India's Carbon Credit Trading Scheme ('CCTS')

From regulation to competitive advantage

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1. Executive insights

1.1 Why CCTS is a strategic inflection point for Indian industry?

India's Carbon Credit Trading Scheme (CCTS) represents the first time that carbon has been formally embedded into the operating economics of Indian industry. Unlike earlier energy efficiency or renewable compliance frameworks, CCTS does not merely reward good behaviour — it penalizes structural carbon inefficiency. For the first time, industrial emissions will translate directly into financial liabilities or financial assets, depending on how companies respond.

CCTS shifts carbon from being a reputational issue to a commercial variable. Emission intensity is no longer an abstract sustainability metric; it becomes a line item that can influence margins, capital allocation decisions and competitiveness in both domestic and export markets. Over the next decade, carbon will increasingly function like any other regulated input cost — similar to fuel, power or water — but with one critical difference: carbon prices are expected to rise structurally, not fall.

This marks a strategic inflection point. Companies that treat CCTS as a compliance burden may find themselves locked into rising costs and shrinking margins. Companies that treat it as a strategic lever can redesign operations, unlock efficiency gains and in some cases generate new revenue streams through surplus carbon credits and green market positioning.

1. Executive insights

1.2 Five realities reshaping decarbonization economics in India

1. Carbon prices will rise faster than most abatement costs

While early CCTS carbon prices may appear modest, global experience suggests that compliance markets tighten rapidly once baseline years are completed and data quality improves. Technology learning curves, on the other hand, push abatement costs downward over time. This creates a crossover point where internal decarbonization becomes cheaper than buying carbon credits. For many Indian industrial sectors, this crossover is likely to occur well before 2035.

2. Emission intensity targets will tighten faster than production growth

India's industrial policy continues to prioritise scale and output growth. However, CCTS targets are designed to tighten progressively. This creates a structural mismatch: even companies that grow efficiently in absolute terms may fail intensity benchmarks and incur penalties simply because their decarbonization pace lags behind regulatory expectations.

3. Carbon markets introduce financial volatility into operations

Carbon is not a fixed tax. It is a traded commodity with price volatility driven by policy changes, market sentiment, credit availability and sector participation. This introduces a new source of earnings volatility and forecasting risk for CFOs and treasury teams.

4. Export competitiveness will increasingly depend on carbon performance

With mechanisms such as the EU Carbon Border Adjustment Mechanism (CBAM), carbon intensity is becoming a trade variable, not just a domestic compliance issue. For export-oriented sectors, carbon inefficiency will increasingly translate into higher landed costs and loss of price competitiveness.

5. ESG scrutiny is shifting from narrative to numbers

Investors, lenders and rating agencies are moving away from high-level sustainability commitments toward quantitative performance indicators. Carbon intensity, compliance exposure and transition plans are becoming central to ESG assessments and capital access.

1. Executive insights

1.3 Why CCTS is fundamentally different from PAT and RECs?

Earlier Indian mechanisms such as the Perform, Achieve and Trade (PAT) scheme and Renewable Energy Certificates (RECs) focused primarily on energy inputs. They rewarded incremental improvements in efficiency or renewable procurement, often with relatively limited financial consequences for non-compliance.

CCTS operates on a fundamentally different logic. It is not concerned with how energy is sourced, but with what comes out of the chimney. Emissions, not energy, become the core regulatory variable. This has three important implications:

1. Process emissions now matter as much as fuel emissions. Sectors such as cement, steel and chemicals - where emissions arise from chemical reactions rather than energy use alone - are directly exposed in ways that PAT never captured.

2. There is no natural ceiling on liability. Under PAT or RECs, non-compliance typically meant purchasing certificates at relatively predictable prices. Under CCTS, companies face open-ended exposure to carbon market prices, which are expected to escalate over time.

3. Carbon performance becomes tradable capital. Companies that outperform benchmarks can monetise excess reductions through Carbon Credit Certificates (CCCs). This converts operational efficiency into a financial asset class.

1. Executive insights

1.4 Carbon as a balance-sheet and cashflow risk

CCTS introduces carbon into three core financial dimensions:

Income statement risk

Companies that fail to meet benchmarks must purchase CCCs, directly increasing operating costs. Over time, this can erode EBITDA, distort cost structures and reduce operating leverage.

Cashflow risk

Carbon liabilities require cash outflows that are not linked to productive investment. In high-carbon sectors, cumulative CCC procurement can rival traditional maintenance capex over a decade.

Balance sheet risk

Carbon exposure increasingly influences:

- Cost of capital
- Credit ratings
- Lending terms
- Equity valuation multiples

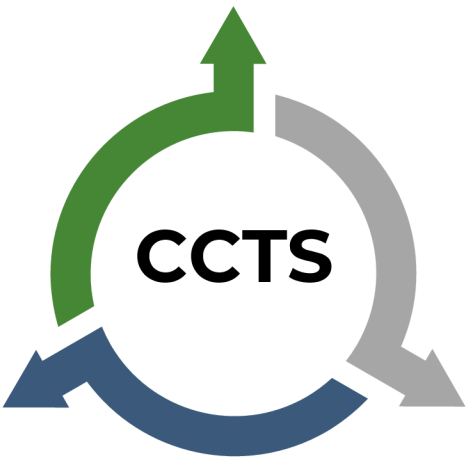
In effect, carbon inefficiency becomes a hidden liability that markets will gradually price in.

1. Executive insights

1.5 CCTS, CBAM and ESG: a converging regulatory ecosystem

CCTS does not operate in isolation. It sits at the intersection of three regulatory and market forces:

Domestic carbon compliance (CCTS)
Determines baseline performance and financial penalties within India.



ESG and sustainable finance frameworks
Shape investor expectations, financing access and corporate reputation.

International trade mechanisms (CBAM, CORSIA)
Impose carbon-related costs at the border for export markets.

Together, these forces create a reinforcing loop. Poor carbon performance triggers higher compliance costs, reduces export competitiveness and weakens ESG scores — which in turn increases financing costs and capital constraints. The combined effect is a systemic disadvantage for carbon-intensive companies that fail to transition early.

1. Executive insights

1.6 Sector exposure snapshot (indicative)

Sector	Carbon exposure	Key risk driver
Cement	High	Process emissions, clinker ratio
Iron & Steel	High	Coal dependence, process chemistry
Refineries	Medium-High	Energy intensity, future electrification
Aluminium	Medium-High	Electricity emissions
Chemicals & Petrochemicals	Medium	Feedstock emissions
Paper & Pulp	Medium	Biomass vs fossil fuels
Textiles	Low-Medium	Power mix, thermal processes

2. CCTS in one view: from policy to practice

2.1 From fragmented schemes to an integrated carbon market

India's Carbon Credit Trading Scheme (CCTS) did not emerge in isolation. It is the outcome of nearly two decades of policy experimentation aimed at improving industrial energy efficiency and reducing emissions without constraining economic growth. What differentiates CCTS is not just its ambition, but its integration — it brings together multiple legacy mechanisms into a unified, market-based carbon framework.

The policy evolution can be broadly understood in three phases:

Phase 1 **Energy efficiency as the primary lever (PAT)**	The Perform, Achieve and Trade (PAT) scheme focused on reducing energy consumption in energy-intensive industries. Targets were defined in terms of specific energy consumption (SEC) and compliance was rewarded through Energy Saving Certificates (ESCerts). While PAT drove measurable efficiency improvements, it remained fundamentally energy-centric, not emissions-centric. Process emissions, fuel quality and carbon intensity of electricity were only indirectly captured.
Phase 2 **Renewable integration and offsets (RECs, CDM)**	Parallel mechanisms such as Renewable Energy Certificates (RECs) and Clean Development Mechanism (CDM) projects enabled companies to meet renewable obligations or generate carbon credits through project-based interventions. These mechanisms created fragmented markets, with limited integration into core industrial regulation.
Phase 3 **Emissions as the regulatory variable (CCTS)**	CCTS marks a structural shift. For the first time, greenhouse gas emissions intensity (GEI) becomes the primary compliance metric. Energy efficiency and renewable procurement remain relevant, but only insofar as they translate into actual emission reductions. The regulatory focus moves from how energy is consumed to what emissions are produced.

This transition reflects a global convergence toward emissions-based regulation and aligns India with international carbon market architectures.

2. CCTS in one view: from policy to practice

2.2 Institutional framework: Who governs the carbon economy

CCTS is anchored within the Indian Carbon Market (ICM) framework and involves a multi-layered institutional architecture designed to separate policy design, technical administration, market operation and verification.

At the core:

1. Ministry of Power (MoP)
Acts as the nodal ministry responsible for overall policy direction and notification of covered sectors and compliance periods.

2. Bureau of Energy Efficiency (BEE)
Serves as the technical administrator. BEE is responsible for:

- Defining sector-specific baselines and benchmarks
- Allocating targets
- Approving monitoring and reporting methodologies
- Issuing Carbon Credit Certificates (CCCs)

3. Accredited Carbon Verification Agencies (ACVs)
Independent third-party entities responsible for verifying reported emissions data and ensuring compliance integrity.

4. Power Exchanges / Carbon Exchanges
Provide the trading infrastructure where CCCs are bought and sold. Prices are determined through market demand and supply, not administratively fixed.

This institutional separation is deliberate. It mirrors international best practice and is intended to ensure: Regulatory credibility, Data integrity, Market transparency, Reduced conflict of interest.

2. CCTS in one view: from policy to practice

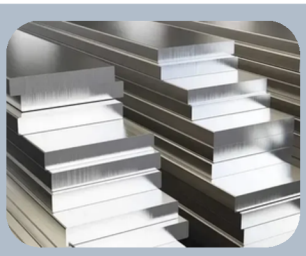
2.3 Covered sectors and compliance timelines

CCTS currently targets energy-intensive and emissions-intensive industrial sectors, which collectively account for a majority of India's industrial greenhouse gas emissions.

These include:

Cement

Iron & Steel



Aluminium

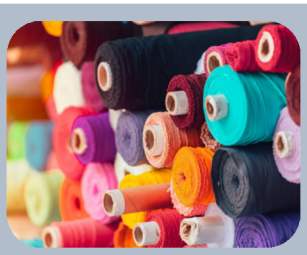
Refineries

Fertilizers

Petrochemicals

Paper & pulp

Chlor-Alkali



Textiles*

**Select sub-sectors*

2. CCTS in one view: from policy to practice

The CCTS compliance mechanism operates on an annual compliance cycle, while targets are generally notified for a multi-year trajectory period (typically 3 years).

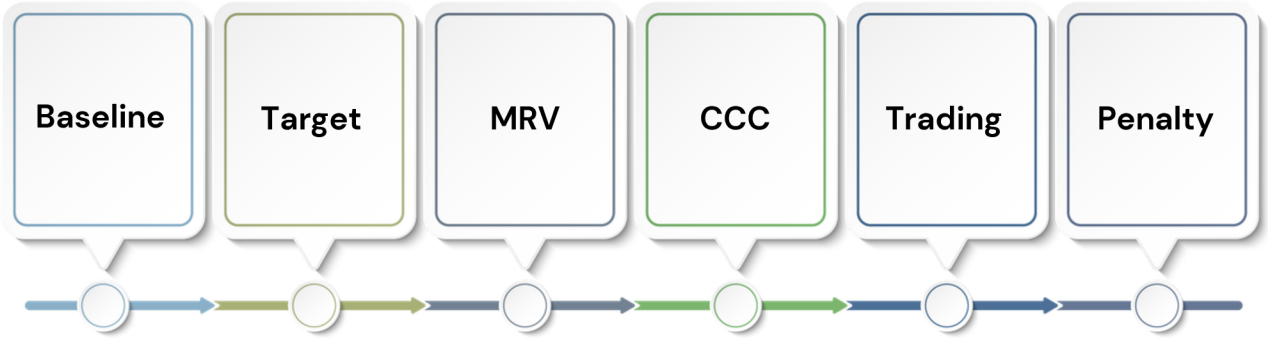
Each cycle consists of:

Importantly, targets are intensity-based, not absolute. This allows for production growth, but forces continuous improvement in emission efficiency.

Over successive cycles, benchmarks are expected to tighten, both in absolute terms and relative to industry weighted averages. This creates a ratchet effect: early cycles appear manageable, but long-term compliance becomes structurally more demanding.

2.4 How CCTS works in practice: The operational logic

At an operational level, CCTS follows a simple but powerful sequence:



While the logic appears linear, its implications for industrial operations are far-reaching.

1. Baseline
Each obligated entity is assigned a baseline greenhouse gas emission intensity (GEI), typically expressed as tonnes of CO_2 equivalent per unit of output. This baseline is derived from historical performance and sectoral benchmarking.

2. Target
A reduction target is applied to the baseline, resulting in a target GEI for the compliance period. Targets vary by sector and sub-sector and are calibrated to reflect technological feasibility and policy ambition.

3. Monitoring, Reporting and Verification (MRV)
Companies must continuously monitor emissions across covered processes; report data using prescribed methodologies and subject the data to third-party verification. This effectively embeds carbon accounting into operational reporting systems.

2. CCTS in one view: from policy to practice

4. Carbon Credit Certificates (CCC)

If a company's actual GEI is lower than the target, it receives CCCs equivalent to the excess reduction multiplied by production volume. These CCCs represent tradable carbon assets.

If actual GEI is higher than the target, the company faces a deficit and must procure CCCs from the market.

5. Trading

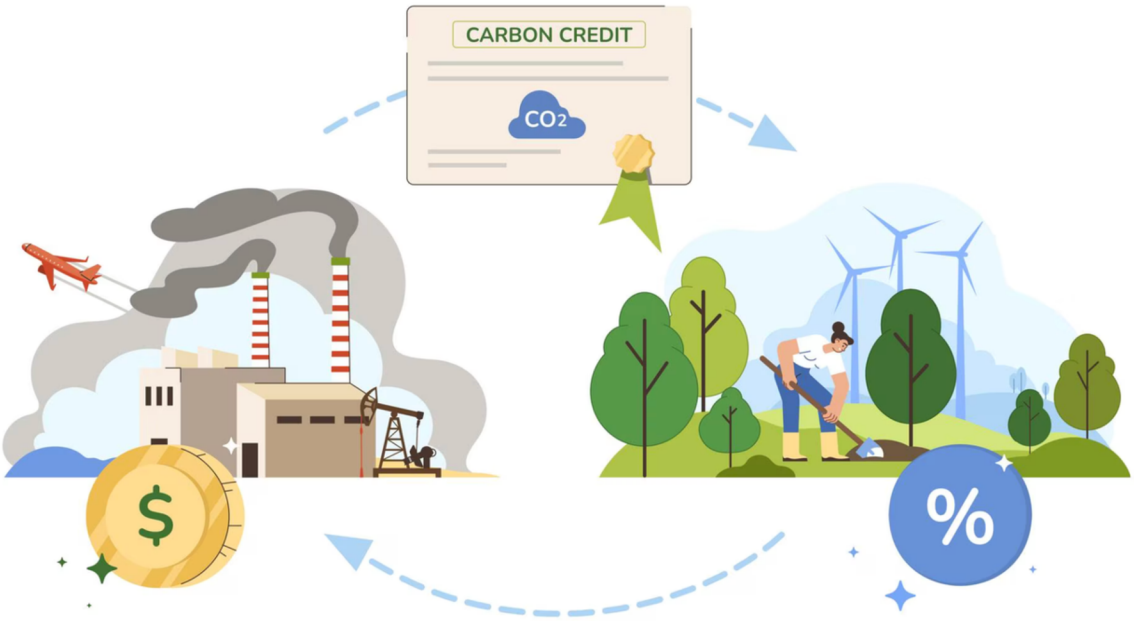
CCCs are traded on approved exchanges. Prices are determined by:

- Supply of surplus credits
- Demand from non-compliant entities
- Expectations of future tightening

Over time, this creates a carbon price signal that influences investment decisions.

6. Penalty

Entities that fail to surrender sufficient CCCs face financial penalties and potential regulatory action. Unlike earlier schemes, penalties are not symbolic they represent real cash outflows.



2. CCTS in one view: from policy to practice

2.5 Why this architecture is structurally powerful

CCTS combines three critical design features:

01 Market-based pricing

Carbon is priced through demand and supply, not fixed administratively. This ensures continuous economic signalling.

02 Intensity-based regulation

Growth is allowed, but inefficiency is penalised. This aligns with India's development priorities while enforcing decarbonization.

03 Tradable compliance instruments

Carbon efficiency becomes monetisable. Operational excellence converts into financial advantage.

Together, these features transform carbon from a passive reporting metric into an active economic variable embedded in production planning, capital investment and corporate strategy

In effect, CCTS creates a new invisible layer over Indian industry a carbon layer that will increasingly shape how factories are designed, how processes are optimised and how capital is allocated over the next two decades.

3. Carbon markets & price signals

3.1 Carbon markets: from environmental instruments to economic signals

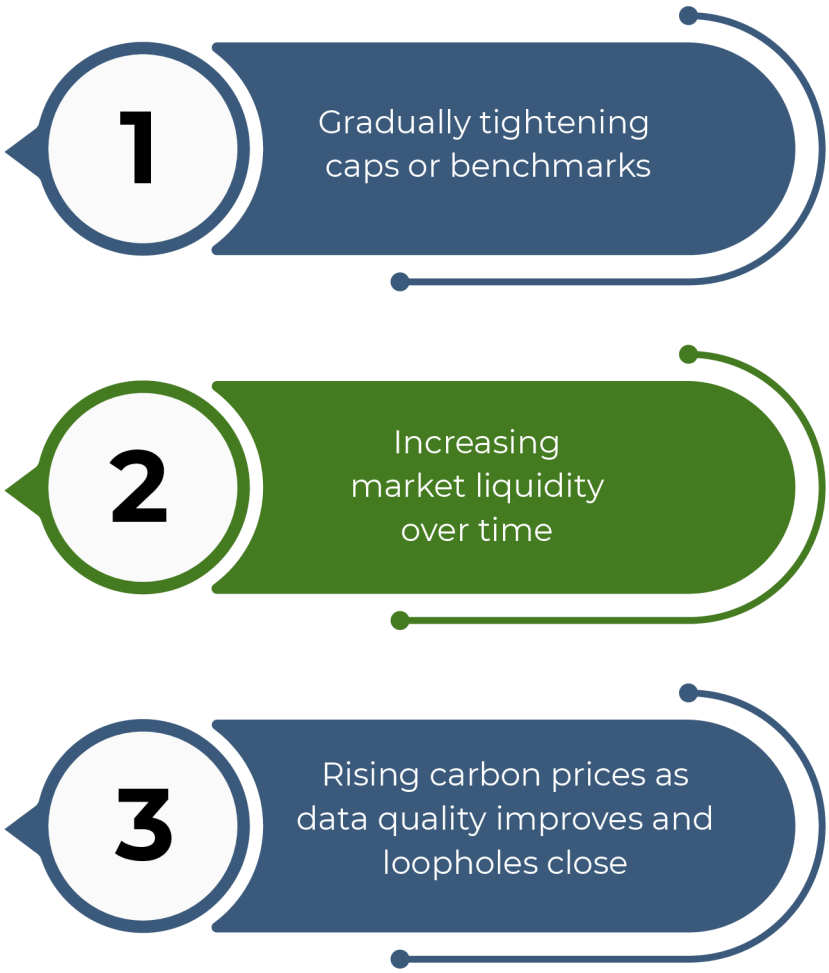
Carbon markets are often discussed as environmental policy tools. In practice, their most powerful function is economic. They convert climate ambition into price signals that influence behaviour across entire value chains. Once established, these price signals operate continuously — regardless of whether individual firms actively engage with climate strategy.

Globally, carbon markets have matured into one of the most effective mechanisms for steering capital and operational decisions. India's Carbon Credit Trading Scheme (CCTS) represents the country's entry into this pricing-led decarbonization paradigm.

What distinguishes carbon markets from taxes or standards is not just flexibility, but dynamic price discovery. Carbon prices reflect policy tightening, technological change, market sentiment, and expectations of future scarcity. For industry, this means carbon costs are not static compliance expenses — they are forward-looking economic indicators.

3.2 Global carbon markets vs India: different starting points, converging logic

Established compliance carbon markets such as the EU Emissions Trading System (EU ETS), China's national ETS, and Korea's ETS share three common characteristics:



3.3 Compliance vs voluntary markets: different roles, different risks

Carbon markets broadly fall into two categories:

Compliance markets

These are created by regulation and mandate participation for covered entities. Prices are driven by:

CCTS is a compliance market. Participation is not optional and failure to comply results in penalties.

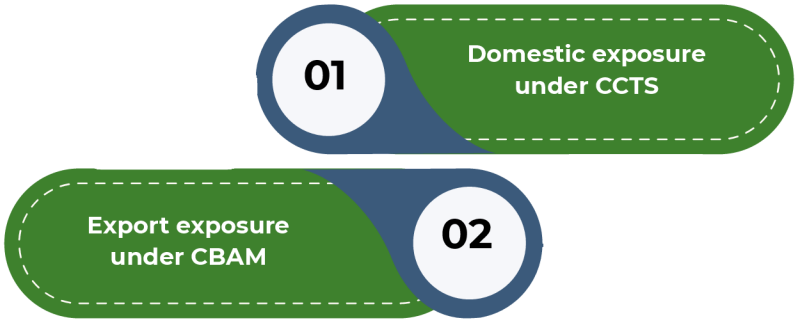
Voluntary carbon markets (VCMs)

These operate outside regulatory mandates and are driven by corporate commitments, reputational goals and supply chain expectations.
Prices vary widely depending on project quality, permanence and credibility.
For Indian industry, voluntary markets play a complementary, not substitutive, role. While voluntary credits may support net-zero claims or residual emissions management, they cannot replace compliance obligations under CCTS.
A common strategic mistake is assuming that low-cost voluntary credits can indefinitely offset regulatory exposure. Global regulatory trends suggest the opposite: compliance markets tighten as voluntary markets are increasingly scrutinized.

3.4 CBAM and trade exposure: carbon at the border

The EU Carbon Border Adjustment Mechanism (CBAM) fundamentally alters how carbon is priced in international trade. Instead of relying solely on domestic carbon pricing, CBAM applies a carbon cost equivalent to imports based on their embedded emissions.

For Indian exporters in sectors such as steel, aluminium, cement and chemicals, this introduces a dual exposure:



The key implication is convergence. Over time, differences between domestic carbon prices and border-adjusted prices are likely to narrow. Companies that delay decarbonization risk paying twice — once domestically and once at the border.

More importantly, CBAM shifts competition from price per tonne of product to price per tonne of carbon. Firms with lower carbon intensity gain a structural advantage, even if their absolute production costs are higher.

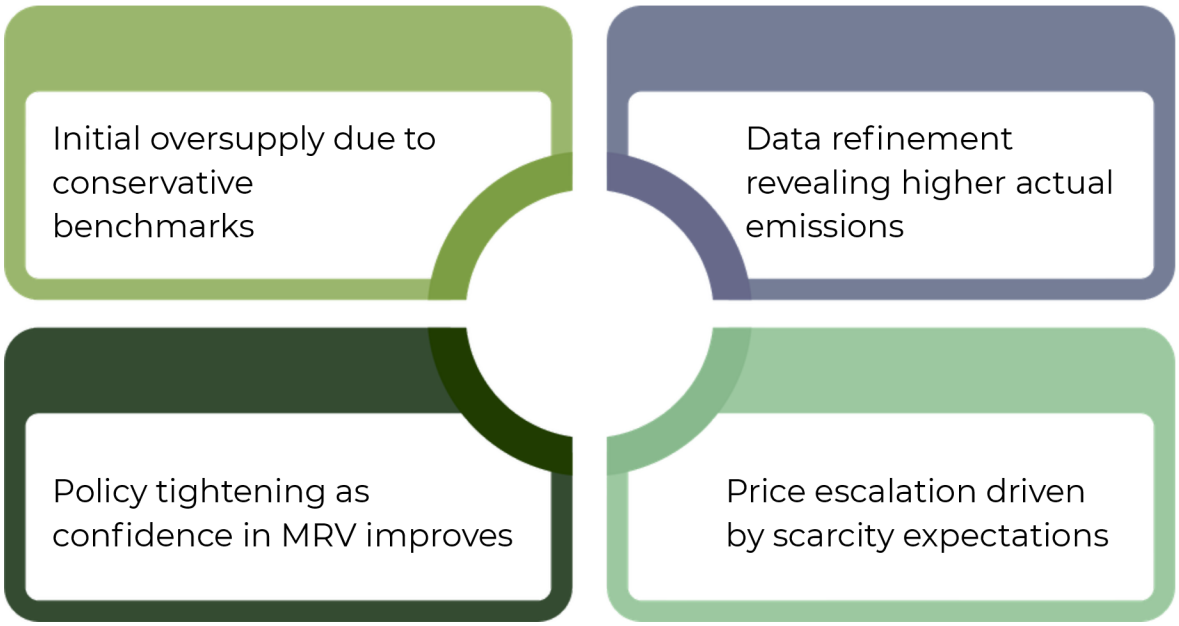
***Note**: Integration of CCTS under CBAM. Article 9 of the CBAM Regulation allows a deduction for carbon prices effectively paid in the country of origin. For India, it is CCTS.*

3. Carbon markets & price signals

3.5 Carbon price trajectories: why early numbers are misleading

Early-stage carbon markets often exhibit low prices. This is not a sign of weak policy; it is a feature of initial design.

Historical experience across jurisdictions shows a consistent pattern:



India's carbon prices are likely to follow this trajectory. The most important driver is not current prices, but expectations of future scarcity. Once companies begin factoring future carbon prices into investment decisions, behaviour shifts rapidly.

For capital-intensive industries with long asset lives, carbon price expectations matter more than spot prices. A plant designed today will operate for 20–30 years. If future carbon prices are expected to rise materially, today's design decisions lock in tomorrow's liabilities.

3. Carbon markets & price signals

3.6 When abatement becomes cheaper than carbon

The most underappreciated insight in carbon economics is the crossover point - the moment when the cost of reducing emissions internally falls below the cost of purchasing carbon credits.

This crossover is driven by two opposing trends:

1. Declining abatement costs due to technology learning, scale and localisation

2. Rising carbon prices due to tightening benchmarks and market maturity

In most industrial sectors, low-cost abatement options exist but are underutilized due to:

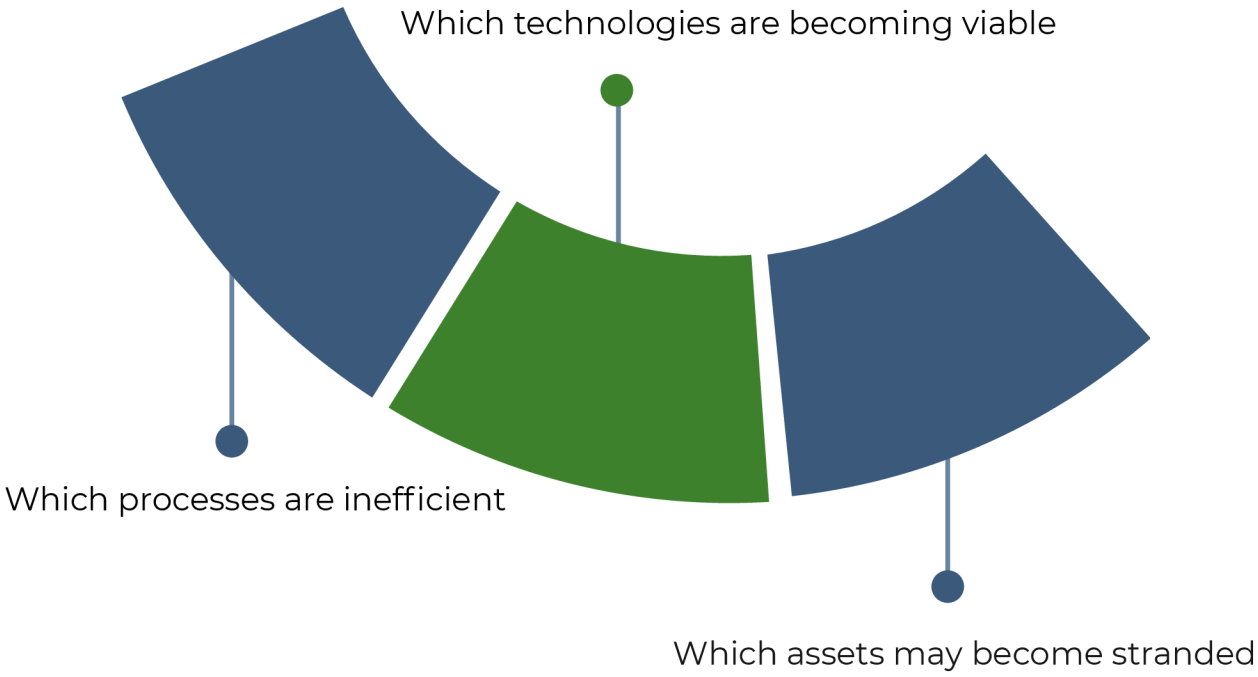
- Capital constraints
- Operational inertia
- Short-term return expectations

CCTS changes this calculus. Once carbon prices approach or exceed abatement costs, inaction becomes the most expensive option. For Indian industry, the strategic implication is clear: Carbon markets reward early movers not because they are altruistic, but because they lock in low-cost reductions before prices rise.

3. Carbon markets & price signals

3.7 Carbon prices as signals, not penalties

The true function of carbon pricing is not punishment; it is information. Carbon prices communicate:



Firms that treat carbon prices as signals can anticipate regulatory tightening, sequence investments intelligently and avoid abrupt cost shocks. Firms that treat them as penalties respond late — often at higher cost.

In this sense, carbon markets do not dictate outcomes. They reveal economics that were previously invisible. CCTS brings this revealing function to Indian industry, marking the beginning of carbon-priced decision-making at scale

4. Carbon risk stress testing for Indian industry

4.1 Carbon risk is not linear, it compounds quietly

Most companies still think of carbon exposure as a single compliance cost: a price per tonne multiplied by emissions. That framing is incomplete — and dangerous.

Carbon risk under CCTS behaves less like a fee and more like financial stress. It compounds across prices, volumes, timelines and markets. Small changes in assumptions — carbon price, production growth, benchmark tightening — can produce disproportionate impacts on cashflow and margins.

Stress testing carbon risk is therefore not about predicting a single number. It is about understanding how fragile or resilient a company's economics are under plausible futures.

4.2 Why conventional risk assessments fall short

Traditional regulatory risk assessments tend to be static.

They assume:

1. **A fixed carbon price**
2. **Stable production volumes**
3. **Predictable compliance costs**

CCTS breaks all three assumptions.

- Carbon prices will move.
- Benchmarks will tighten.
- Production decisions will interact with emissions intensity.

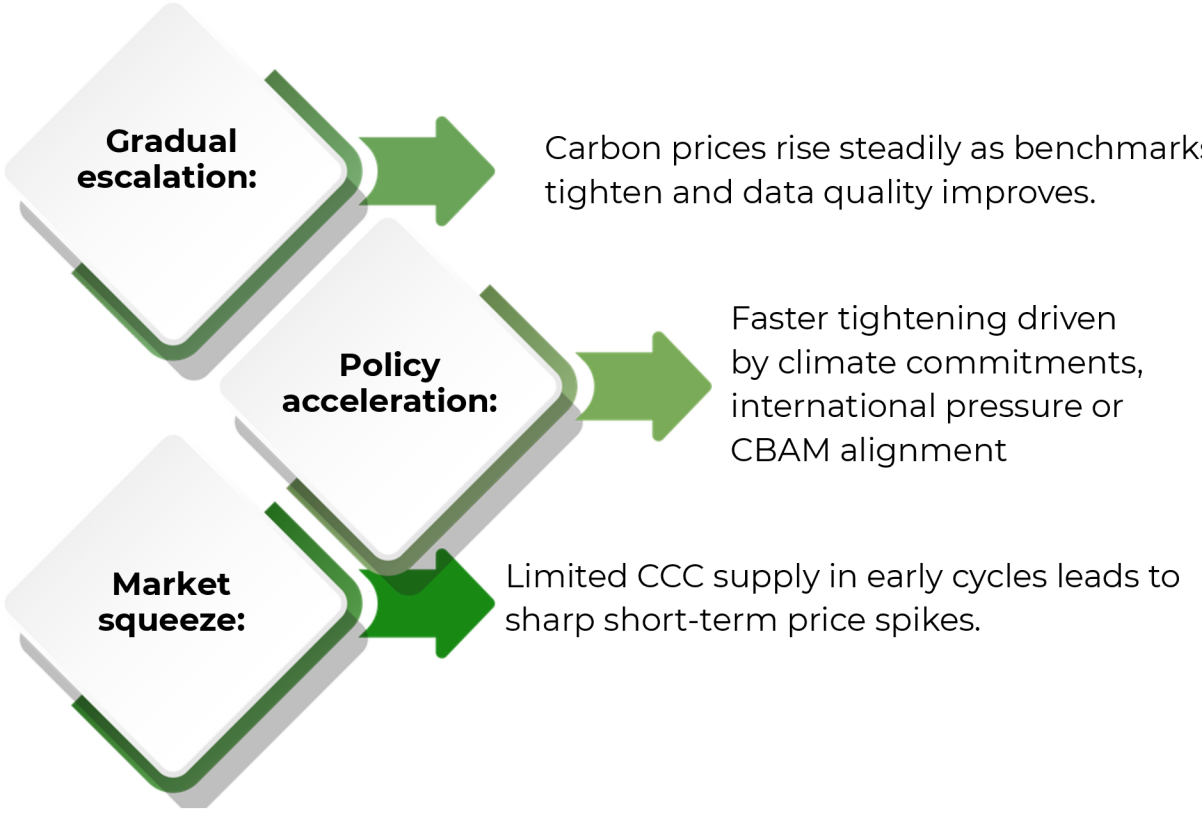
As a result, carbon risk behaves more like interest rate risk or commodity price risk than a regulatory penalty. It deserves the same level of scenario analysis and board attention.

4.3 Stress test 1: Carbon price shock scenarios

The most visible source of carbon risk is price escalation.

However, the real exposure lies not in today's prices, but in how quickly prices can rise once the market tightens.

Three illustrative scenarios highlight this dynamic:



The insight is not the absolute price level, but sensitivity. For high-emission sectors, even moderate price increases translate into material EBITDA erosion, particularly where margins are already thin.

What often surprises management teams is how quickly carbon costs move from immaterial to strategic — not over decades, but within a single compliance cycle.

4.4 Stress Test 2: Production growth versus tightening benchmarks

India's industrial strategy is built on growth. CCTS, however, is built on relative performance.

This creates a structural tension.

Under stress testing, this scenario is common. As production scales faster than decarbonization measures are deployed, total exposure to carbon costs rises even if efficiency improves on paper.

This creates a counterintuitive outcome:

Growth amplifies carbon risk unless it is explicitly decoupled from emissions intensity.

For companies planning capacity additions or debottlenecking, this interaction becomes critical. Carbon risk must be assessed not just at current scale, but at future operating levels.

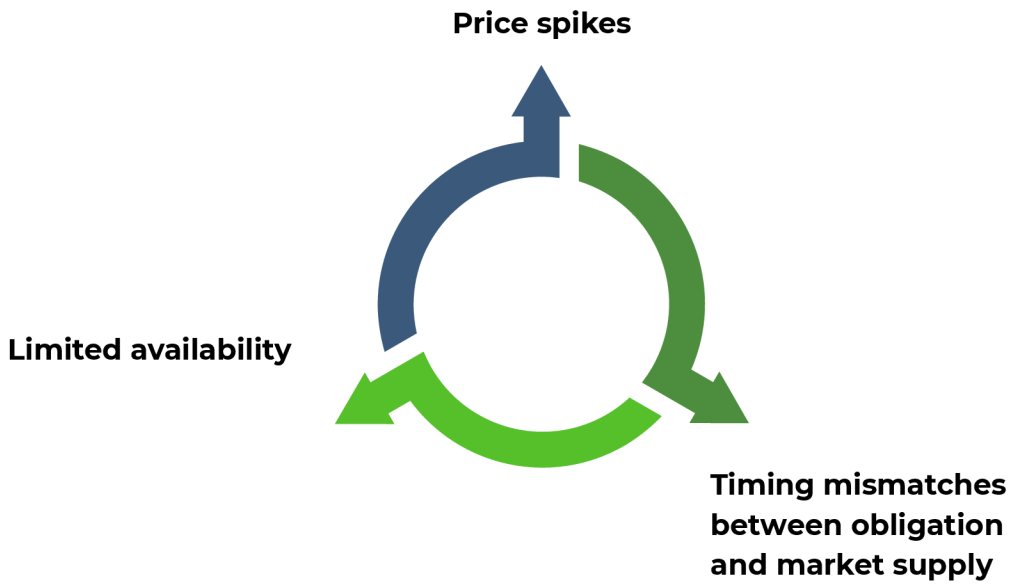
4.5 Stress Test 3: Carbon Credit Certificate (CCC) availability and liquidity risk

One of the least discussed risks under CCTS is market liquidity.

In early compliance cycles:

- CCC supply may be concentrated among a small set of outperformers
- Trading volumes may be thin
- Prices may be volatile

A company that assumes it can always "buy its way out" of non-compliance may find itself exposed to:



This is not hypothetical. Similar dynamics have played out in early phases of other carbon markets globally.

Liquidity risk transforms carbon exposure from a cost management issue into a procurement and treasury challenge.

4.6 Stress Test 4: EBITDA, cashflow and margin compression

When carbon costs are layered onto existing cost structures, their impact is rarely uniform.

Carbon exposure tends to:

1. Compress margins rather than increase headline costs
2. Reduce operating leverage
3. Affect high-volume, low-margin segments disproportionately

Over multiple compliance cycles, recurring CCC purchases can rival or exceed routine maintenance capex. Unlike capex, however, these outflows do not improve productivity or asset life.

From a cashflow perspective, carbon costs behave like:

- A recurring operating drain
- A volatility amplifier
- A drag on free cash flow available for growth or deleveraging

This is why carbon risk increasingly features in credit assessments and lender due diligence.

4. Carbon risk stress testing for Indian industry

4.7 Stress test 5: Carbon as a valuation and capital allocation risk

Carbon risk does not stop at the factory gate. It increasingly influences how markets value companies.

Three channels are emerging clearly:

01

Cost of capital

Lenders and investors are beginning to differentiate between firms with credible transition strategies and those without. Carbon-intensive firms face higher risk premiums, particularly for long-dated capital.

02

Asset valuation

Assets with high embedded emissions and limited retrofit options face a risk of economic obsolescence, even if they remain technically operational.

03

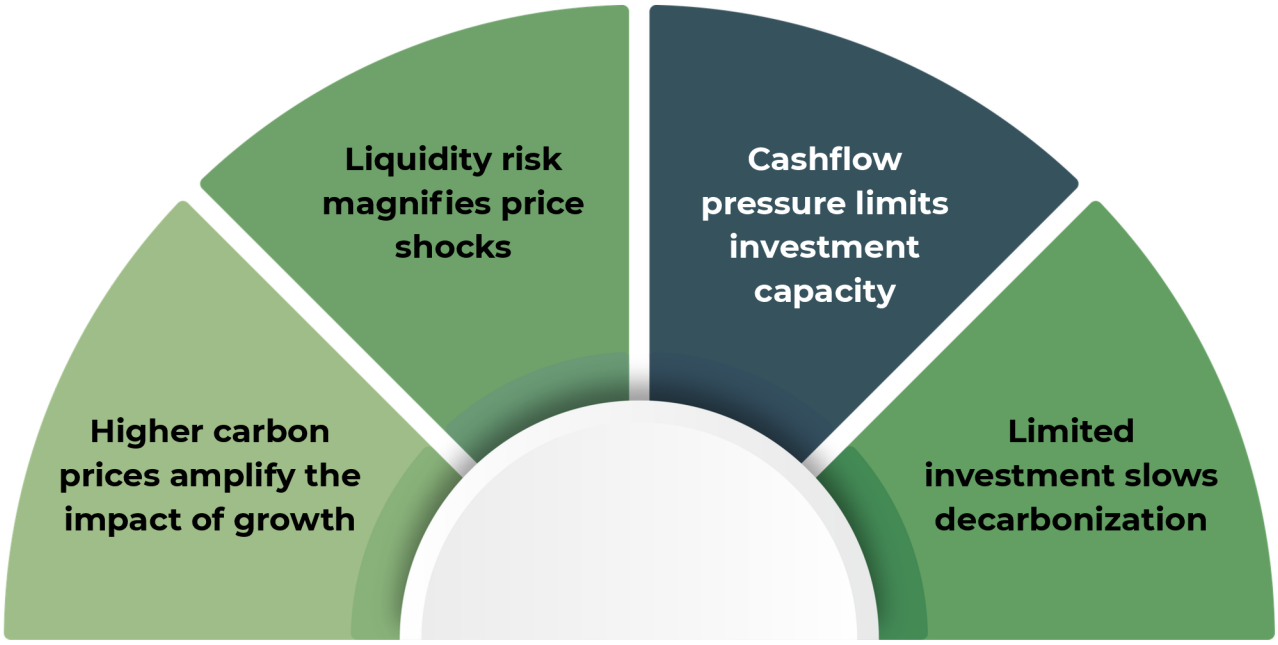
Capital allocation bias

As carbon prices rise, capital naturally flows toward lower-intensity processes, products, and geographies. Companies that fail to adapt may find themselves crowded out of growth capital.

In effect, carbon inefficiency becomes a strategic handicap, not just a compliance cost.

4.8 The cumulative effect: why carbon risk accelerates

Individually, each stress factor appears manageable. Together, they interact and reinforce one another:



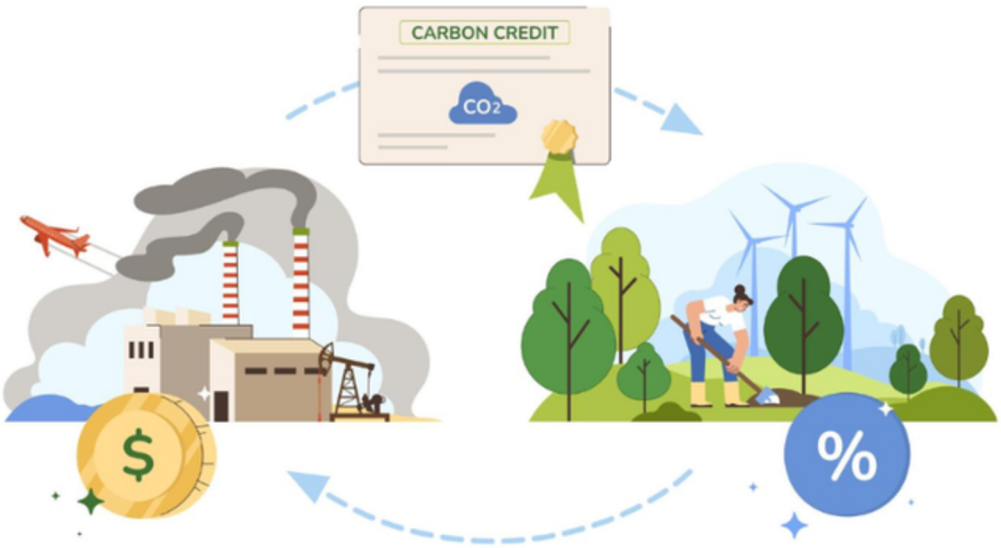
This feedback loop explains why late movers often face non-linear cost escalation, while early movers stabilise their exposure.

4.9 Reframing carbon stress testing: from defence to strategy

The purpose of carbon stress testing is not to model worst-case scenarios for reporting purposes. Its real value lies in informing strategic choices:

- Which plants should receive decarbonization capex first
- Which growth projects remain viable under rising carbon prices
- Where internal carbon pricing should be set
- When buying CCCs makes sense and when it doesn't

Companies that embed carbon stress testing into capital planning gain a decisive advantage: they see costs before they materialise.



4.10 A quiet conclusion most companies miss

CCTS does not force companies to decarbonize immediately.
It does something more subtle and more powerful.

It forces companies to choose between:

- Paying for carbon repeatedly, or
- Paying once to reduce it

Over time, the economics of that choice become increasingly one-sided.

The real risk under CCTS is not that carbon prices rise.
The real risk is waiting until they matter.

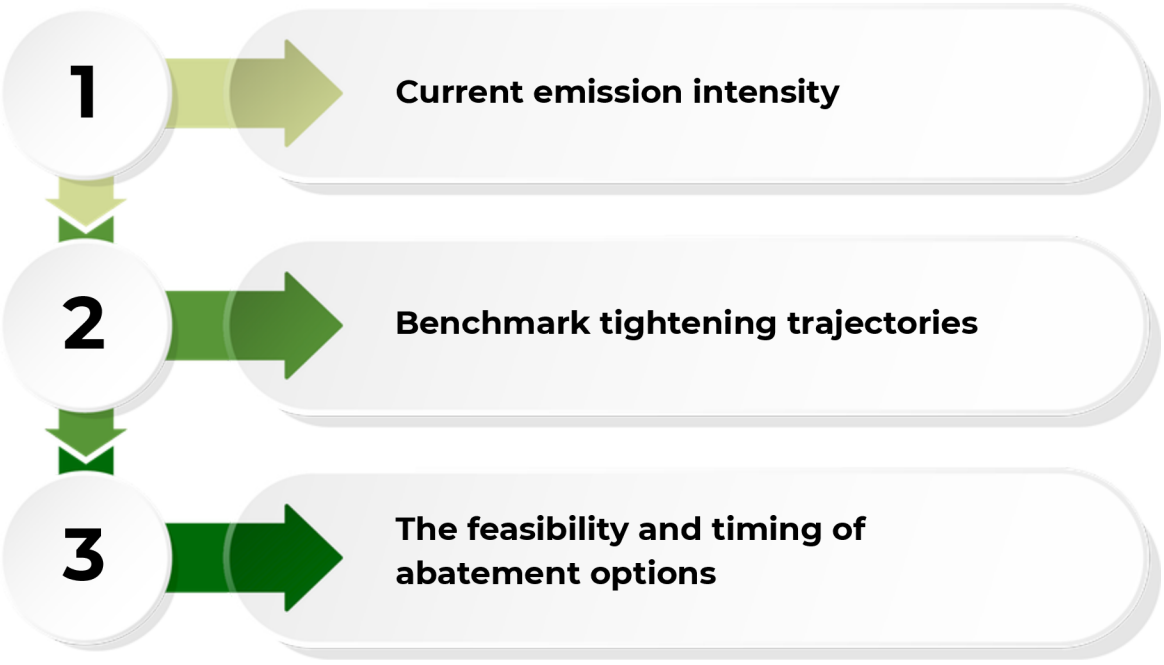
5. Sector impact snapshot: relative exposure under CCTS

5.1 Why relative exposure matters more than absolute emissions

In early discussions around CCTS, sectoral exposure is often reduced to a single question: “Which sectors emit the most?”

This framing is incomplete.

CCTS does not penalize emissions in isolation. It penalises misalignment between:



As a result, relative exposure under CCTS is shaped not only by how much a sector emits, but by how constrained it is in responding. A smaller-emitting sector with limited flexibility can face greater regulatory stress than a larger emitter with mature abatement pathways.

This section therefore ranks sectors based on structural exposure, not speculative cost outcomes.

5. Sector impact snapshot: relative exposure under CCTS

5.2 How sector exposure is assessed in this report

Sector exposure under CCTS has been assessed using publicly available information and policy design logic, across five dimensions:

1. **Emission profile**

   Contribution of the sector to industrial emissions and the nature of those emissions (energy vs process).

2. **Benchmark tightening risk**

   Likelihood of progressively stringent GEI targets based on sector maturity and policy priority.

3. **Abatement optionality**

   Availability, maturity and scalability of emission reduction levers.

4. **Growth interaction**

   Extent to which production growth amplifies intensity-based exposure.

5. **Market and trade sensitivity**

   Exposure to international mechanisms (CBAM), export markets and investor scrutiny.

Each sector is evaluated qualitatively and comparatively, using data from government sources, industry disclosures and global market experience.

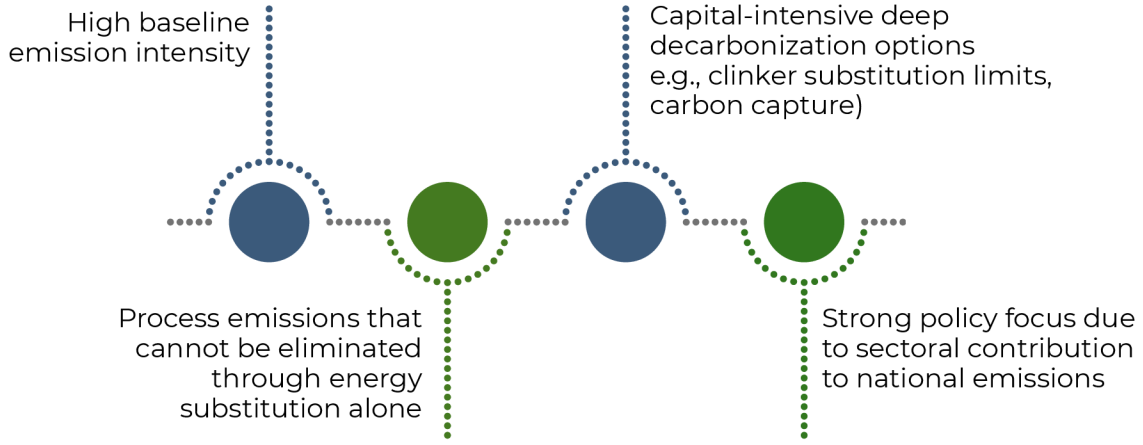
5. Sector impact snapshot: relative exposure under CCTS

5.3 High exposure sectors: structurally constrained and policy-critical

Cement

The cement sector represents one of the highest exposure profiles under CCTS due to the dual nature of its emissions. A significant share of emissions arises from process chemistry rather than fuel use, limiting the effectiveness of conventional efficiency measures.

Key exposure drivers:



While the sector has demonstrated efficiency improvements over time, future reductions require structural changes, making compliance increasingly challenging as benchmarks tighten.

5. Sector impact snapshot: relative exposure under CCTS

Iron and Steel

Iron and steel exhibits similarly high exposure, driven by:

1. Heavy reliance on coal-based processes
2. Long asset lifecycles and high capital lock-in
3. Limited short-term abatement options for primary steelmaking

The sector's exposure is amplified by:

- Expansion plans aligned with national infrastructure growth
- High export sensitivity in certain product categories
- Increasing scrutiny from global buyers and financiers

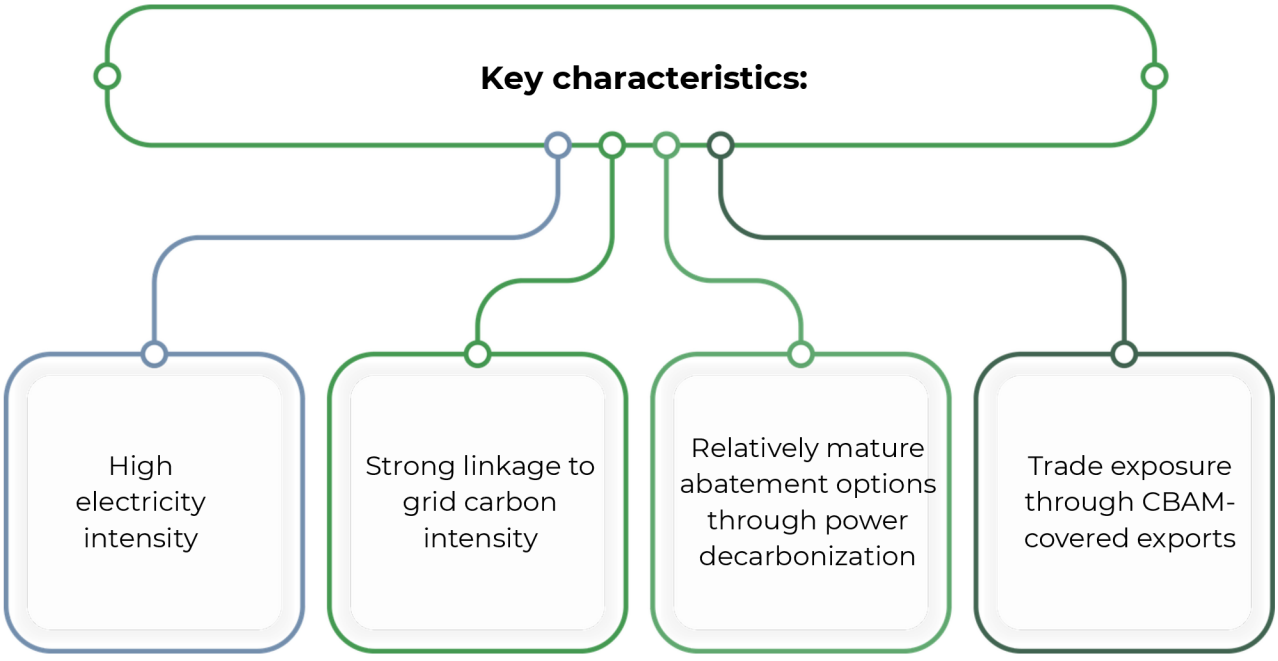
Under an intensity-based regime, production growth without parallel process transformation significantly magnifies regulatory stress.

5. Sector impact snapshot: relative exposure under CCTS

5.4 Medium–high exposure sectors: transition-ready but capital-dependent

Aluminium

Aluminium's exposure under CCTS is shaped less by process chemistry and more by electricity emissions. While this creates substantial exposure in coal-dominated grids, it also offers clear decarbonization pathways through renewable power sourcing.



The sector's exposure is therefore strategic rather than structural companies with access to clean power can materially reduce risk, while others may face sustained pressure.

5. Sector impact snapshot: relative exposure under CCTS

Refineries

Refineries sit at an important intersection of:

- High energy intensity
- Complex process emissions
- Exposure to long-term demand uncertainty from energy transition

Under CCTS, refinery exposure is shaped by:

1. Incremental tightening of efficiency benchmarks
2. Limited short-term abatement beyond optimisation
3. Medium-term reliance on electrification and low-carbon hydrogen

The sector's challenge is not immediate compliance, but long-term competitiveness as carbon costs intersect with shifting fuel demand.

5. Sector impact snapshot: relative exposure under CCTS

5.5 Medium exposure sectors: transition-ready but capital-dependent

Chemicals and Petrochemicals

This sector displays heterogeneous exposure profiles due to:

- Wide variation in feedstocks and processes
- Differences in product lifecycles and market structures

While some sub-sectors face process-related constraints, others benefit from:

Energy efficiency gains

Feedstock optimisation

Emerging circular economy pathways

Under CCTS, exposure is uneven, making internal benchmarking and asset-level strategies critical.

5. Sector impact snapshot: relative exposure under CCTS

Paper and Pulp

Paper and pulp typically exhibits:

- **Moderate emission intensity**
- **Higher flexibility through biomass usage and energy optimisation**
- **Limited exposure to international carbon border mechanisms**

The sector's risk lies more in operational discipline than structural infeasibility. Well-managed assets can remain aligned with tightening benchmarks, while inefficient operations may face increasing compliance pressure.

5. Sector impact snapshot: relative exposure under CCTS

5.6 Lower exposure sectors: compliance-driven rather than transformative

Textile (select segments)

Textiles generally show lower direct exposure under CCTS due to:

- Lower process emissions
- Greater reliance on electricity and thermal energy

However, exposure should not be underestimated.

For textiles, CCTS functions less as a transformational policy and more as a discipline-enforcing mechanism.

5. Sector impact snapshot: relative exposure under CCTS

5.7 Sector exposure map (indicative)

Sector	Relative exposure	Primary driver
Cement	High	Process emissions, limited abatement
Iron & Steel	High	Coal dependence, asset lock-in
Aluminium	Medium-High	Electricity emissions
Refineries	Medium-High	Energy intensity, transition risk
Chemicals	Medium	Process diversity
Paper & Pulp	Medium	Biomass and efficiency leverage
Textiles	Low-Medium	Power mix, margin sensitivity

5. Sector impact snapshot: relative exposure under CCTS

5.8 Priority signals emerging from the snapshot

Three strategic signals cut across sectors:

1. Exposure is path-dependent

Sectors with limited early action face disproportionate pressure in later cycles.

2. Flexibility matters more than baseline position

Sectors with multiple abatement levers are better positioned even if current emissions are high.

3. Growth amplifies divergence

High-growth sectors without aligned decarbonization strategies experience accelerating exposure under intensity-based regimes.

5. Sector impact snapshot: relative exposure under CCTS

5.9 Why this snapshot matters for decision-makers

This sectoral view is not intended to label winners and losers. Its purpose is to prioritise attention.

CCTS does not require every sector to transform at the same pace but it does require every sector to understand where pressure will build first.

For companies, the real value lies in asking:

Those questions not compliance checklists determine who adapts early and who pays later.

6. CCTS readiness index & transition maturity curve

61 CCTS readiness index & transition maturity curve

The uncomfortable truth: exposure does not hurt — unpreparedness does. In every carbon market, companies that struggle most are not always the biggest emitters, but those who believed they were fine until rules hardened, prices moved, or auditors probed deeper. Under CCTS, what separates companies is not ambition statements, but how ready the organisation actually is when carbon stops being theoretical.

Real readiness shows in moments like: production teams knowing before finance that an intensity target will be missed; management debating which plant to decarbonise first, not whether; carbon appearing in capex meetings uninvited. Companies reaching these moments early remain calm; others scramble expensively.

6. CCTS readiness index & transition maturity curve

A predictable pattern has emerged across compliance carbon markets:

01 **Early confidence:** "We're efficient, we'll manage."

02 **First surprise:** data inconsistencies, benchmark interpretation issues, missed targets despite improvements.

03 **Market dependence:** buying credits feels cheaper than fixing operations.

04 **Cost realisation:** credit prices rise, CFOs ask questions.

05 **Late restructuring:** decarbonisation becomes urgent and expensive.

CCTS Readiness is about breaking this sequence early.

6. CCTS readiness index & transition maturity curve

6.2 Five readiness gaps that quietly create exposure:

01

The data illusion

Aggregated, delayed, non-decision-grade emissions data, known annually not operationally, with inability to explain intensity movements. Under CCTS, the lag makes non-compliance visible only after the window to act has closed.

02

The regulation knowledge gap

Treating CCTS as a legal notification to interpret, rather than a technical operating manual. Low readiness: benchmarks accepted without challenge, methodologies followed mechanically. High readiness: teams understand target construction, run scenarios internally, anticipate regulatory updates.

03

The operational disconnect

Carbon tracked by sustainability teams while operations focus on throughput, yield, downtime. High-readiness organisations translate carbon targets into operational language; operators know which levers move intensity. Low-readiness ones discover efficiency gains did not equal compliance.

6. CCTS readiness index & transition maturity curve

The capital blind spot

04

Carbon entering financial conversations only as a future cost, rather than as a capital filter. Prepared firms ask whether assets remain competitive under tighter benchmarks, whether expansions lock in exposure or reduce it, and whether they are investing in flexibility or rigidity. Delaying this thinking erodes optionality.

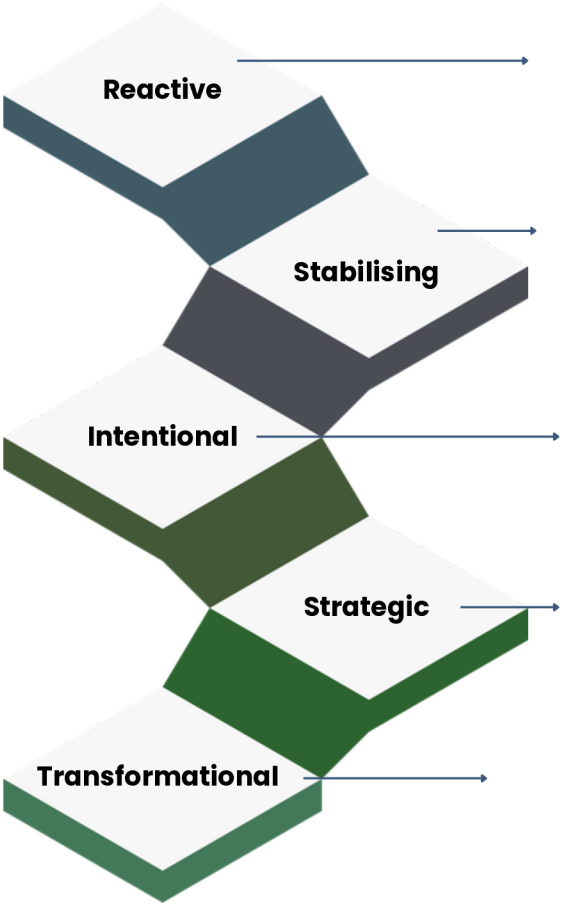
The governance misplacement

05

Carbon sitting with ESG/EHS teams, surfacing annually, discussed after decisions. In prepared companies, carbon appears in operating reviews alongside margins and volumes, quietly and consistently influencing decisions. It's about where carbon sits in the organisational reflex, not about adding committees.

6. CCTS readiness index & transition maturity curve

6.3 The Transition Maturity Curve - Companies move through recognisable stages:



Carbon is something to “handle” at compliance deadlines

Surprises reduce, costs contained but strategy still defensive.

Decarbonisation is sequenced, some costs avoided.

Carbon influences where and how the company grows.

Carbon efficiency becomes a competitive differentiation.

Most Indian companies today sit between Reactive and Stabilising. The opportunity and risk lie in how quickly they move beyond.

7. Boardroom FAQs
20 critical questions answered

This section addresses the most common questions raised by boards, C-suite executives, and investors about CCTS. Answers are concise, actionable, and grounded in current regulatory frameworks.

7. Boardroom FAQs
20 critical questions answered

1 Compliance & timing

When does CCTS compliance actually begin for our sector?

Compliance starts the year your sector's emission-intensity targets are officially notified. For sectors with targets already assigned, 2025–26 and 2026–27 are the first mandatory years. If your company has no target for 2025–26, you stay under PAT Cycle-8 until formal CCTS notification.

What happens if we miss the first compliance deadline?

You pay an environmental compensation tied to the market price of Carbon Credit Certificates (CCCs), set above the average traded price to discourage non-compliance. The penalty does not remove future obligations. Enforcement is currently financial; further sanctions may follow under future rules.

Can we delay compliance if our sector isn't ready?

No. Timelines are fixed by regulation. Use public consultation periods (via industry associations) to input on benchmarks and timelines. Some phasing flexibility has been shown, but once notified, compliance is mandatory.

7. Boardroom FAQs
20 critical questions answered

2 Financial Impact & Accounting

Q: How should we account for carbon liabilities?

Provision them as contingent liabilities under Ind AS 37 in the year emissions occur. CCCs you generate are intangible assets (Ind AS 38). Engage your auditors and ICAI early—accounting guidance will evolve.

What is a realistic carbon price forecast for budgeting?

No official forecast exists. Assume modest prices early, materially higher later, with upside risk greater than downside.

Will carbon costs be accepted as pass-through costs by our customers or regulators?

It depends. Regulated sectors (e.g., power distribution) might get partial, delayed tariff pass-through. In competitive sectors, assume no automatic pass-through. Focus on reducing costs, not recovering them.

7. Boardroom FAQs
20 critical questions answered

3 **Operational & technology**

Do we need to change our production processes or just buy carbon credits?

Buying credits is a short-term tactic. Carbon prices will likely rise faster than abatement costs, and CCC supply is uncertain. Process improvements—efficiency, fuel switching, technology upgrades—are essential long-term.

How accurate does our MRV system need to be? What's the acceptable error margin?

Regulations will specify error thresholds. Under-reporting triggers penalties; over-reporting reduces your burden. Invest in robust monitoring (continuous for large sources) and third-party verification to minimise audit risk.

Can we use carbon offsets from our renewable energy projects ?

No. CCTS targets are intensity-based, covering direct (Scope 1) emissions. Renewable energy reduces Scope 2, not process emissions. Offsets aren't eligible now; this may change in future phases.

7. Boardroom FAQs
20 critical questions answered

4 Carbon credit market & trading

Can we bank surplus CCCs for future years ?

Yes, banking is currently allowed. No detailed limits have been set yet. Treat surplus CCCs as bankable; decide to hold or sell based on commercial strategy, not assumed expiry.

Who will we buy CCCs from if we are short? Is supply guaranteed?

No guaranteed supply. CCCs come only from entities that outperform their targets, traded on exchanges. There is no government backstop. Early-year availability and prices will be uncertain—relying solely on purchases is risky.

Can we trade CCCs internationally?

Currently, only within India. International linking (EU ETS, Article 6) is being explored but not near-term. Don't plan on importing credits. High-quality CCCs could gain value if linking happens later.

7. Boardroom FAQs
20 critical questions answered

5 Strategy & competitiveness

Will our competitors in China or Southeast Asia face similar carbon costs?

China's ETS prices are currently lower; Southeast Asia is fragmented. Short-term competitive disadvantage is possible. Long-term, global carbon pricing convergence is likely, especially for CBAM-exposed exports.

How will CCTS affect our export competitiveness, especially to Europe?

From 2026/27, the EU's CBAM will charge for embedded emissions. Strong CCTS performance may partly offset that cost if recognised under CBAM rules. Competitiveness will depend on your emissions intensity versus the EU carbon price gap.

6 Technology

Should we invest in carbon capture (CCS/CCU) now?

For most companies, not yet—costs are high and the technology is unproven at scale in India. Prioritise energy efficiency and fuel switching. Hard-to-abate sectors with long-lived assets might pilot CCS to build optionality for post-2030.

7. Boardroom FAQs
20 critical questions answered

7 Governance & ESG

How should our board oversee CCTS?

Assign oversight to an ESG/Sustainability Committee. Key duties: approve carbon strategy and abatement capital, review carbon risk quarterly, monitor MRV and compliance, ensure financial provisioning, and link executive KPIs to carbon performance. Treat CCTS as a core business risk.

Must we disclose CCTS liabilities to investors and lenders?

Yes. Disclose in financial statements (contingent liabilities), annual reports (MD&A), and ESG filings (BRSR, CDP, TCFD). Lenders increasingly add carbon covenants. Non-disclosure risks regulatory breach and loss of investor confidence.

What if government changes or rules are relaxed?

Regulatory reversal is unlikely. Carbon pricing is embedded in India's NDCs under the Paris Agreement. Rules may be tweaked (benchmarks, timelines) but direction will tighten. Betting on relaxation is high-risk—over-prepare.

7. Boardroom FAQs
20 critical questions answered

8 Implementation & Next Steps

What is the first thing we should do on Monday morning?

Conduct a rapid carbon exposure assessment: estimate your emission intensity against likely benchmarks, calculate potential CCC shortfall/surplus, and run financial impact at different carbon price scenarios. A 2–4 week directional exercise is enough to kick off board discussions—don't wait for perfect data.

Do we need external consultants or can we manage internally?

Most companies need external support for MRV design and verification, benchmark analysis, abatement technology assessment, and carbon market strategy. Adopt a hybrid model: external expertise for technical areas, internal ownership of strategy and execution

These FAQs will be updated as CCTS regulations evolve and implementation experience accumulates. For sector-specific questions or detailed guidance, consult legal and technical advisors with expertise in carbon markets.

8. Conclusion
the decade of carbon economics

CCTS is fundamentally an economic mechanism, not an environmental directive. By introducing price, scarcity, and accountability into what was once abstract, it forces an overdue reckoning with efficiency, asset longevity, capital allocation, and long-term competitiveness. The next five years constitute a decisive window. Historical patterns from mature carbon markets confirm that early periods of manageable benchmarks and contained prices inevitably give way to tighter constraints, and outcomes are shaped not by initial emission levels but by the discipline, capability, and optionality built during these formative years. For Indian industry, this window offers a finite opportunity to stabilise exposure at low cost, recalibrate systems without disruption, and deploy capital deliberately rather than reactively—before the margin for affordable action narrows permanently.

The firms that endure this transition successfully will be those that treat CCTS as a strategic signal rather than a compliance exercise. They will sequence decarbonisation where it is economically rational, embed carbon into investment governance, and systematically reduce exposure volatility. Over time, this discipline compounds—shifting from a cost-management function into a structural advantage in capital access, operational resilience, and market positioning. The quiet migration of carbon from sustainability disclosures into operating reviews and financial planning will not be announced, but it will define the fault line between prepared and unprepared enterprises. CCTS does not penalise present emissions; it penalises the failure to anticipate their future value. It rewards preparedness over ambition and, for those that recognise it early, offers not a constraint on growth but a framework for more durable and competitive growth. The decade ahead will belong not to those who simply comply, but to those who internalise the carbon price signal to reshape their business for a resource-constrained world.

8. Conclusion
the decade of carbon economics

8.1 A final reflection

CCTS does not ask Indian industry to slow down.
It asks it to grow with awareness.

It does not reward intent. It rewards preparedness.

And it does not penalise emissions today, it penalises the failure to anticipate how emissions will be valued tomorrow.

The companies that recognise this early will find that CCTS is not a constraint on growth, but a framework for more resilient growth.

That distinction will define winners over the next decade.

About the author

Bhoomika is an ESG expert and Chartered Accountancy Article Associate with experience in GHG emissions accounting and MRV (Measurement, Reporting, and Verification) audits in the steel industry.

Her work in emissions assessment, data verification and industrial decarbonization has provided practical insights into carbon management and sector-specific emissions challenges.

This white paper by AVA and MGC Global seeks to provide insights into India's Carbon Credit Trading Scheme (CCTS) and highlight its significance in India's low-carbon transition.

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