing in H2-DRI pilots by Company X and TATA Steel
Molten oxide electrolysis via renewable energy electricity	Electrolytic process at high temperature using an inert anode to convert iron ore to molten iron	TRL 5–6	Boston Metal	Zero emissions with renewable electricity	No commercial example in India yet
Electrowinning via renewable energy electricity	Low-temperature aqueous electrolysis process for extracting iron directly from ore	TRL 5–6	SIDERWIN (ArcelorMittal-led consortium)	~0.3 tCO_2/tcs	No known pilot or commercial project in India
HIsarna + CCUS	Smelting iron ore fines directly in a cyclone converter furnace; avoids sintering and coke making	TRL 6	Tata Steel IJmuiden, Rio Tinto	0.4 tCO_2/tcs (with CCS)	TATA Steel R&D is involved; HIsarna is being explored for future deployment
Hydrogen plasma smelting reduction	Uses hydrogen plasma to reduce iron ore directly in a high-temperature plasma arc furnace	TRL 5	SuSteel (Voestalpine AG)	Zero emissions with renewable electricity	IMMT has conducted lab-scale experiments on hydrogen plasma reduction
High-intensity smelting (HIsmelt)	Smelts iron ore with coal in a high-intensity smelt reduction process; suitable for low-grade ores	TRL 9	Rio Tinto; Nucor; Mitsubishi; Shougang Corp., Australia; Shandong Molong Petroleum Machinery Co., Ltd., China	1.6 tCO_2/tonnes of hot metal	No HIsmelt commercial deployment in India yet
Rotary hearth furnace	Reduces iron ore in a rotating hearth furnace using carbonaceous material as reductant	TRL 9	Nippon Steel & Sumitomo; POSCO JV, Korea	1.3 tCO_2/t DRI or 1.6 tCO_2/tcs	Used at pilot scale; no major deployment in India reported

Source: *Greening the Steel Sector in India: Roadmap and Action Plan*, MoS, 2024.

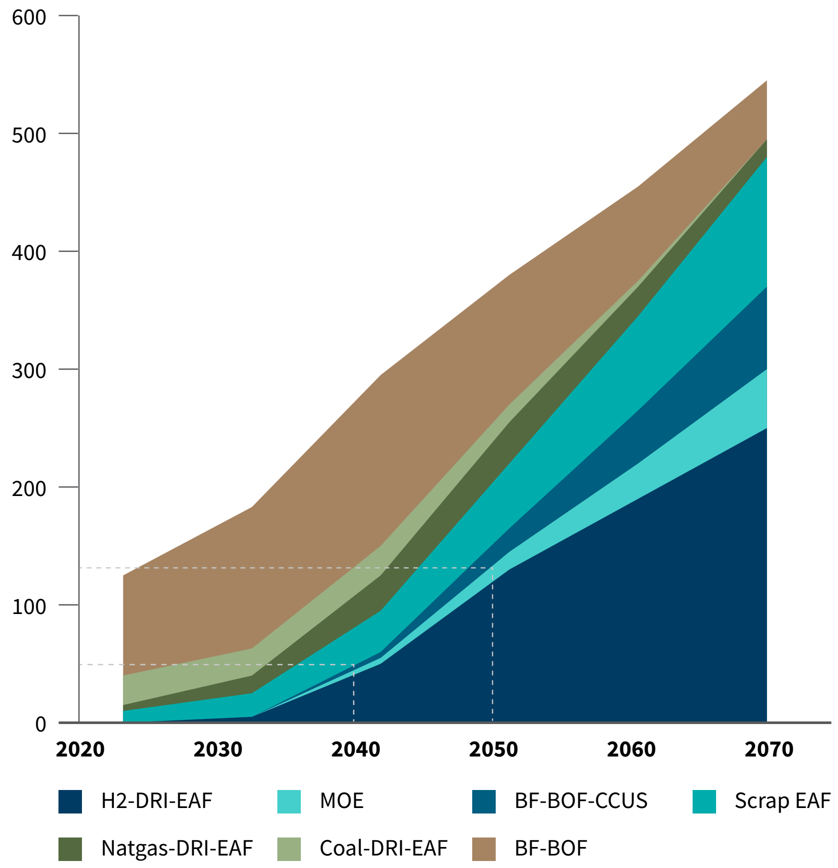
To achieve net zero, it is clear that a fundamental shift in how steel is made needs to happen

Achieving net zero by 2050 requires a >50% increase in the amount of near-net-zero steel produced through the GH2-DRI-EAF route compared with a 2070 net-zero trajectory

Crude steel production by technology route, 2020–70, as per TERI Net Zero 2050 scenario (in Mt)



Crude steel production by technology route, 2020–70, as per TERI Net Zero 2070 scenario (in Mt)

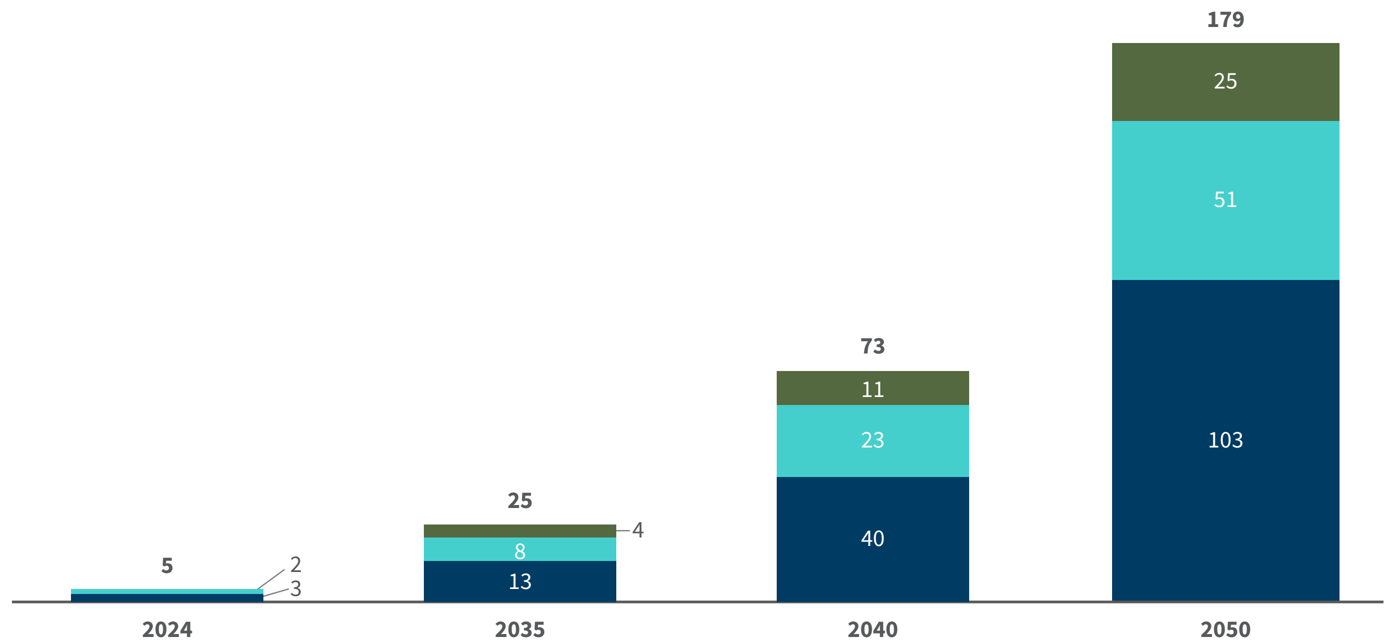


Source: *Achieving Green Steel Roadmap*, TERI, 2022.
Note: MOE refers to molten oxide electrolysis, which involves using an electrolytic process at high temperature using an inert anode to convert iron ore to molten iron. It is a near-zero steelmaking process when powered by renewable energy. It has no commercial application yet and is currently at TRL 5–6.

Looking ahead, demand for green steel is likely to increase significantly, driven largely by the construction sector

The construction sector is projected to have the highest green steel demand by 2050; although the automotive sector has a comparably low level of absolute demand (around 14%), it is expected that green steel will account for 98% of the sector's steel demand

Green steel demand by sector from 2024 to 2050 (in Mt)



Green steel penetration	2024	2035	2040	2050
Construction	2%	10%	27%	50%
Infrastructure	3%	10%	25%	50%
Automotive	3%	20%	44%	98%

Construction Infrastructure Automotive

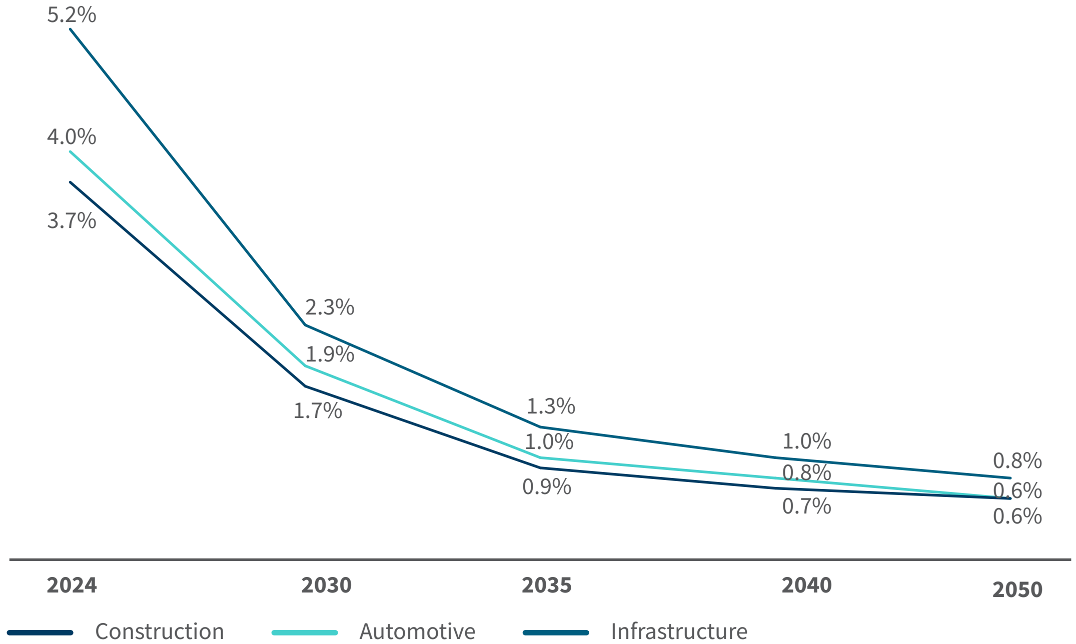
Source: *Unlocking Green Steel Demand*, EY Parthenon, 2025.

Key offtakers are likely to see only an incremental increase in product costs from the green premium associated with GH2-DRI-EAF

Steel makes up a meaningful share of the production value in key sectors; however, a shift to green steel raises costs incrementally, with infrastructure seeing the highest impact; over time, the increase in cost may become minimal

	Share of steel in cost (in %)
Infrastructure	**~5%–20%**
Automotive	**~15%–20%**
Construction	**~15%–25%**

Percentage increase in production costs for automotive, infrastructure, and construction projects due to use of GH2-DRI-EAF steel across time



Source: *Unlocking Green Steel Demand*, EY Parthenon, 2025.
Note: Other costs leading up to sales price include cost of goods sold (US$191/t steel), profit after tax (US$40/t steel), and depreciation + tax (US$39/t steel). Carbon price is assumed to be ~US$58/t$CO_2$ by 2030, ~US$115/t$CO_2$ by 2040, and ~US$229/t$CO_2$ by 2050. The modelling is based on interviews with leading companies in each sector and analysis of financial reports.

Scenarios can help provide insight into how the steel sector needs to evolve to meet net-zero targets, and how it may evolve in reality

Scenarios can be exploratory, normative, or predictive in nature, cover different scopes, and use very different modelling approaches to arrive at outputs		When pathways or approaches are put together, they can provide useful sector-level insight and appropriate benchmarks for companies
Scenario intention	Scenarios are either "normative," showing how the sector should transition to meet a specific net-zero temperature target, "exploratory," demonstrating how the sector might evolve under particular conditions, or "predictive" in that they aim to map the sector's evolution under business-as-usual conditions.	What kinds of policies may be required to achieve an outcome (e.g., carbon pricing, price subsidies, technology mandates)?
Scenario scope	Scenarios can vary significantly in their scope — from being multisectoral global scenarios, which can serve as global benchmarks, to country-specific and sector-focused scenarios that provide tailored insights relevant for transition assessments.	Which technologies does the sector's transition rely on? How quickly do they scale? What are the intersectoral implications?
Scenario methodology	Scenarios can vary significantly in their methodology; some may be drawn from top-down integrated assessment models. Others may be bottom-up sector-specific models and incorporate qualitative insight from experts.	What are the other dependencies built into the scenario (e.g., consumer willingness to pay, technology cost reductions, technological readiness improvement)?

Source: RMI analysis.

Assuming net-zero targets remain unchanged, scenarios project that the pressure from regulatory, technology, and market drivers will increase

		International Energy Agency (IEA) Net-Zero Emissions (2050)[i] | Global scenario		Mission Possible Partnership (MPP) Carbon Cost (2050)[ii] | Industry-led scenario		TERI Net Zero (2070)[iii] | India scenario building on MPP	
		2035	2050	2035	2050	2035	2050
Regulation and policy	Emissions reductions mandates	Net-zero 2050 scenarios assume coordinated and rapid rollout of emissions reductions measures, including mandates				Government may mandate use of low-carbon tech in 2040s	
	Carbon pricing	Carbon price rises to US$65/$tCO_2e$ for emerging markets	Carbon price rises to US$200/$tCO_2e$ for emerging markets	Carbon price rises to US$52/$tCO_2e$	Carbon price rises to US$200/$tCO_2e$	Implies need for carbon pricing implementation, but does not comment on trajectory	
Technology	Shift to secondary steelmaking	30% of steel is scrap based	40% of steel is scrap based	13% of steel made using scrap-EAF	17% of steel made using scrap-EAF	11% of steel made using scrap-EAF	20% of steel made using scrap-EAF
	Shift to low-emissions primary steelmaking	25% of iron and 20% of steel are low emissions	95% of iron and 50% of steel are low emissions	94% of steel made using low-carbon tech	100% of steel made using low-carbon tech	~20% of steel made using low-carbon tech	~68% of steel made using low-carbon tech
Market	Decline in steel demand due to resource efficiency	~25% reduction in steel demand relative to IEA STEPS baseline	~50% reduction in steel demand relative to IEA STEPS baseline	13% reduction in steel demand relative to baseline	24% reduction in steel demand relative to baseline	-	25% reduction in steel demand relative to baseline
	Demand for low-carbon steel	All scenarios assume that steel consumers will absorb green steel providing it is cost competitive with grey steel					

High impact **Medium impact** **Low impact**

Source: (i) *Energy Technology Perspectives*, International Energy Agency, 2024; (ii) Making Net-Zero Steel Possible, Mission Possible Partnership, 2022; (iii) *Achieving Green Steel*, TERI and Energy Transitions Commission, 2022; and technical annex, TERI and Energy Transitions Commission.

Scenarios vary in scope and relevance; comparing results across multiple scenarios provides a richer benchmark. (1/3)

Scenario provider	Scenario context	Scenario	Year of last update	Type of scenario	Temperature alignment	Probability of achieving temperature	India-specific outputs?	Steel data points captured	Relevance for India steel CTA
Mission Possible Partnership	Steel pathways informed and validated by companies like TATA Steel, Arcelor Mittal, CSN, ThyssenKrupp, BP, HSBC, and others focussed on global net zero by 2050.	Baseline	2023	Exploratory	> 2°C	-	Yes	• Total crude steel production • Steel production by route • Emissions intensity by production route • Projected scrap availability for India	Highly relevant
		Technology moratorium	2023	Normative	< 2°C	<50%	Yes		Highly relevant
		Carbon cost	2023	Normative	1.5°C	50%	Yes		Highly relevant
RMI	RMI modelled pathways for steel decarbonisation to provide insight into potential futures and enabling factors and barriers. Focus is on net zero by 2050.	Progress as usual	2023	Exploratory	-	-	Yes	• GHG emissions from iron and steel • Steel production by route • Emissions intensity by production route • Levelised cost of steel by production route	Highly relevant
		Hydrogen economy	2023	Exploratory	-	-	Yes		Highly relevant
		Net-zero aligned	2023	Normative	-	-	Yes		Highly relevant
TERI, Energy Transitions Commission	ETC India, behind the MPP global scenario, initiated activities in 2017–18 with a focus on the decarbonisation of India's steel sector alongside TERI, with 2050 and 2070 net-zero pathways.	Net Zero 2070 (NZ2070)	2022	Normative		-	Yes	• Production route by technology • Steel emissions intensity across pathways (calculated)	Highly relevant
		Net Zero 2050 (NZ2050)	2022	Normative		-	Yes		Highly relevant
		Baseline	2022	Exploratory	> 2°C	-	Yes		Highly relevant
		Resource efficiency	2022	Exploratory		-	Yes		Highly relevant

Source: RMI analysis.

Note that scenarios are not built equal in scope or relevance; comparing results from multiple scenarios can provide a richer benchmark (2/3)

Scenario provider	Scenario context	Scenario	Year of last update	Type of scenario	Temperature alignment	Probability of achieving temperature	India-specific outputs?	Steel data points captured	Relevance for India steel CTA
Bloomberg New Energy Finance (BNEF)	The *New Energy Outlook* is BNEF's flagship annual publication that presents long-term scenarios for the global energy transition.	Economic Transition Scenario	2025	Exploratory	2.6°C	67%	Yes	• Emissions intensity of steel production • Final energy consumption profile of steel industry	Relevant
		Net Zero Scenario	2024	Normative	1.75°C	67%	Yes		Relevant
UN PRI	The UN PRI commissioned the Inevitable Policy Response consortium to prepare institutional investors for the portfolio risks and opportunities associated with a forecast acceleration of policy responses to climate change.	Forecast Policy Scenario	2023	Exploratory	1.6°C–1.7°C	50%–66%	Yes	• GHG emissions from iron and steel • Steel production by route • Emissions intensity by production route	Relevant
Institute for Sustainable Futures (ISF), University of Sydney and Net Zero Asset Owners Alliance	ISF developed the One Earth Climate Model (OECM) in 2019 with the Institute of Networked Energy Systems and Energy Systems Analysis of the German Aerospace Centre.	OECM 1.5°C	2023	Normative	1.5°C	>50%	Yes	• Emissions intensity of steel disaggregated by primary and secondary steel • Share of steel by primary and secondary	Somewhat relevant (limited technology insights)
LSE Transition Pathway Initiative (TPI)	Evaluates companies' carbon emissions against different climate scenarios consistent with the UN Paris Agreement.	1.5°C	2025	Normative	1.5°C	50%	No	• Global steel emissions intensity benchmarks	Somewhat relevant (India insight limited)
		Below 2°C	2025	Normative	1.65°C	50%	No		
		National pledges	2025	Exploratory	2.6°C	50%	No		

Source: RMI analysis.

Note that scenarios are not built equal in scope or relevance; comparing results from multiple scenarios can provide a richer benchmark (3/3)

Scenario provider	Scenario context	Scenario	Year of last update	Type of scenario	Temperature alignment	Probability of achieving temperature	India-specific outputs?	Steel data points captured	Relevance for India steel CTA
Network for Greening the Financial System (NGFS)	The NGFS develops scenarios to help financial institutions understand the economic and financial impacts of climate change and associated policy responses. The NGFS has developed seven long-term scenarios through 2100 and four short-term scenarios through 2030. The seven long-term scenarios are captured here.	Delayed transition	2025	Exploratory	1.7°C	<50%	Yes	• Total steel production • Final energy consumption of steel by fuel source	Somewhat relevant (limited steel data points)
		Fragmented World	2025	Exploratory	2.4°C	>75%	Yes		
		Current policies	2025	Exploratory	3°C	>90%	Yes		
		NDCs	2025	Exploratory	3°C		Yes		
		Net Zero 2050	2025	Normative	1.4°C	50%	Yes		
		Below 2°C	2025	Normative	1.8°C	67%	Yes		
		Low demand	2025	Normative	1.1°C		Yes		
IEA	In May 2021, the IEA published its landmark report *Net Zero Emissions by 2050: A Roadmap for the Global Energy Sector*. The report set out a narrow but feasible pathway for the global energy sector to contribute to the Paris Agreement's goal of limiting the rise in global temperatures to 1.5°C above pre-industrial levels. The 2023 update sets out an updated pathway to net zero by 2050, taking account of the key developments that have occurred since 2021.	Net-Zero Emissions (NZE)	2023	Normative	1.5°C	50%	No	• Steel emissions intensity • Production route by technology	Low relevance (no India-specific outputs and limited steel data coverage)

Source: RMI analysis.

Notes

Notes

www.rmi.org

www.climatepolicyinitiative.org

An Introduction to Corporate Transition Assessments in India

A guide for bankers to assess the transition risks and opportunities of companies

Akshima Ghate, Ankur Malyan, Kaustav Sood, Riya Saxena, Anjan Ghosh, Divya Pinge, Gauri Tandon, Kalpesh Gada, Khaja Mohammad Haris, and Neha Khanna, *An Introduction to Corporate Transition Assessments in India: A guide for bankers to assess the transition risks and opportunities of companies*, RMI, Climate Policy Initiative, 2026, https://rmi.org/insight/an-introduction-to-corporate-transition-assessments-in-india