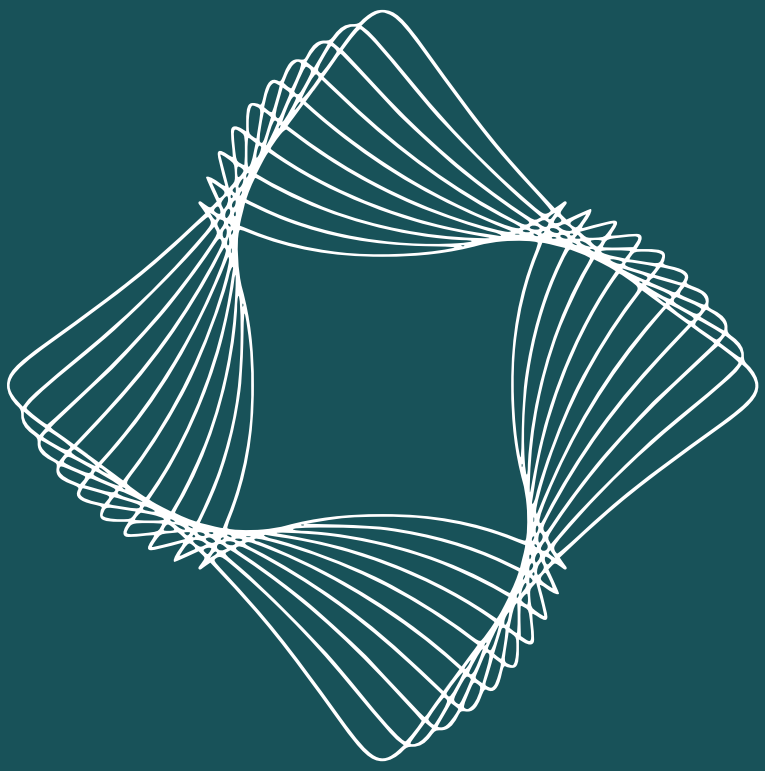
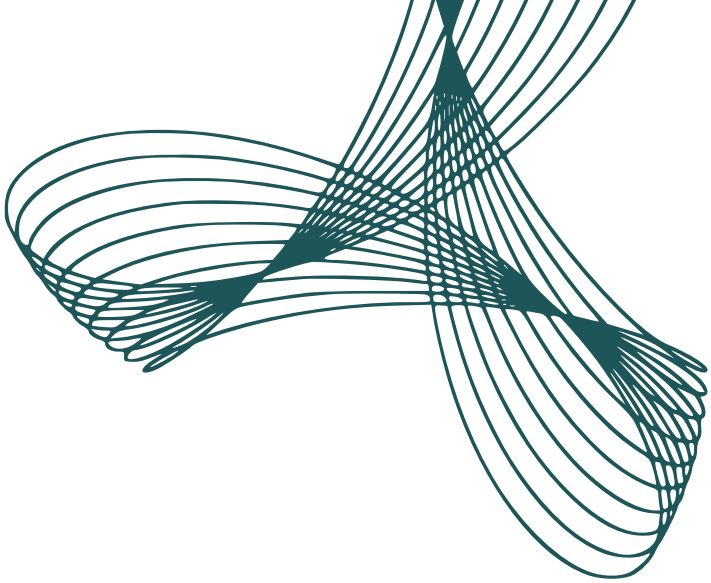
climate decode

India's Carbon Pricing-CCTS

Inaugral Market Outlook





India CCTS Market Outlook January 2026

Setting the Scene

Modeled Supply & Demand Insights

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Climate Decode

Enterpise workspace for climate action

Climate Decode is an agentic AI decarbonisation manager for industrial emitters. Our work focuses on a single problem: how to allocate capital and sequence decarbonisation so that companies meet their climate and compliance objectives at the lowest possible long term cost.

We take a unified view of all the major drivers that matter for these decisions. That includes production growth, technology options, energy choices and, increasingly, compliance carbon costs. As carbon markets expand and rules become more complex, these costs are no longer a side issue. They directly influence margins, competitiveness and investment timing. Climate Decode exists to make this complexity tractable and decision ready.

At the core of Climate Decode are two integrated platforms powered by Agentic AI. TerraNova models compliance exposure and least cost decarbonisation pathways by linking production, benchmark trajectories, project options and carbon prices. Canopy manages residual emissions through structured portfolios of carbon credits and environmental attributes, aligned with regulatory and claims guidance.

These systems continuously simulate regulatory outcomes, test scenarios and rank decisions by economic impact as policy, market and operational conditions evolve.

India's Carbon Credit Trading Scheme (CCTS) illustrates why this approach is needed. CCTS is not only an environmental policy. It is an industrial policy instrument in which production growth, emissions intensity benchmarks, and decarbonization investment jointly determine compliance costs and competitiveness. Managing CCTS requires scenario-based decision support rather than static reporting. As CCTS moves into implementation, Climate Decode brings global compliance market experience to India, acting as market infrastructure to support economically rational, data-driven decision-making.

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Executive Summary

India's Carbon Credit Trading Scheme (CCTS) is an intensity-based compliance market where obligations are set at the facility level through Greenhouse Gas Emissions Intensity (GEI) benchmarks expressed as emissions per unit of output. Facilities that outperform their assigned GEI generate Carbon Credit Certificates (CCCs), while facilities that underperform must purchase and surrender CCCs to cover excess emissions relative to their benchmark. Unlike cap-and-trade systems, CCTS does not impose an absolute emissions cap. Market balance is therefore driven by production growth, achievable emissions-intensity improvement, and the pace of benchmark tightening. As a result, total emissions can continue to rise alongside industrial output unless benchmark stringency increases sufficiently, making relative performance the central compliance metric.

The scheme initially covers India's most energy- and emissions-intensive industrial sectors. Final GEI notifications have been issued for cement, aluminium, chlor-alkali, and pulp & paper on 8 October 2025, and for textiles, petrochemical refining, petrochemical crackers, and secondary aluminium on 13 January 2026, establishing binding compliance obligations from the first compliance year. Draft GEIs have also been published for iron and steel, with final benchmark levels still subject to confirmation. These sectors are included in the analysis to develop an integrated view of likely market formation, while explicitly recognising the regulatory uncertainty associated with draft-notified benchmarks.

To accommodate this uncertainty, the modelling framework applies final GEIs directly where notified and uses adjusted draft GEIs for iron and steel sector. Draft benchmarks are directionally modified to reflect the observed differences between draft and final benchmarks in sectors where GEIs have already been confirmed. The first compliance year is treated as a transition year and modelled on a prorated basis, reflecting the fact that GEIs become effective from the date of publication rather than the start of the fiscal year.

Market outcomes are assessed using a scenario-based approach. Under the base scenario, which reflects the most likely pathway given current regulatory signals, the market begins FY 2025–26 with a moderate net surplus of around 4.35 million CCCs, driven by transitional benchmarks and partial-year coverage. This surplus is short-lived. The market turns net short from FY 2027–28 onward, with an annual deficit of roughly 2 million CCCs in FY 2027–28, widening to about 10 million CCCs by FY 2029–30 as deficits in iron and steel and other sectors outweigh surplus generation in cement. In a supply-heavy scenario, faster decarbonisation and stronger performance keep the market net long throughout the period, with annual surpluses on the order of 8.7 million CCCs by FY 2029–30. In contrast, the supply-constrained scenario leads to rapid tightening, with the market shifting into deficit by FY 2026–27 and reaching an annual shortfall of roughly 20.2 million CCCs by FY 2029–30, implying a cumulative deficit of close to 44.1 million CCCs by the end of the decade.

Because the CCTS has not yet produced observable market prices, the pricing outlook is anchored to comparable intensity-based systems, including India's PAT mechanism and early price signals from China's national ETS. Under the base scenario, prices are expected to remain relatively low in the first compliance year, in the range of roughly INR 1,000–2,000 per tonne, reflecting limited trading activity in a broadly long market. As deficits emerge and cumulative surpluses are exhausted, prices are expected to rise gradually through the late 2020s and settle around INR 3,900–4,000 per tonne by 2030, consistent with a structurally tighter compliance market rather than an early-phase transition system.

Two broader implications follow from these results. First, for sectors exposed to the EU's Carbon Border Adjustment Mechanism, a well-calibrated CCTS provides a mechanism to internalise carbon costs domestically rather than paying them abroad, allowing capital to remain within India to support industrial decarbonisation and upgrading.

Second, the effectiveness and credibility of the CCTS will depend critically on greater regulatory clarity. At present, GEIs have been published for only the first two compliance years, and major sector (iron and steel) remains under draft treatment. For an intensity-based market to function effectively and to support capital-intensive investment decisions, regulated entities require forward visibility on benchmark levels and a clear, transparent regulatory process governing emissions-intensity reduction over time. Publishing multi-year GEI trajectories and formalising adjustment and stabilisation mechanisms will therefore be central to building market confidence, sustaining liquidity, and ensuring that the CCTS delivers a durable and effective carbon price signal.

India's Decarbonisation Pathway

Policy Context

Section Insights

- **Ambition 2070:** India's updated NDC commits to a 45% reduction in emissions intensity by 2030 (vs. 2005) and 50% non-fossil power capacity, with net-zero by 2070.
- **Decoupling underway:** India is one of the world largest emitters in absolute terms, yet emissions intensity has already fallen more than 35% between 2005–2020, even as GDP and energy demand continue to grow.
- **Main Driver:** Energy sector accounts for ~75% of total GHG emissions, with coal-based power and heavy industry as the dominant sources.
- **Growth pressure**: Energy-related CO_2 emissions rose ~7% in 2023 and ~5% in 2024, the fastest growth among major economies.
- **CCTS as a bridge**: A domestic intensity-based carbon price that aligns industrial growth with climate targets and may help mitigate CBAM exposure for exporters.

India's decarbonisation pathway is anchored in its commitments under the Paris Agreement and subsequent national policy updates. India ratified the Paris Agreement in 2016 and submitted its first Nationally Determined Contribution (NDC) outlining mitigation, adaptation, and climate priorities aligned with national development objectives. The original NDC committed India to reducing the emissions intensity of gross domestic product (GDP) by 33–35 percent from 2005 levels by 2030, increasing the share of non-fossil fuel capacity in electricity generation to 40 percent (conditional on international support), and creating an additional carbon sink of 2.5–3.0 billion tonnes of CO_2e through enhanced forest and tree cover.[1]

In 2022, India submitted its updated NDC, significantly strengthening its mitigation ambition. The updated commitments include a 45 percent reduction in emissions intensity of GDP by 2030 (relative to 2005 levels) and a target of achieving 50 percent of cumulative installed electricity capacity from non-fossil sources by 2030. These updates reaffirm India's commitment to a cleaner development pathway and align near-term actions with its long-term objective of achieving net-zero emissions by 2070. Together, these strengthened NDC targets set the direction for India's decarbonisation pathway and create the foundation for the policy architecture required to deliver them. Building on this, India has developed a comprehensive set of national climate and energy strategies that translate high-level commitments into sectoral plans and regulatory instruments.

Emission Profile and Structural Drivers

India's decarbonisation pathway must be understood in the context of its current emissions profile, which reflects the dual reality of rapid economic development and strong dependence on fossil energy. India is now, alongside China and the United States, one of the world's largest emitters in absolute terms. Yet on a per-capita basis, its emissions remain among the lowest in the G20, underscoring the country's low historical contribution and development-driven energy demand.

Energy-related emissions dominate India's emissions profile, accounting for three quarters of total greenhouse gas emissions. Within this category, coal-based power generation and heavy industry, particularly iron and steel, cement, aluminium, refineries and petrochemicals are the principal sources of emissions.

[1] UNFCCC NDC Registry; Government of India,

Agriculture and waste contribute smaller but structurally important shares. In contrast, land use, land-use change, and forestry (LULUCF) continue to function as a net carbon sink, supporting India's broader mitigation strategy.[2]

More recent trends captured in the IEA's CO_2 Emissions in 2023[3] and Global Energy Review 2025[4] indicate that India's energy-related emissions rebounded quickly after COVID-19. Emissions grew by just over 7% in 2023, reaching around 2.8 Gt CO_2, in line with the strong GDP expansion of 6.7%. They rose by a further 5.3% in 2024, the fastest rate among major economies, driven largely by surging power demand, industrial production, and infrastructure expansion. India also recorded the second-largest absolute increase in global energy demand, exceeding the combined increase of all advanced economies (Figure 1).

While absolute emissions have continued to rise, India has made notable progress in reducing emissions intensity.

Official inventories indicate that India had already achieved a reduction of over 35 percent in emissions intensity of GDP between 2005 and 2020, effectively meeting its original NDC target ahead of schedule. This decoupling reflects a combination of renewable energy deployment, efficiency improvements, structural economic shifts, and policy interventions.

India's absolute emissions are still rising in line with economic growth, but the carbon intensity of its economy is steadily declining. This dual movement underscores the challenge at the heart of India's net-zero roadmap: managing continued development and industrial expansion while sharply bending the emissions trajectory downward over time. As India implements the carbon credit trading scheme (CCTS) and scales its clean energy programmes, the emissions profile is expected to evolve progressively, with industrial intensity reductions under CCTS emerging as a central lever in aligning near-term performance with the country's net-zero 2070 target.

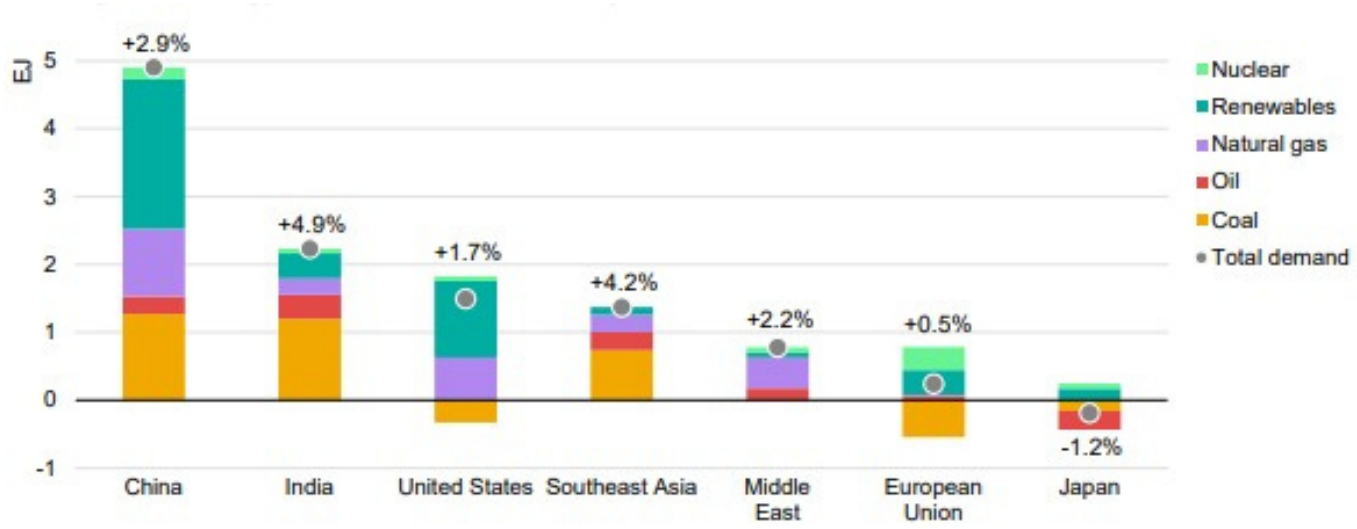

Figure 1. Global Emissions Growth Drivers: China, India & Major Economies (IEA)

Source: International Energy Agency (IEA), "CO_2 Emissions in 2023" and "Global Energy Review 2025".

[2] https://unfccc.int/sites/default/files/NDC/2022-08/India%20Updated%20First%20Nationally%20Determined%20Contrib.pd India Fourth Biennial Update Report (BUR-4); IEA Global Energy Review; Government of India statistical releases.

[3] https://www.iea.org/reports/co2-emissions-in-2023

[4] https://www.iea.org/reports/global-energy-review-2025

Industrial Decarbonisation Challenge

India's industrial sector sits at the centre of its decarbonisation challenge. Heavy industries such as iron and steel, cement, aluminium, fertilisers, and petrochemicals are emissions-intensive, capital-heavy, and often reliant on coal or high-temperature.

Many of these sectors face limited near-term options for deep decarbonisation without substantial capital investment, long lead times, and technology risk. Efficiency improvements and incremental optimisation have delivered meaningful reductions to date, but these measures alone are insufficient to align industrial emissions with India's medium- and long-term climate objectives. Transformational pathways such as green hydrogen, electrification of high-temperature processes, alternative binders in cement, and carbon capture remain cost-intensive and unevenly mature. This creates a structural gap between ambition and feasible near-term action, particularly in sectors exposed to international competitiveness pressures.

Role of Carbon Markets in India's Transition

India's climate policy framework is built on an interconnected set of national plans, sectoral strategies, and legislative instruments that translate its NDC commitments into actionable pathways. At the core of this architecture is the National Action Plan on Climate Change (NAPCC)[5], which provides the overarching strategic direction for mitigation, adaptation and technology deployment.

Building on this foundation, more recent instruments like the National Electricity Plan 2023 (NEP 2023)[6], the National Green Hydrogen Mission[7], and the Energy Conservation (Amendment) Act 2022[8] (which enables the CCTS) operationalise India's NDC targets and long-term net zero strategy.

A pivotal component of this modernised climate architecture is the Energy Conservation (Amendment) Act 2022, which establishes the legal basis for a national carbon market. The amendment authorises the central government to create a carbon credit trading scheme and empowers a designated agency to issue and regulate tradable carbon credit certificates. Acting under this mandate, the government formally notified the CCTS and designated the Bureau of Energy Efficiency (BEE) as its administrator.[9]

The CCTS builds upon a decade of experience with the Perform, Achieve and Trade[10] (PAT) mechanism but extends far beyond it, shifting India from a narrowly efficiency-focused programme to a comprehensive, economy-wide compliance carbon market. As designed, the CCTS is intended to become India's primary instrument for driving emissions intensity reductions in industry, aligning corporate behaviour with national climate goals and enabling a structured, market-based pathway toward NDC implementation and the 2070 net-zero objective. By attaching an explicit economic consequence to emissions-intensity performance, CCTS is intended to influence operational decisions, investment planning, and technology adoption across hard-to-abate sectors. It complements supply-side policies such as renewable energy expansion and the National Green Hydrogen Mission by providing a transparent demand-side performance signal.

[5] https://pmc.ncbi.nlm.nih.gov/articles/PMC2822162/
[6] https://powermin.gov.in/en/content/national-electricity-plan-0
[7] https://mnre.gov.in/en/national-green-hydrogen-mission/
[8] https://powermin.gov.in/sites/default/files/The_Energy_Conservation_Amendment_Act_2022_0.pdf
[9] https://mnre.gov.in/en/centre-act/
[10] https://beeindia.gov.in/perform-achieve-and-trade-pat.php

Carbon Pricing, CBAM and International Competitiveness

The growing use of carbon pricing instruments in international trade adds an important external dimension to India's decarbonisation pathway. The European Union's Carbon Border Adjustment Mechanism (CBAM) represents the most significant near-term policy development in this context. CBAM introduces a carbon cost on selected imported goods based on their embedded greenhouse gas emissions, with the objective of aligning the carbon cost faced by foreign producers with that borne by EU manufacturers under the EU Emissions Trading System (EU ETS).

From 2026 onward, EU importers of covered products, including iron and steel, aluminum, cement, fertilisers, hydrogen, and electricity, will be required to purchase and surrender CBAM certificates priced in line with EU ETS allowances. While CBAM allows for deductions where a carbon price has already been paid in the country of origin, recognition depends on the credibility, transparency, and verifiability of the domestic carbon pricing framework.

For India, the implications are material. Several CBAM-covered sectors overlap directly with India's most emissions-intensive and export-oriented industries. Facilities with higher emissions intensity, or those unable to demonstrate verifiable carbon performance and compliance costs domestically, face increased exposure to border carbon charges, potentially eroding international competitiveness over time.

India's CCTS has the potential to play a meaningful role in reducing CBAM exposure, but its impact will depend on both design choices and how the EU ultimately treats carbon costs incurred under intensity-based systems. CCTS can help in three ways. First, by tightening greenhouse-gas emissions intensity targets in hard-to-abate sectors, CCTS encourages facilities to reduce their actual embedded emissions, directly lowering the number of CBAM certificates required. Second, a credible and transparent domestic carbon price could support India's case that its exporters already face a carbon cost. If recognised by the EU, this would reduce the CBAM obligation proportionally to the carbon price already paid.

However, there is uncertainty about whether EU rules will treat payments under an intensity-based scheme like CCTS in the same way as carbon costs under a classic cap-and-trade system. CBAM is legally tied to the EU ETS, and its deduction mechanism was designed with ETS-type structures in mind. Whether CCTS compliance payments qualify as a "carbon price" for CBAM purposes, and to what extent, remains to be clarified. The divergence between the CCTS intensity-based architecture and the EU ETS's absolute-cap structure therefore, creates a potential recognition gap

India's decarbonisation pathway is characterised by rising absolute emissions alongside declining emissions intensity, with industrial performance emerging as a critical lever for aligning growth with climate objectives. The CCTS serves as a central policy mechanism for translating national commitments into facility-level incentives.

The following sections assess how this mechanism is expected to form and function as a market, based on modelled supply–demand dynamics rather than historical outcomes.

Purpose, Scope and Analytical Boundaries

Market Scope

CCTS has two pillars:

- Compliance mechanism for large industrial facilities, where each obligated entity receives facility-specific greenhouse gas emissions intensity (GEI) benchmarks and annual reduction trajectories.
- Offset mechanism for non-obligated entities that implement eligible mitigation projects and receive Carbon Credit Certificates (CCCs) through approved methodologies.

The analysis focuses exclusively on the compliance segment of the Indian Carbon Market, covering obligated GEI benchmarks and annual compliance requirements. Voluntary carbon markets and non-compliance uses of carbon credits fall outside the scope of this assessment. Offset-generated CCCs are excluded from the core supply–demand balance in early compliance years. This reflects regulatory separation between compliance and offset issuances.

Sectoral Scope

The compliance mechanism initially covers India's most energy- and emissions-intensive sectors:

- Cement*
- Aluminium*
- Chlor-alkali*
- Pulp and paper*
- Secondary Aluminium*
- Petrochemical*
- Petro-refinery*
- Textile*
- Iron and steel**
- Fertilisers***

*Official GEI Notified
**Draft GEI Notified
***Included in the first list, but no GEI notified

Emissions Covered:

CCTS covers the following emissions:
- Direct fuel combustion emissions
- On-site energy use
- Industrial process emissions
- Indirect emissions from purchased electricity and heat

Compliance instrument

The tradable instrument under CCTS is the CCC.
- One CCC represents one tonne of CO_2e reduced or avoided relative to an assigned GEI benchmark, as verified and issued under the CCTS framework.
- CCCs are issued, held, traded, banked, and surrendered through the national ICM registry.

Prorated first year

For the first compliance year of India's CCTS, we apply a prorated treatment to reflect how GEI benchmarks are implemented in practice. Under the regulations, GEI targets become effective from the date of official publication rather than the start of the fiscal year. Four sectors-cement, aluminium, pulp and paper, and chlor-alkali-received final GEI notifications in October 2025. Secondary aluminium, petrochemicals, petroleum refineries, and textiles received final GEI notifications in January 2026, meaning compliance for these sectors effectively begins from that date. For iron and steel, only draft GEIs have been published to date, so formal compliance has not yet commenced. To maintain consistency at the aggregate market level, our modelling assumes a February 2026 start date for this sector, reflecting an indicative scenario in which the final GEI notification is issued approximately one month after the January 2026 tranche. This assumption will be updated once the official notification date is confirmed.

Definition of Demand and Supply

Demand

CCC demand refers to the modelled compliance requirement of obligated facilities whose achieved GEI exceeds their assigned benchmark.
Demand arises where a facility's achieved GEI is higher than the target GEI and corresponds to the excess emissions that must be covered through the surrender of CCCs.
Key characteristics of demand include:

- GEI is non-discretionary for obligated entities.
- Demand is driven by production changes (due to macro and micro factors), decarbonisation, technology constraints, and the tightening of GEI benchmarks.

Supply

For this report, CCC supply refers to the modelled volume of credits generated by obligated facilities that outperform their assigned GEI benchmarks in a given compliance period.
Supply arises where a facility's achieved GEI is lower than its target GEI, with credit volumes calculated as the difference between benchmark and achieved intensity multiplied by verified production.
Key characteristics of supply in this analysis include:

- Supply is performance-based, not project-based.
- Supply is a function of production levels, emissions-intensity improvements, and benchmark stringency.
- Reported supply represents modelled, potential issuance, adjusted for pro-rated compliance periods (for the first year).

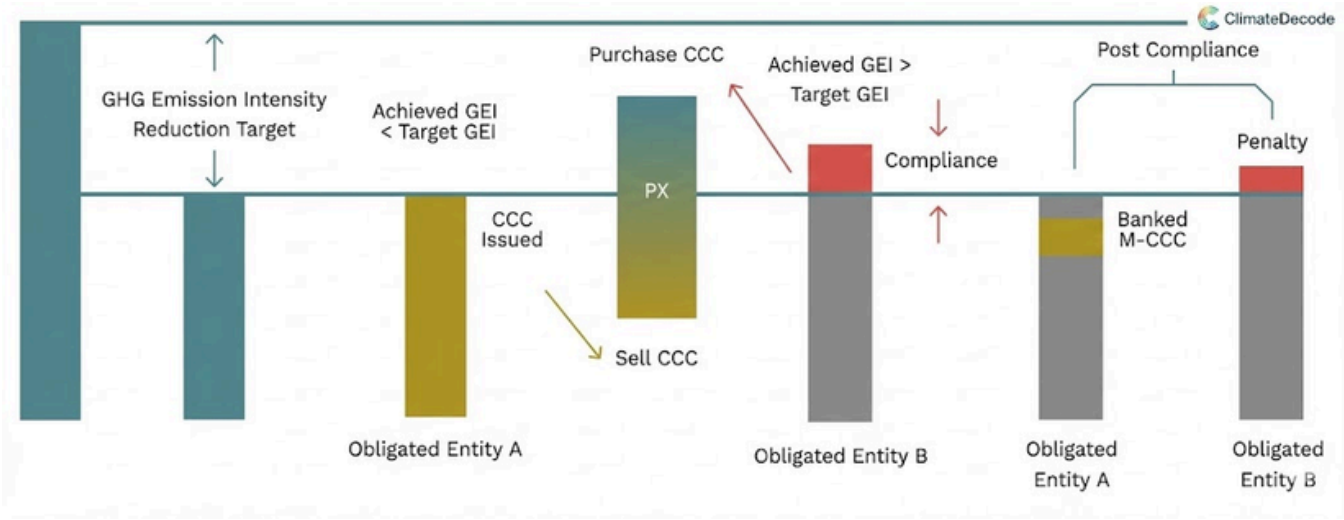

Figure 2. Illustrative Operation of India's CCTS

Source: IAdapted from Bureau of Energy Efficiency (BEE), Government of India, notifications issued under the Energy Conservation (Amendment) Act, 2022, relating to the Carbon Credit Trading Scheme (CCTS).

- Each facility receives a GEI target and must report verified emissions and output annually.
- If actual GEI is above the target, the facility must purchase and surrender CCCs.
- If actual GEI is below the target, the facility generates CCCs that can be banked or sold.
- Non-compliance results in environmental compensation linked to average CCC market prices.

[3] https://unfccc.int/sites/default/files/NDC/2022-08/India%20Updated%20First%20Nationally%20Determined%20Contrib.pd
India Fourth Biennial Update Report (BUR-4); IEA Global Energy Review; Government of India statistical releases.
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Supply and Demand Assessment

Scenario Framework

Section Insights

- **Early surplus is transitional:** The FY 2025–26 surplus is driven by partial-year coverage, relaxed early benchmarks, and learning-phase behaviour, rather than durable abatement capacity. This cushion fades as full-year compliance begins.
- **Intensity-based design creates uneven outcomes:** Because CCTS is intensity-based, outcomes vary sharply by sector. Iron and steel quickly become the dominant source of demand once benchmarks tighten, while cement's surplus only temporarily offsets system pressure.
- **Benchmark calibration is the key driver:** Small changes in effective stringency or realised efficiency gains lead to very different outcomes, from persistent surplus to rapid deficit.
- **Deficits force intervention:** Sustained shortages would trigger price volatility and liquidity stress, making regulatory recalibration or added flexibility likely..
- **Over-supply weakens signals:** A persistently long market suppresses trading and price signals, reducing the effectiveness of CCTS as a decarbonisation tool.
- **Actions for firms:** Early surpluses offer a short window for credit banking and abatement planning before tightening conditions dominate.

To assess the range of plausible outcomes under India's CCTS, we apply a scenario-based modelling approach rather than a single deterministic forecast. The objective is to evaluate how market balance could evolve under different combinations of economic growth, decarbonisation progress, and policy calibration. Given that CCTS is an intensity-based system, aggregate supply and demand for CCCs are primarily determined by three interacting drivers:

- **Production growth,** which scales the volume of output subject to GEI benchmarks
- **Emissions-intensity improvement**, reflecting the pace and feasibility of efficiency gains, energy optimisation, fuel switching, and technology adoption
- **Benchmark stringency,** defined by how quickly GEI benchmarks tighten/loosen across compliance years

GEI Benchmark Uncertainty Treatment

For benchmark stringency, confirmed GEI targets for the first two compliance years (FY 2025–26 and FY 2026–27) are applied directly. For the iron and steel sector, indicative adjustments are applied to the draft GEIs to represent a similar softening of GEIs of confirmed sectors. The FY 2025–26 emissions-intensity target is set 0.5% above the draft level, and the FY 2026–27 target is set 1.5% above the FY 2026–27 draft target. These adjustments are directional and do not seek to replicate the scale of observed changes in confirmed sectors.

Adjusted early-year targets for iron and steel, together with final notified GEIs for confirmed sectors, are used to construct the weighted-average benchmark applied in subsequent compliance years.

Firm-size adjustment for Decarbonisation

Scenario-specific firm-size multipliers are applied to reflect differences in decarbonization capability. Larger firms, with greater access to capital, technology, and operational flexibility, are assumed to comply more efficiently. Higher production volumes further strengthen compliance incentives, as non-compliance results in disproportionately higher costs.

Scenario Definition

Base Case: The base case reflects the most likely pathway based on current regulatory signals and observed sectoral readiness for decarbonization. Production growth follows historical trends and announced capacity additions. Decarbonisation progress is assumed to be moderate and sector-specific, driven primarily by incremental improvements rather than structural shifts.

Bounding Scenarios: Two bounding cases are used to assess uncertainty.

- **Supply-heavy scenario** assumes materially higher credit availability, driven by faster uptake of decarbonisation measures and operational optimisation, selective deployment of low-carbon technologies, unchanged benchmark progression beyond FY 2026–27, and stronger production growth.
- **Supply-constrained scenario** reflects a tighter market, assuming slower decarbonisation due to capital constraints, technology limitations, or operational lock-in, alongside slightly lower production growth.

Assumption	Base Case	Supply-Heavy Scenario	Supply-Constrained Scenario
Production growth	In line with historical trends and announced capacity additions	Higher-than-expected growth	Slightly lower-than-expected growth
FY 2025–26 coverage	Production is pro-rated from 8 October 2025 and 13 January 2026, with the remaining sector assumed to start from 13 February 2026 (not yet confirmed).	Same as base case	Same as base case
Decarbonisation progress	Moderate, sector-specific, incremental improvements	Faster-than-expected uptake of efficiency and low-carbon measures	Slower progress due to capital, technology, or operational constraints
Benchmark evolution	Progressive tightening based on weighted average of FY 2025–26 and FY 2026–27	Same adjustment as base case	Same adjustment as base case
Treatment of unconfirmed sectors	FY 2025–26 target relaxed by 0.5% vs draft 2025-26; FY 2026–27 relaxed by 1.5% vs draft 2026–27	Same adjustment as base case	Same adjustment as base case

Base Case

Under the Base scenario, the CCTS market starts FY 2025–26 with a moderate net surplus of around 43.5 lakhs (4.35M) CCCs, largely reflecting transitional benchmark settings and partial-year application. This surplus is short-lived. This surplus narrows to ~17.8 lakhs (1.78M) CCCs in FY 2026–27, before the market turns net short from FY 2027–28 onward. The deficit widens from ~20.2 lakhs (2.02M) CCCs in FY 2027–28 to ~59.2 lakhs (5.92M) CCCs in FY 2028–29, reaching ~100 lakhs (10M) CCCs by FY 2029–30.

- **Year 1 (FY 2025–26):** The CCTS market is broadly long, allowing most companies to meet targets without trading, resulting in limited initial activity. Cement remains the main and most consistent source of supply over the period, generating surpluses that help cushion system-wide tightening in the early years, with its contribution remaining nearly the same over the years.
- **Years 2 onward:** Some sectors begin missing targets, triggering active credit buying and selling, with firms also banking credits to manage future compliance risk. Iron and steel become the dominant driver of demand from FY 2026–27 onward, as scale effects and limited near-term abatement options mean that deficits in steel quickly overwhelm the surplus generated by cement. Additional demand pressure builds in textiles, chlor-alkali, pulp and paper, and aluminium, where benchmark trajectories advance faster than deployable decarbonisation measures.
- **End of decade:** Demand driven by steel and other hard-to-abate sectors significantly exceeds supply, with cement surpluses no longer sufficient, resulting in a ~100 lakhs (10M) CCC shortfall by FY 2029–30. In an intensity-based system without a fixed price cap and with penalties linked to market prices, such a deficit is unsustainable and would likely drive sharp price increases and reduced liquidity. To avoid excessive compliance costs and market disruption, regulators are likely to slow or partially ease target tightening after 2027, keeping the market workable as CCTS matures

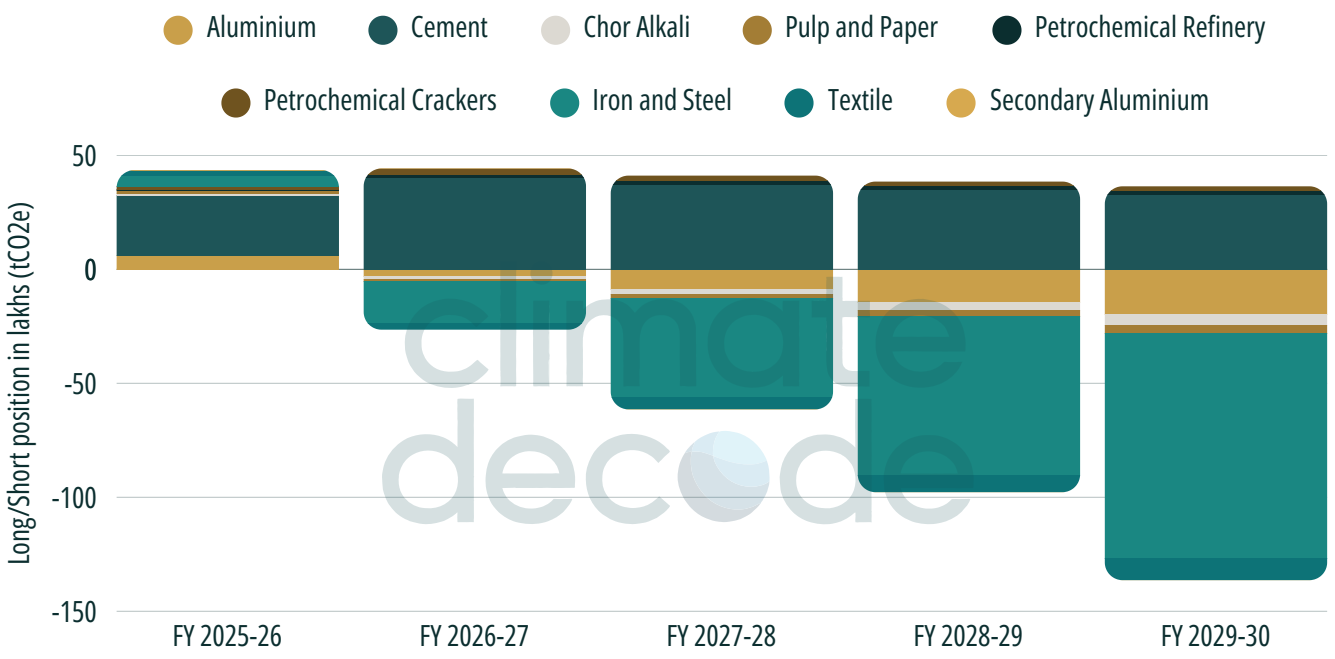


Figure 3. CCTS Compliance Position- Base Case

Supply-Heavy Scenario

Under the Supply-Heavy scenario, the CCTS reflects an upper-bound case for credit availability, driven by faster-than-expected efficiency gains, higher emissions abatement uptake, and softer effective benchmark tightening relative to the Base case. The market begins FY 2025–26 with a larger net surplus of about 55.9 lakhs (5.59 M) CCCs and remains net long throughout the outlook period. That surplus persists each financial year, resulting in a cumulative surplus of ~417 lakh (41.7 million) CCCs by FY 2029–30.

- **Year 1 (FY 2025–26):** The market remains net long, with most sectors able to meet targets without trading, resulting in limited to near-null trading activity. Cement is the dominant and persistent source of supply, generating year-on-year surpluses supported by strong relative performance under looser effective stringency.
- **Years 2 onward:** The market continues to remain net long, with surplus credits increasingly banked by sectors expected to face deficits in later years as a hedge against future compliance requirements. On the demand side, textiles remain structurally short even under favourable assumptions and account for the largest share of aggregate deficits as output expands, while aluminium gradually moves into deficit at a smaller scale and slower pace than in the Base scenario. Petrochemicals remain a net surplus contributor, though their contribution is small relative to the overall market balance.
- **End of decade**: As the scheme progresses, surplus and deficit positions diverge further across sectors. While cement and iron & steel remain broadly long and generate most of the surplus, aluminium, textiles, pulp and paper, and chlor-alkali increasingly move into deficit and begin purchasing credits. Trading activity increases over time, but volumes and prices remain lower than in the Base scenario due to the persistent overall surplus, leaving the market comparatively less effective.

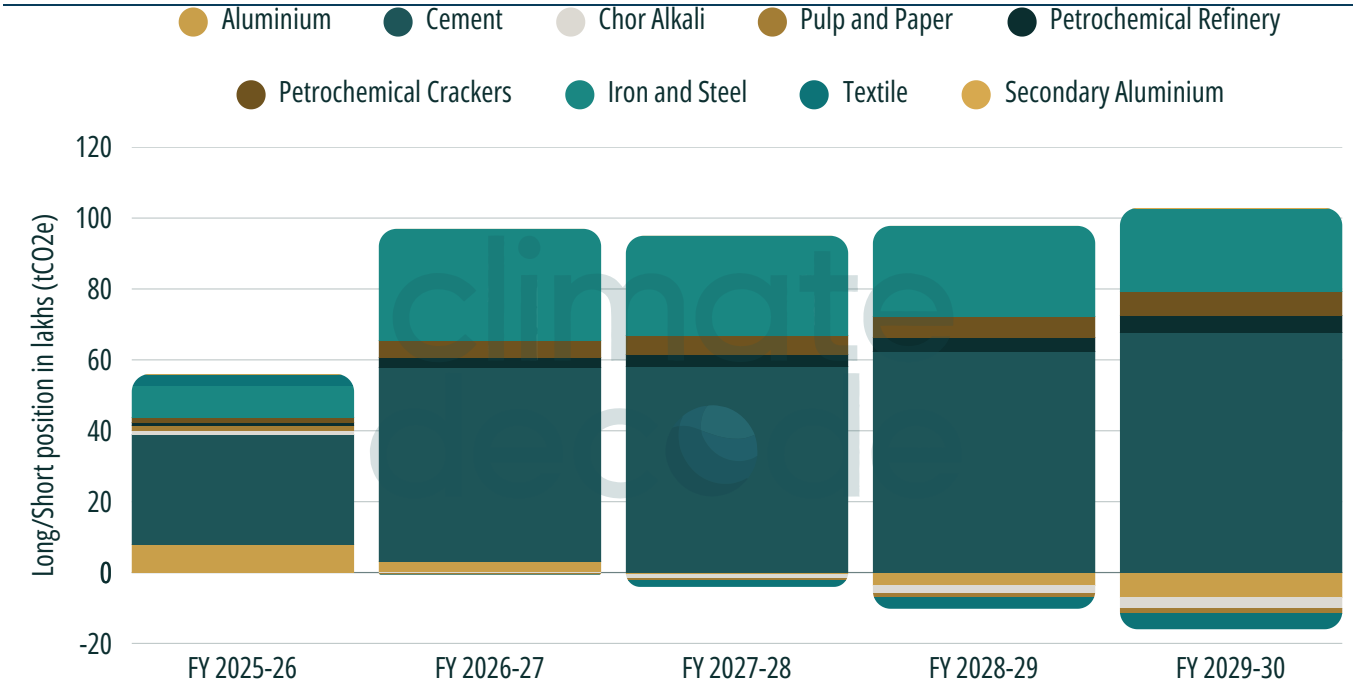


Figure 4. CCTS Compliance Position- Supply-Heavy Scenario

Supply-Constrained Scenario

Under the supply-constrained scenario, the market begins FY 2025–26 with a modest net surplus of 33.1 lakhs (3.1M) CCCs, but this balance deteriorates rapidly. By FY 2026–27, the system shifts into deficit, and the short position deepens sharply thereafter, reaching an annual deficit of 203.2 lakhs (20.2M) CCCs by FY 2029–30. On a cumulative basis, the market moves from near balance in the early years to a substantial shortfall of approximately 444.1 lakhs (44.11M) CCCs by FY 2029–30, indicating severe tightening and sustained supply insufficiency.

- **Year 1 (FY 2025–26):** Despite an initial near-balance position, the market shows early signs of tightening. Cement remains surplus-generating and is the primary source of supply, but its ability to cushion the system is already weaker than in the Base and Supply-Heavy scenarios**.**
- **Years 2 onward:** From FY 2026–27, the system moves decisively into deficit. Iron and steel emerge as the largest and most persistent source of demand pressure due to scale, continued reliance on coal-based production routes, and limited near-term abatement flexibility under tightening benchmarks. Cement continues to generate surplus credits, but its surplus declines sharply over time, significantly reducing its offsetting role. Pulp and paper, chlor-alkali, petrochemicals, textiles, and aluminium all move progressively deeper into deficit as benchmark trajectories advance faster than deployable decarbonisation measures.
- **End of decade:** The market becomes structurally short across nearly all regulated sectors, with little remaining internal capacity to rebalance supply and demand. As CCC scarcity deepens, market functioning deteriorates, leading to acute liquidity stress and unstable price signals. Such conditions are unsustainable in practice and would almost certainly necessitate government intervention—through benchmark recalibration, additional flexibility mechanisms, or temporary relief measures—to restore basic functionality within the CCTS.

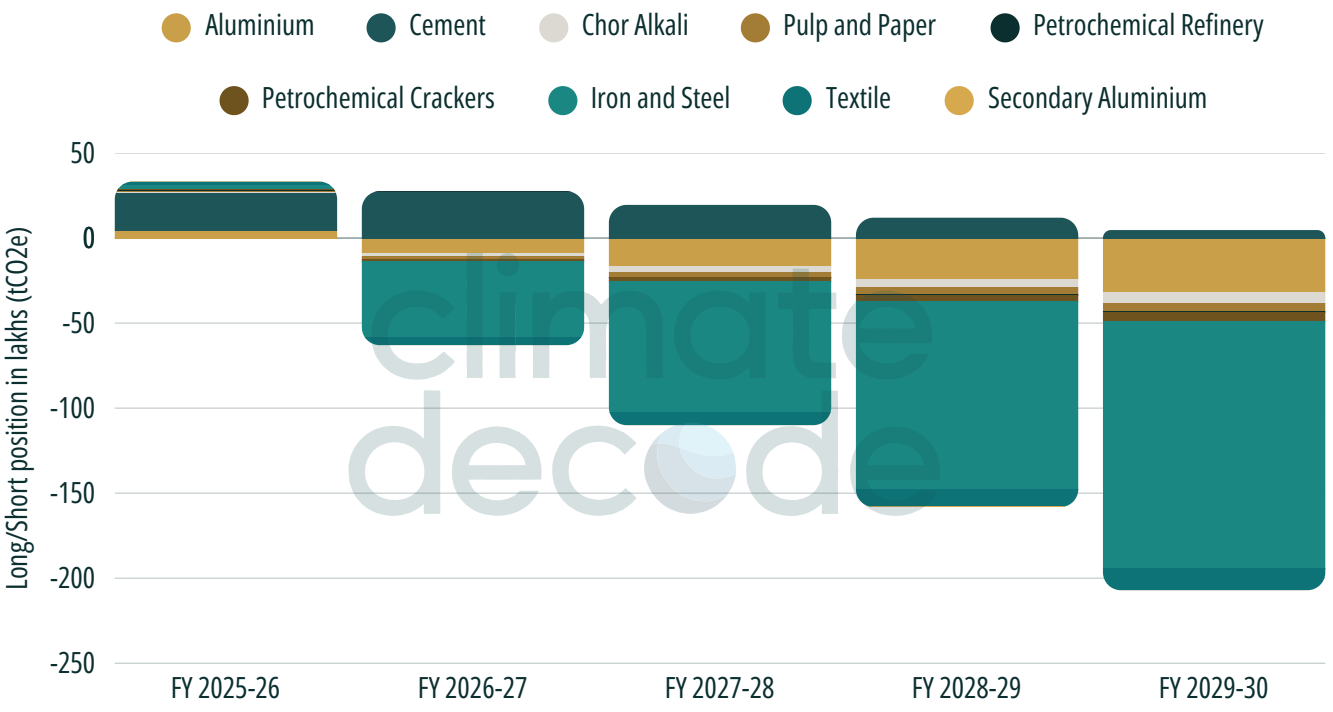


Figure 5. CCTS Compliance Position- Supply Constrained Scenario

Pricing Outlook and Market Stabilisation under CCTS

Section Insights

- **Benchmark-anchored start (FY 2025–26):** With no observed CCTS prices, the Base Case is anchored to PAT Cycle III ESCerts and early China ETS prices (~INR 719–898/tCO_2).
- **Early surplus phase**: A comfortably long market in FY 2025–26 limits trading and anchors prices near the lower band (~INR 1,035–1,980).
- **Mid-period firming (FY 2027–29)**: Emerging sectoral deficits lead to gradual price increases, but remaining surplus availability keeps price discovery weak.
- **Late-decade tightening**: By the late 2020s, cumulative surpluses are exhausted and price formation shifts toward compliance pressure and non-compliance risk.
- **End of decade signal (2030):** Prices approach ~INR 3,900–4,000 by 2030, reflecting tightening conditions at the end of the modelling horizon.

Framing Price Analysis

As the CCTS enters its first compliance year, there is no observed market price to serve as a direct reference for CCCs prices. Any forward price assessment must therefore be anchored to comparable systems rather than historical CCTS trading data. Two reference points are particularly relevant.

First, CCTS effectively replaces India's PAT mechanism for emissions-intensity regulation in covered industrial sectors (except power). As such, recent prices observed in PAT Cycle III provide the closest domestic benchmark for the initial value of compliance instruments under an intensity-based framework familiar to Indian industry.[1]

Second, for international comparison, China's national Emissions Trading Scheme provides an observable reference. China ETS commenced trading in 2021. Reported market prices at launch were approximately USD 8/ INR 719 per tonne, and reported prices in recent years have been closer to USD 10/INR 898 per tonne. These observed prices provide an external benchmark for an early-stage, intensity-based compliance system implemented at the national scale.

In our analysis, all scenarios therefore begin from a common initial reference price anchored to

1. the latest observed PAT Cycle III ESCert levels, and
2. prevailing prices in the China ETS. From this shared starting point, price trajectories diverge based on the modelled evolution of market balance, sectoral deficits and surpluses, and the pace of benchmark tightening under each scenario.

Taken together, the scenario-based supply–demand outcomes define the boundaries within which price formation under the CCTS is expected to occur. With no historical trading data available in the inaugural compliance phase, price signals must emerge from the interaction between surplus availability, the pace at which deficits materialise across sectors, and the evolving cost of compliance over time.

The following section, therefore, translates these market balance dynamics into indicative price trajectories, illustrating how pricing is expected to evolve as the scheme transitions from initial implementation toward a more mature, constraint-driven market.

Pricing Outlook, Base Case Scenario

This section outlines the expected evolution of CCTS prices across the initial compliance phase and into the late 2020s. In the absence of observed market prices, the outlook reflects the interaction between surplus availability, emerging deficits, and tightening compliance conditions over time.

- **Year 1 (FY 2025–26)**: In the first compliance year, the market is comfortably long, and most sectors can meet their targets without needing to buy credits. With little expectation of trading and no urgency to transact, prices are expected to sit near the lower end of the band, around **INR 1,035–1,980.**

- **Years 2 onward:** As the scheme moves into the middle years, some sectors begin to fall short of their targets, and trading activity starts to appear. However, because surplus credits are still available, prices rise only gradually. The market remains relatively liquid, but price discovery is still weak.

- **End of decade:** From the late 2020s onward, the balance shifts clearly into shortage. Annual deficits widen, cumulative surpluses are exhausted. At this stage, prices are no longer anchored by surplus availability but by the cost of non-compliance and the need to secure credits in a tightening market. Under these conditions, prices are expected to move steadily higher and settle around **INR 3,900–4,000 by 2030,** consistent with a structurally short market rather than early-phase compliance dynamics.

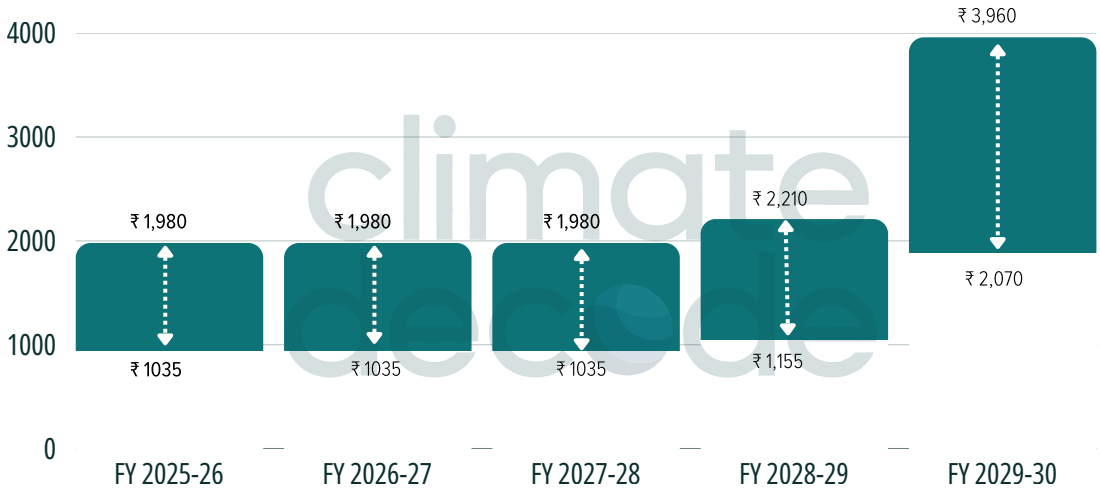


Figure 6. CCTS Pricing Outlook- Base Case

Policy Intervention & Market Management

The scenario outcomes indicate that the CCTS is not sustainable at either extreme of market imbalance and cannot be relied upon to self-correct without intervention.

In a supply-constrained outcome, persistent and widening shortages of CCCs eventually undermine market functionality. As available credits are exhausted, compliance shifts from market-based trading to penalty exposure. Because penalties are defined as twice the average price of annual transactions, a severely short market with limited liquidity creates an unstable feedback loop: prices rise sharply, the penalty benchmark escalates mechanically, and compliance costs become unbounded. In such conditions, the market effectively breaks—there is no ceiling price, no credible compliance alternative, and no remaining liquidity to clear obligations. Rather than incentivising abatement, the system becomes punitive, driven by escalating penalties rather than investment signals, ultimately threatening compliance credibility and political durability.

At the opposite extreme, a persistently supply-heavy outcome is equally unsustainable. When CCC availability consistently exceeds demand, prices compress toward zero. In this environment, credit revenues are insufficient to support capital-intensive decarbonisation investments, and the market provides little incentive beyond incremental efficiency improvements. While compliance remains technically achievable, the carbon price signal fails to perform its core function of mobilising capital for structural emissions reductions, locking the system into low-ambition outcomes.

Taken together, these dynamics demonstrate that neither persistent scarcity nor persistent surplus represents a viable steady state for an intensity-based system like CCTS. Active market management is therefore a necessary design feature, not a market failure. Without mechanisms to moderate extreme outcomes, the system risks either collapsing under credit scarcity or becoming economically irrelevant under excess supply.

This need for intervention is further amplified by external carbon cost pressures, particularly from the EU's CBAM. For CBAM-exposed sectors, a well-calibrated and effectively managed CCTS enables carbon costs to be internalised domestically rather than paid abroad, allowing capital to remain within India and be recycled into domestic decarbonisation and industrial upgrading.

Looking ahead, the evolution of CCTS prices will be shaped less by initial benchmarks and more by how effectively the scheme is calibrated as industrial decarbonisation deepens. As compliance obligations tighten and external pressures such as CBAM intensify, maintaining a credible, stable price signal will be critical to ensuring that CCTS supports investment, preserves competitiveness, and remains a durable pillar of India's long-term transition.

Sectoral Insights

ALUMINIUM

16 facilities
Smelters|Refineries| Secondary

2.27% Weighted Average Reduction

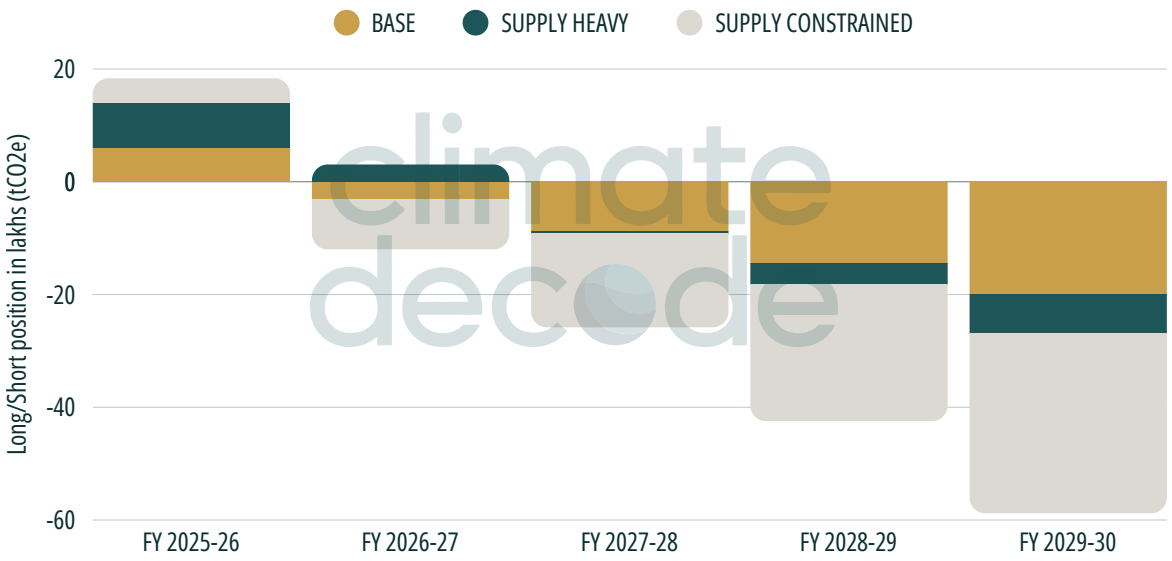


Figure 7. Aluminium Compliance Position

Aluminium is among India's most emissions-intensive sectors due to the electricity intensity of refining and smelting and continued reliance on coal-based captive power. With limited near-term abatement options and only incremental improvements expected through renewable power substitution and efficiency gains, the sector trends toward a net demand position under tightening benchmarks.

- **Base Case outcome**: The sector begins with a modest surplus of ~6 lakhs (0.6M) CCCs in FY 2025–26, before shifting into deficit and reaching ~20 lakhs (2.0M) CCCs by FY 2029–30. At the Base Case end-of-forecast price level (~INR 3,900–4,000/CCC), this implies a net compliance liability of ~INR 780–800 crore for the aluminium sector.
- **Supply-Heavy outcome:** A higher initial surplus of ~8 lakhs (0.8M) CCCs delays tightening, but the sector still turns short from FY 2026–27, with deficits limited to ~7 lakhs (0.7M) CCCs by FY 2029–30
- **Supply-Constrained outcome:** A smaller initial surplus of ~4 lakhs (0.4M) CCCs is followed by rapid tightening, with deficits widening to ~32 lakhs (3.2M) CCCs by FY 2029–30, indicating materially higher exposure under adverse conditions.

Aluminium flips from a ~6 lakh (0.6M) CCC surplus to a ~20 lakh (2.0M) CCC deficit by FY 2029–30, implying a Base Case compliance liability of ~INR 780–800 crore.

CEMENT

186 facilities
Clinkerisation| Integrated & Composite Plants| Grinding Units| Speciality Segments

1.57% Weighted Average Reduction

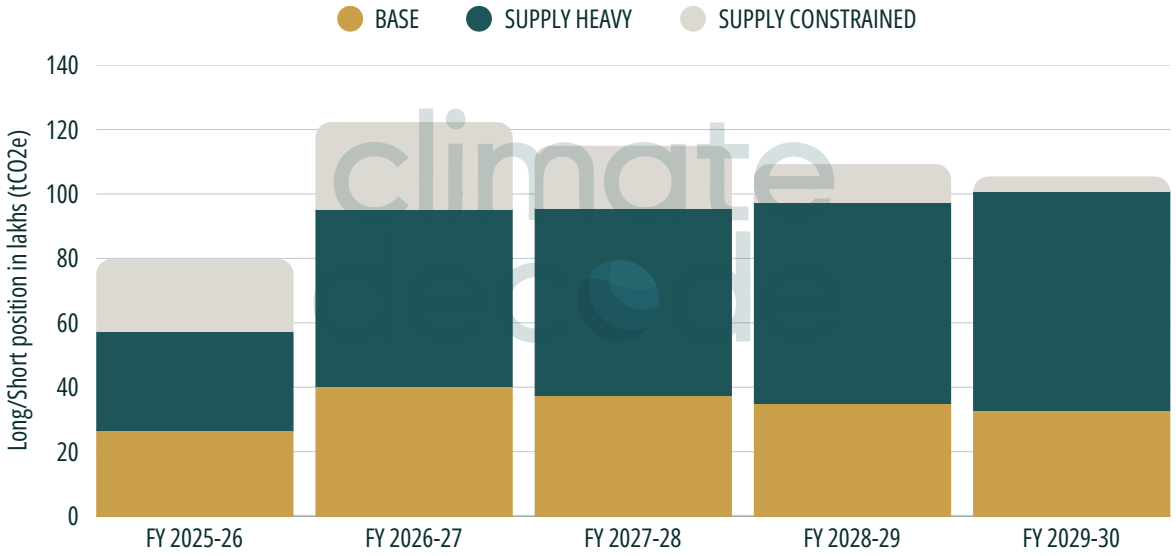


Figure 8. Cement Compliance Position

The sector has historically delivered efficiency-led reductions through clinker substitution, WHR, and blended cement, but future decarbonisation under India's Net Zero 2070 pathway increasingly depends on material efficiency and emerging technologies such as CCUS.

- **Base Case outcome:** Cement remains comfortably long throughout the period, with surpluses rising from ~27 lakhs (2.7M) CCCs in FY 2025–26 to ~33 lakhs (3.3M) CCCs by FY 2029–30, with surplus levels gradually moderating after FY 2026–27. At the Base Case end-of-forecast price (~INR 3,900–4,000/CCC), the FY 2029–30 surplus implies a potential sector-wide opportunity of ~INR 1,287–1,320 crore.
- **Supply-Heavy outcome:** Larger and sustained surpluses, expanding from ~31 lakhs (3.1M) CCCs to ~68 lakhs (6.8M) CCCs by FY 2029–30.
- **Supply-Constrained outcome:** Early surpluses of ~22–27 lakhs (2.2–2.7M) CCCs erode steadily, with the sector remaining marginally long through FY 2029–30 and surplus compressing to ~5 lakhs (0.5M) CCCs by the end of the period.

Cement remains net long, generating a ~33 lakh (3.3M) CCC surplus by FY 2029–30, equivalent to a Base Case value of ~INR 1,287–1,320 crore.

CHLOR ALKALI

30 facilities
Heterogeneous mix- wide dispersion in baseline emissions intensity

3.09% Weighted Average Reduction

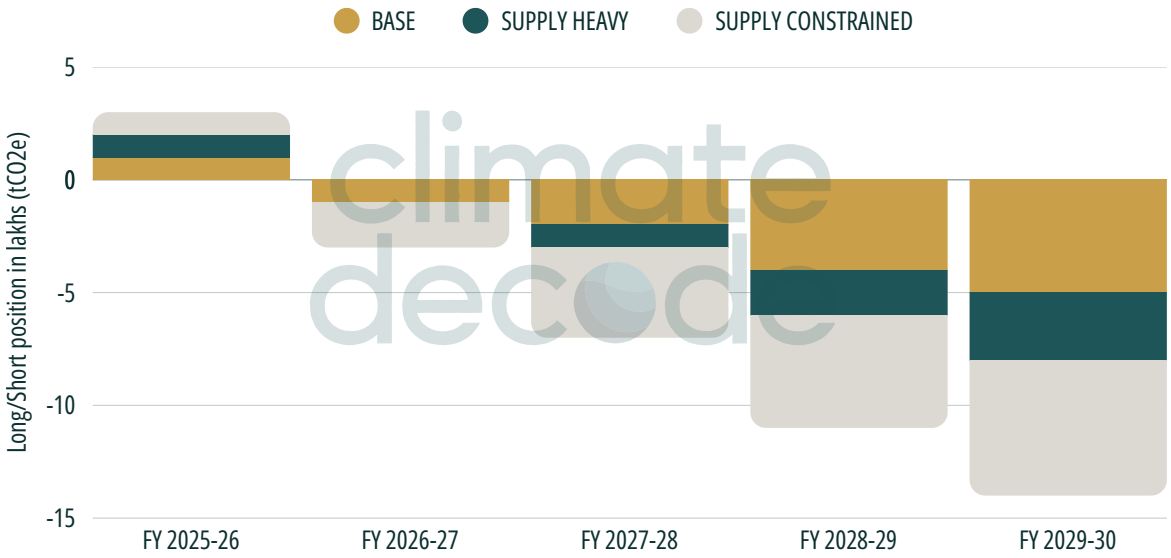


Figure 9. Chlor Alkali Compliance Position

Chlor Alkali sector has largely exhausted process-level abatement potential following the near-complete transition to membrane technology and increased hydrogen utilisation. As a result, future emissions-intensity reductions are increasingly constrained and primarily driven by renewable electricity and power-mix decarbonization, making the sector structurally exposed to tightening GEI benchmarks.

- **Base Case outcome:** The sector begins with a modest surplus of ~0.88 lakh (0.09M) CCCs in FY 2025–26, before shifting rapidly into deficit, reaching ~4.7 lakhs (0.47M) CCCs by FY 2029–30. At the Base Case end-of-forecast price (~INR 3,900–4,000/CCC), this implies a net compliance liability of ~INR 180–190 crore.
- **Supply-Heavy outcome:** A slightly higher initial surplus (~1.15 lakhs / 0.12M CCCs) moderates tightening, but the sector remains net short from FY 2026–27, with deficits limited to ~3 lakhs (0.3M) CCCs by FY 2029–30.
- **Supply-Constrained outcome:** Rapid deterioration of supply after the transition year, with deficits accelerating to ~6.4 lakhs (0.64M) CCCs by FY 2029–30.

Chlor-alkali flips from a small ~0.9 lakh (0.09M) CCC surplus to a ~4.7 lakh (0.47M) CCC deficit by FY 2029–30, implying a Base Case compliance liability of ~INR 180–190 crore.

PULP AND PAPER

53 facilities
integrated mills | Recycled fibre | Agro-based plants
Paper mills

2.83% Weighted Average Reduction

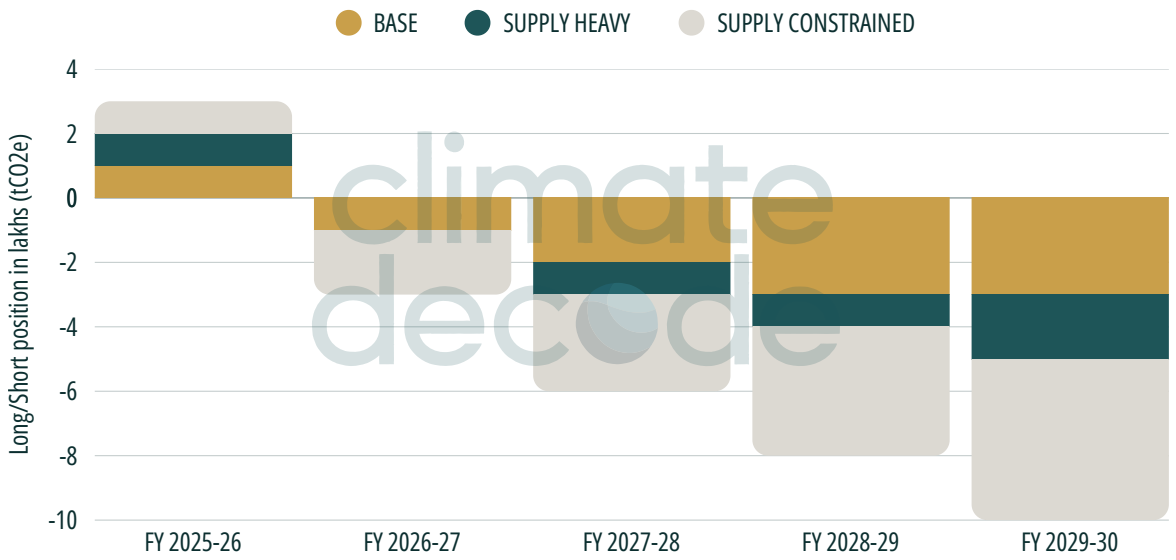


Figure 10. Pulp and Paper Compliance Position

Pulp and Paper sector is both energy- and water-intensive, with emissions primarily driven by steam generation and electricity use. While best-practice technologies are well documented, many Indian mills operate below leading international performance levels, leaving compliance outcomes highly sensitive to GEI benchmark stringency, particularly for integrated and RCF-based facilities. Small changes in benchmarks, therefore, translate into material compliance impacts for high-intensity facilities.

- **Base Case outcome:** The sector begins with a surplus of ~1 lakh (0.1M) CCCs in FY 2025–26 , then shifts rapidly into deficit, with reaching to ~3.2 lakhs (0.3M) CCCs by FY 2029–30. At the Base Case end-of-forecast price (~INR 3,900–4,000/CCC), this implies a potential sector-wide liability of ~INR 124–128 crore.
- **Supply-Heavy outcome:** A higher initial surplus (~1.3 lakhs / 0.13M CCCs) expands steadily, reaching ~1.6 lakhs (0.45M) CCCs by FY 2029–30.
- **Supply-Constrained outcome:** A smaller initial surplus (~0.8 lakh / 0.08M CCCs) erodes rapidly, narrowing to near balance by FY 2028–29 and turning marginally short by FY 2029–30, with a deficit of ~4.78 lakh (0.48M) CCCs.

Pulp & paper remains net short, generating a ~3.2 lakh (0.3M) CCC deficit by FY 2029–30, equivalent to a Base Case liability of ~INR 124–128 crore.

PETROCHEMICAL REFFINERY

21 facilities
spanning public and private operators

1.61% Weighted Average Reduction

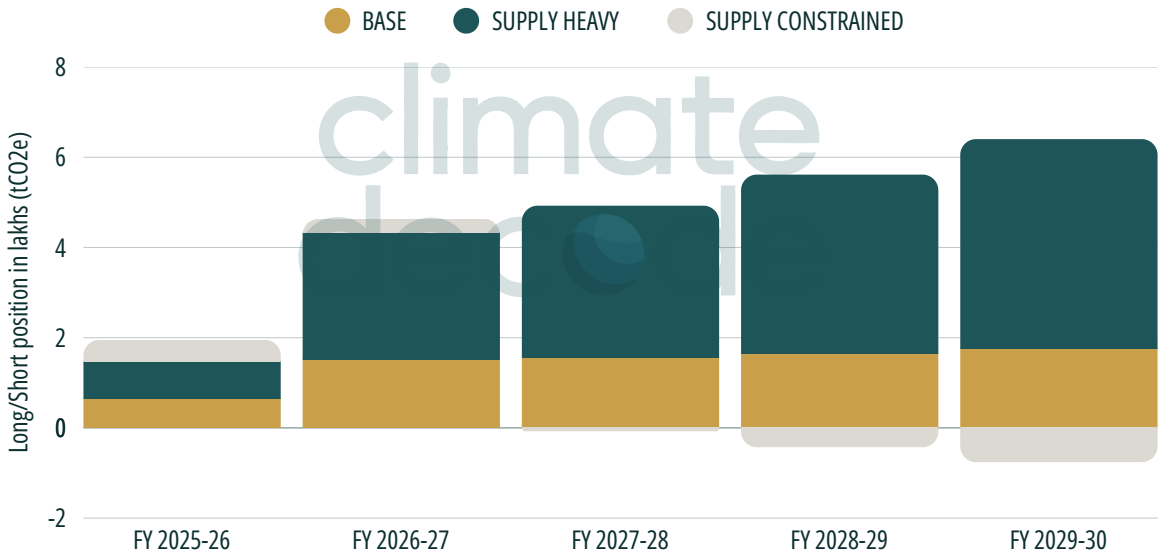


Figure 11. Petrochemical Refinery Compliance Position

India's refining system operates at a very large scale, processing >250 MMTPA of crude oil. Emissions arise primarily from utilities systems—steam, power, and hydrogen production—alongside high-temperature furnaces and continuous unit operations. Differences in refinery configuration, conversion severity, and hydrogen management result in significant dispersion in baseline emissions intensity across facilities.

- **Base Case outcome:** The sector begins with a surplus of ~0.65 lakh (0.07M) CCCs in FY 2025–26, rising steadily to ~1.76 lakhs (0.17M) CCCs by FY 2029–30. At the Base Case end-of-forecast price (~INR 3,900–4,000/CCC), this implies a potential sector-wide opportunity of ~INR 66–68 crore.
- **Supply-Heavy outcome:** A higher initial surplus (~0.83 lakhs / 0.08M CCCs) expands materially, with the sector remaining strongly net long and reaching ~4.65 lakhs (0.46M) CCCs by FY 2029–30.
- **Supply-Constrained outcome:** Early surplus (~0.47 lakh / 0.05M CCCs) erodes progressively, narrowing to near balance by FY 2028–29 and turning marginally short at ~0.76 lakh (0.07M) CCCs by FY 2029–30.

Petroleum refining remains net long, generating a ~1.76 lakh (0.18M) CCC surplus by FY 2029–30, equivalent to a Base Case opportunity of ~INR 68–71 crore.

PETROCHEMICAL CRACKERS

11 facilities
gas- and naphtha-based cracker complexes

1.78% Weighted Average Reduction

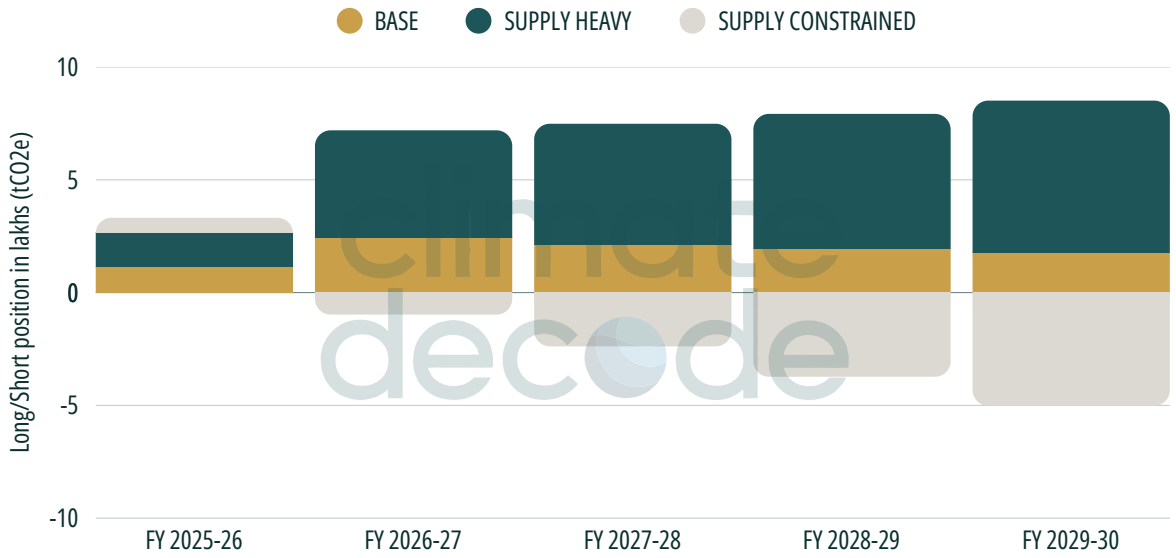


Figure 12. Petrochemical Crackers Compliance Position

Petrochemical crackers form a distinct but operationally integrated segment of the petroleum value chain, producing ethylene, propylene, and basic intermediates that underpin plastics, textiles, packaging, and downstream manufacturing. Steam cracking is inherently energy-intensive and operates close to thermodynamic limits, constraining deep emissions-intensity reductions.

- **Base Case outcome:** The segment begins with a surplus of ~1.16 lakhs (0.12M) CCCs in FY 2025–26 and remains net long throughout the period, with surplus narrowing slightly to ~1.8 lakhs (0.18M) CCCs by FY 2029–30. At the Base Case end-of-forecast price (~INR 3,900–4,000/CCC), this implies a potential sector-wide opportunity of ~INR 70–72 crore.
- **Supply-Heavy outcome:** Sustained and expanding surpluses, rising from ~1.49 lakhs (0.15M) CCCs to ~6.7 lakhs (0.67M) CCCs by FY 2029–30.
- **Supply-Constrained outcome:** A modest initial surplus (~0.67 lakh / 0.07M CCCs) reverses quickly, with deficits widening to ~5.02 lakhs (0.5M) CCCs by FY 2029–30.

Petrochemical crackers remain marginally net long, sustaining a ~1.7 lakh (0.17M) CCC surplus by FY 2029–30, equivalent to a Base Case opportunity of ~INR 70–72 crore.

IRON AND STEEL

253 facilities
largest and most diverse industrial sector under CCTS

1.85% Weighted Average Reduction

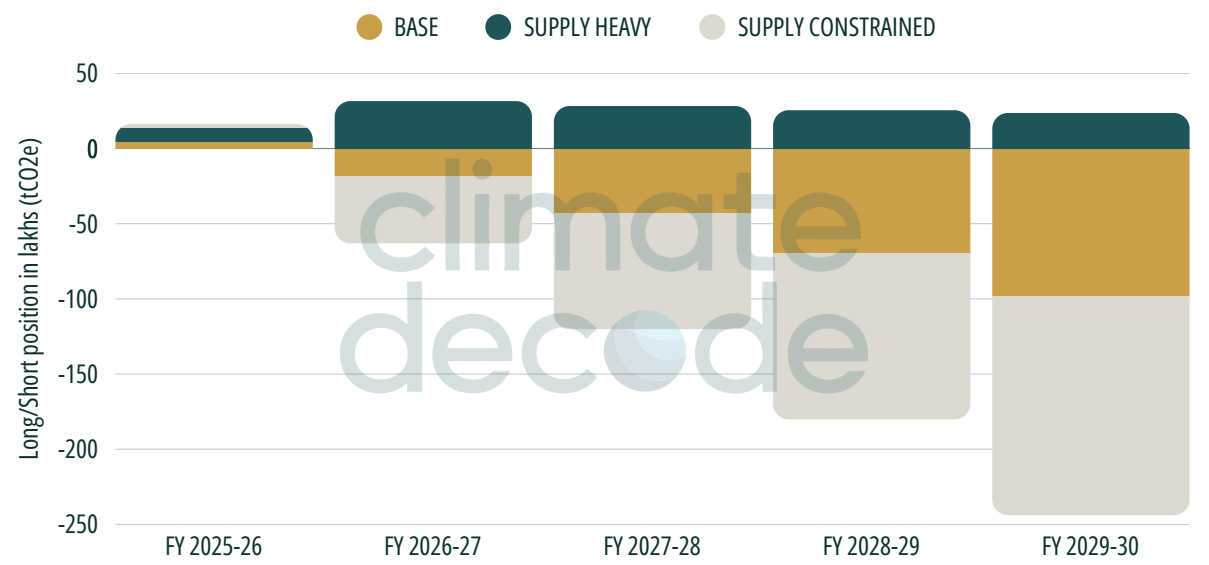


Figure 13. Iron and Steel Compliance Position

Iron and steel are among India's largest industrial sources of emissions, contributing ~297 $MtCO_2$ in 2021–22 with an average emissions intensity of ~2.36 tCO_2 per tonne of crude steel. The sector is dominated by coal-based production routes, with BF–BOF and coal-based DRI accounting for ~70–75% of output, materially constraining near-term decarbonisation.

- **Base Case outcome:** The sector begins FY 2025–26 with a CCC surplus of ~4.87 lakh (0.5M), flips into a CCC deficit of ~18 lakh by FY 2026–27, and tightens rapidly thereafter to a CCC deficit of ~98.8 lakh (9.9M) by FY 2029–30. At Base Case prices of ~INR 3,900–4,000/CCC, this translates into ~INR 3,860–3,960 crore of annual compliance exposure, establishing iron & steel as the core demand driver of CCTS.
- **Supply-Heavy outcome:** A higher initial surplus of ~9.04 lakh (0.9M) CCCs is sustained across the period, with the sector remaining net long and surpluses moderating to ~23.6 lakh (2.4M) CCCs by FY 2029–30.
- **Supply-Constrained outcome:** A smaller opening surplus of ~2.34 lakh (0.23M) CCCs is quickly exhausted, with deficits emerging from FY 2026–27 and deepening sharply to ~145 lakh (14.5M) CCCs by FY 2029–30.

Iron & steel becomes the core CCTS demand anchor, flipping from a ~4.87-lakh(0.5M) surplus to a ~99-lakh (9.9M) CCC deficit by FY 2029–30, implying ~INR 3,900–4,000 crore of annual Base Case compliance exposure.

TEXTILE

173 facilities
Spanning| Spiining| Processing| Fibre| Composite Units

3.14% Weighted Average Reduction

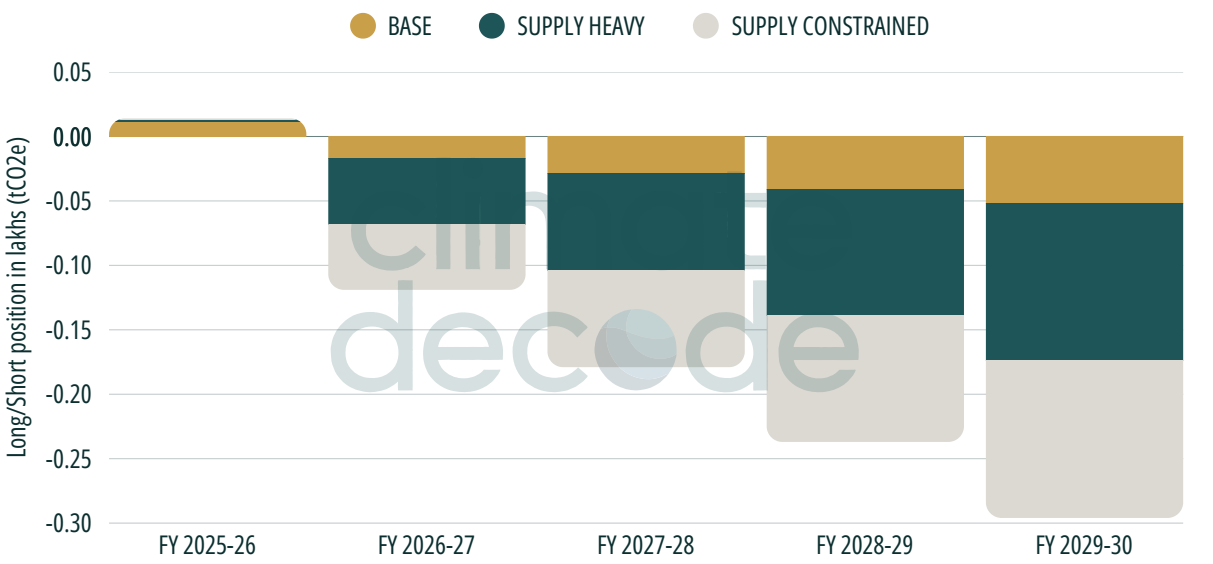


Figure 14. Textile Compliance Position

Textile is a highly energy- and thermal-intensive sector, with emissions concentrated in wet processing, bleaching, dyeing, and finishing, largely dependent on fossil-based steam and thermal energy. Structural fragmentation of MSMEs, accounting for ~80% of installed capacity, constrains coordinated decarbonisation and limits rapid adoption of capital-intensive abatement solutions.

- **Base Case outcome:** The sector begins FY 2025–26 with a modest surplus of ~2.3 lakh (0.02M) CCCs, but tightens rapidly, flipping into a deficit of ~2.8 lakh (0.3M) CCCs by FY 2026–27. Deficits widen steadily thereafter, reaching ~9.58 lakh (0.96M) CCCs by FY 2029–30. At Base Case prices of ~INR 3,900–4,000 per CCC, this implies an annual compliance exposure of ~INR 374–385 crore, establishing textiles as a structurally short sector under CCTS.
- **Supply-Heavy outcome:** A higher initial surplus of ~3.18 lakh (0.32M) CCCs delays tightening marginally; however, the sector still turns net short from FY 2026–27, with deficits expanding to ~4.33 lakh (0.43M) CCCs by FY 2029–30.
- **Supply-Constrained outcome:** An almost negligible opening surplus of ~1.68 lakh (0.2M) CCCs is immediately exhausted, with deficits deepening to ~12.95 lakh (1.3M) CCCs by FY 2029–30, indicating severe structural tightness.

Textiles turns structurally short early under CCTS, reaching a ~12.95-lakh (1.3M) CCC deficit by FY 2029–30—equivalent to ~INR 400 crore of annual Base Case compliance exposure.

Conclusions

India's CCTS is still in the early stages of deployment, and the first compliance year is deliberately structured to avoid imposing an immediate burden on regulated entities. Transitional benchmarks, partial-year applicability, and limited tightening mean that near-term compliance can largely be managed through existing operational performance rather than large, upfront capital commitments. As such, early market outcomes should be viewed as part of a system-build phase rather than a test of long-run stringency.

Over the medium to long term, however, the CCTS is expected to become a meaningful price-setting mechanism for industrial decarbonisation. As benchmarks tighten and production growth compounds, supply–demand dynamics will increasingly translate relative emissions performance into financial outcomes, creating a clearer incentive to invest in emissions-intensity reductions. The effectiveness of this signal will depend on how credibly and consistently the market framework evolves beyond the initial years.

At present, significant uncertainty remains. The government has published confirmed GEIs for only the first two compliance years, with no explicit trajectory for subsequent tightening. This lack of forward visibility complicates long-term planning for regulated entities, particularly for capital-intensive sectors where investment decisions require multi-year lead times. For an intensity-based market to function effectively, predictable policy signals are critical; prolonged uncertainty risks weakening market confidence, distorting investment timing, and reducing the effectiveness of the carbon price. In addition, key elements of market design related to managing unsustainable surplus or deficit conditions remain undeveloped. As the supply–demand analysis shows, extreme outcomes are not self-correcting under the current framework. Clear mechanisms for recalibrating benchmarks, introducing flexibility, or stabilising prices will be necessary to preserve liquidity, compliance credibility, and investment signals as the market matures.

These considerations are further heightened for sectors exposed to external carbon costs under the EU's CBAM. A well-calibrated CCTS has the potential to internalise carbon costs domestically, reducing the risk that Indian producers pay carbon prices abroad and allowing capital to remain within India to support domestic decarbonisation and industrial upgrading. Aligning CCTS design and compliance pathways with CBAM requirements will therefore be an important test of the scheme's strategic value.

Against this backdrop, effective participation in the CCTS will require companies to move beyond annual compliance and adopt forward-looking strategies. The requirement for regulated entities to submit five-year emissions-intensity reduction plans reflects this need and underscores the importance of integrated planning across operations, investment, and market participation.

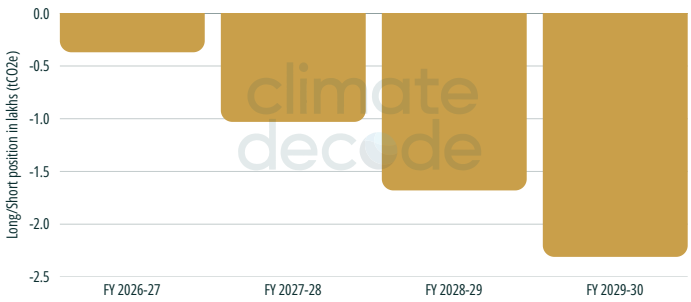
Climate Decode supports this transition by helping companies manage and optimise CCTS compliance while embedding it within broader decarbonisation and CBAM strategies. This includes quantifying compliance exposure, designing emissions-reduction pathways that meet both CCTS and CBAM requirements, optimising the timing and use of credits, and supporting long-term planning under policy uncertainty. By linking operational data, market dynamics, and regulatory design, Climate Decode enables companies to stay ahead of compliance while directing capital toward the most effective decarbonisation outcomes.

Case Study: From Annual Compliance to Managed Exposure

An aluminium smelter would become a covered entity under India's Carbon Credit Trading Scheme (CCTS), and management approaches the new obligation as a routine annual compliance formality, with no immediate visibility on its actual surplus or deficit position. This scenario is hypothetical, based on publicly available data.

What Climate Decode helped the entity do?

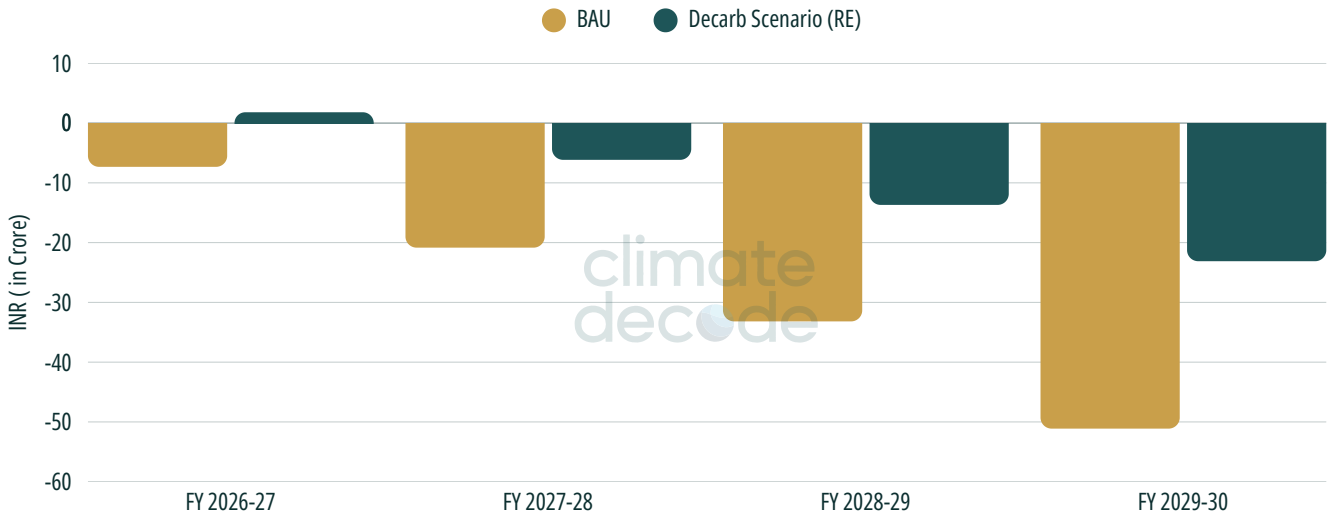
Position



Forecast position (4-year):

Climate Decode's Terranova would help the smelter translate tightening GEI into a year-by-year surplus/deficit outlook, so the team could see the compliance trajectory before it hit the P&L. This is the core advantage in an intensity-based system where targets tighten over time, and positions can flip even with stable operations.

Financial Exposure



Efficiently Decarb considering compliance exposure:

Climate Decode would help the team identify electricity as the dominant lever and assess the availability of renewable electricity (RE) sourcing. In this case, a 1% RE shift could be sufficient to flip FY26 into a surplus of 9,276 tCO_2e and show a net gain of ₹1.81 crore after electricity costs, turning a compliance action into a CFO-approvable ROI decision.

Carbon credits as risk management

Next, Climate Decode could help the entity decide what it could do with early surpluses by comparing near-term sale value to future avoided purchase cost under tightening GEI. Because the forecast showed a return to deficits (31,323 tCO_2e in 2027 and 69,519 tCO_2e in 2028 in this case), the platform would recommend banking the FY26 surplus to reduce exposure to later, potentially higher-cost procurement.

Decision Logic

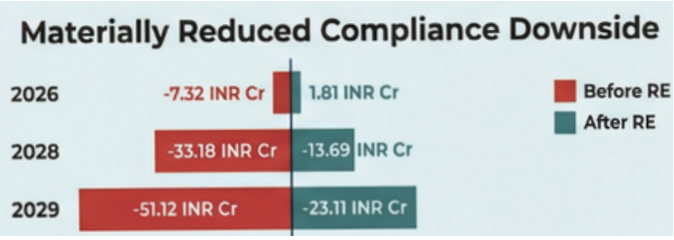
How does the platform determine if banking is better than selling?
By calculating whether future avoided procurement cost (from using banked CCCs against forecast deficits) is greater than today's sale proceeds, using a price curve, discount rate, and scenario probabilities.

What are the financial risks if GEI tightens further than expected?
Tighter GEI increases (i) the probability and magnitude of future deficits, (ii) forced procurement volumes, and (iii) exposure to price spikes in a constrained CCC market, raising both expected cost and tail risk. This generally increases the value of early banking as a hedge.

How does the RE shift directly impact the long-term deficit?
It reduces the facility GEI by lowering the emissions factor of electricity within the boundary. However, tightening targets can outpace the improvement, so the platform uses the 5-year projection to show whether the RE trajectory is sufficient or only delays the deficit.

Climate Decode could enable an aluminium smelter to transition from passive annual compliance to structured exposure management. By modeling forward GEI tightening, the client would justify near-term renewable electricity deployment on net financial benefit and convert early CCC surpluses into a hedge against anticipated future shortfalls.

Climate Decode would design a phased renewable electricity strategy for an aluminium smelter to cut grid-linked emissions without disrupting production growth.



Why Climate Decode is Your Partner in CCTS

Climate Decode is built as an agentic planning layer, not just a carbon accounting tool. It connects decarbonisation, residuals, and finance so that CCTS targets can be translated into executable plans.

- **GHG Quantification:** Facility-level and product-level GHG inventories aligned with CCTS system boundaries, notified methodologies, and sector-specific GEI benchmarks. Outputs are audit-ready and designed to support statutory compliance, third-party verification, and emissions-intensity reporting.
- **Verification Support:** End-to-end support through the CCTS verification cycle, including pre-verification gap assessments, documentation structuring, evidence mapping, and coordinated responses to verifier queries—reducing approval risk, delays, and rework.
- **Emissions Reduction Planning (Decarbonisation Roadmaps):** CCTS-aligned decarbonisation roadmaps that prioritise interventions based on emissions-intensity impact, cost effectiveness, technical readiness, and implementation timelines, with explicit linkage to compliance outcomes.
- **Feasibility Assessment:** Technical and economic feasibility assessment of identified decarbonisation options, covering capex and opex implications, operational constraints, emissions-intensity improvement potential, and sensitivity to future benchmark tightening.
- **Compliance Position Assessment & Management (CCTS S&D-backed):** Forward-looking assessment of CCC surplus or deficit positions under multiple production, benchmark, and policy scenarios. This analysis is underpinned by Climate Decode's proprietary CCTS supply–demand (S&D) report, providing market-level visibility on credit availability, demand pressure, and indicative price signals to support informed compliance, procurement, banking, or monetisation decisions.

Powered by agentic AI. Executed with tailored advisory expertise.

TerraNova Platform

Agentic AI parther for your decarbonisation and compliance management

Advisory Services

Experts delivering tailored solutions for you

Book your consultation now: contact_india@climate-decode.com

Appendices

Data and Methodology

This report provides a forward-looking, scenario-based assessment of supply, demand, and indicative price formation under India's CCTS. As the scheme is entering its inaugural compliance phase and has not yet generated observable trading data, all results presented are modelled outcomes, not forecasts of realised market transactions. The objective of the analysis is to understand how the CCTS market could evolve under different combinations of production growth, emissions-intensity improvement, and benchmark stringency, and to identify relative sectoral exposure, market tightening risks, and policy-relevant inflection points.

Data Sources and Coverage
The analysis draws on a combination of regulatory, sectoral, and market reference data, including:

- Final and draft Greenhouse Gas Emissions Intensity notifications issued under the Energy Conservation (Amendment) Act, 2022
- Facility-level and sector-level disclosures from Bureau of Energy Efficiency (BEE) and PAT Cycle III documentation
- Publicly available data on industrial production, capacity additions, and historical output trends
- Secondary literature and sector studies used to inform feasible decarbonisation trajectories

Where final GEI benchmarks were not available at the time of analysis, draft benchmarks were used and adjusted analytically to reflect patterns observed between draft and final notifications in other sectors. These adjustments are applied for modelling consistency only and should not be interpreted as regulatory expectations.

Scenario Design
To reflect uncertainty and avoid reliance on a single deterministic outcome, the analysis applies a three-scenario framework:

- Base Case: Most-likely pathway based on current regulatory signals, moderate decarbonisation progress, and sector-specific production growth aligned with historical trends
- Supply-Heavy Scenario: Faster-than-expected efficiency gains and technology uptake, combined with higher production growth, resulting in looser market conditions
- Supply-Constrained Scenario: Slower decarbonisation progress due to capital constraints and operational lock-in, producing tighter market balances

For Iron and steel sector without final GEI notifications, draft benchmarks are adjusted directionally for modelling purposes to reflect observed differences between draft and final targets in notified sectors. These adjustments are analytical only and do not represent expected regulatory outcomes.

First-Year Treatment
Because GEI benchmarks become effective from the date of notification rather than the start of the fiscal year, the first compliance year is treated as pro-rated, with production scaled accordingly to ensure consistency across sectors.

Pricing Approach
No historical CCTS price exists. Base Case prices are therefore anchored to:

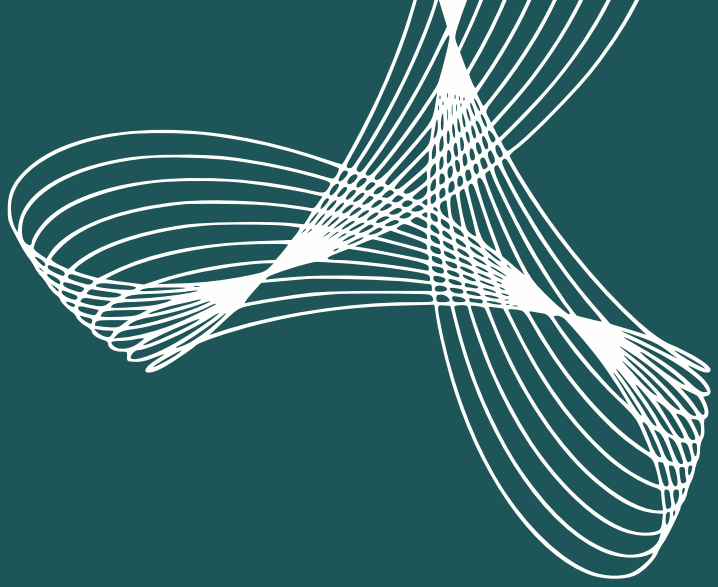
- Recent PAT Cycle III ESCert prices, reflecting domestic compliance experience under an intensity-based system
- Early-stage China ETS prices, providing an international reference for a national, industrial ETS

Prices evolve endogenously based on the modelled tightening of market balance, with scarcity in later years driving higher marginal compliance costs.

Interpretation and Limitations
All results represent modelled outcomes, not predictions. Persistent extreme surpluses or deficits are unlikely to be sustained in practice and would almost certainly trigger regulatory recalibration through benchmark adjustment, flexibility mechanisms, or policy intervention. The analysis should therefore be interpreted as an assessment of directional market pressures and relative sectoral exposure, rather than precise compliance outcomes.

Glossary of Terms

- **CCTS (Carbon Credit Trading Scheme**) India's national compliance carbon market established under the Energy Conservation (Amendment) Act, 2022. CCTS regulates emissions through sector-specific emissions-intensity benchmarks rather than absolute caps.
- **CCC (Carbon Credit Certificate):** The tradable compliance unit under CCTS. One CCC represents one tonne of CO_2 equivalent (tCO_2e) reduced or avoided relative to an assigned GEI benchmark.
- **GEI (Greenhouse Gas Emissions Intensity)** A metric expressing greenhouse gas emissions per unit of output (e.g., tCO_2e per tonne of product). GEI benchmarks define compliance obligations under CCTS.
- **Benchmark Tightening:** The progressive reduction in allowed emissions intensity over time, expressed as percentage reductions in GEI benchmarks across compliance years.
- **Compliance Surplus:** A positive compliance position where a facility's actual emissions intensity is lower than its benchmark, resulting in the issuance of CCCs.
- **Compliance Deficit**: A negative compliance position where a facility's emissions intensity exceeds its benchmark, requiring the purchase and surrender of CCCs.
- **Base Case Scenario:** The central modelling case reflecting moderate production growth, incremental decarbonisation, and benchmark tightening aligned with current regulatory signals.
- **Supply-Heavy Scenario:** A modelling case in which credit availability is higher due to faster efficiency gains, stronger technology uptake, or looser effective benchmark stringency.
- **Supply-Constrained Scenario:** A modelling case characterised by slower decarbonisation progress and tighter market balance, resulting in larger CCC deficits.
- **PAT (Perform, Achieve and Trade):** India's legacy energy-efficiency trading mechanism, used as a domestic reference point for early CCTS price anchoring.
- **Intensity-Based System:** A regulatory framework in which compliance obligations scale with output levels, as opposed to absolute emissions caps.
- **Penalty Mechanism**: The compliance backstop under CCTS, defined as a financial penalty linked to prevailing market prices when CCCs are unavailable.
- **CBAM (Carbon Border Adjustment Mechanism):** The European Union's policy applying a carbon cost to imported goods based on embedded emissions, relevant for export-oriented CCTS-covered sectors.
- **Net-Zero 2070 Target:** India's long-term climate objective to achieve net-zero greenhouse gas emissions by 2070, which informs benchmark trajectories and policy design.



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