# Bridging The Bankability Gap in India's Carbon Credit Trading Scheme: Carbon Contracts for Difference and the CERC–SEBI Jurisdictional Question

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***Abstract*—Purpose: India has legislated a compliance carbon market, the Carbon Credit Trading Scheme (CCTS), 2023, but early Carbon Credit Certificate (CCC) prices are unlikely to finance capital-intensive deep decarbonisation in steel, fertilisers and cement. This paper examines whether Carbon Contracts for Difference (CCfDs) can bridge this bankability gap, and which regulatory architecture would minimise the risk of jurisdictional disputes between the Central Electricity Regulatory Commission (CERC) and the Securities and Exchange Board of India (SEBI).**

**Design/methodology/approach: A mixed-methods design combines doctrinal analysis of Indian statutes, notifications and the Supreme Court's 2021 order on electricity derivatives; a comparative case study of CCfD and related support programmes in Germany, the Netherlands, the United Kingdom, Canada and Denmark; a stylised discounted cash-flow model of a two-way CCfD under three carbon-price paths and four strike prices; and a multi-criteria assessment of regulatory options with robustness checks across four weighting schemes.**

**Findings: Under a central price path, a 15-year CCfD at ₹10,000/$tCO_2e$ for a 1 Mtpa $H_2$-DRI steel plant carries a present-value public cost of about ₹9,921 crore (₹6,449 per discounted tonne). At an identical strike, two-way settlement weakly dominates one-way settlement on fiscal grounds. Because 'Carbon Credit' has been notified under Section 2(bc) of the Securities Contracts (Regulation) Act, 1956 and a CCfD is economically a contract for differences, a CERC-only regime is legally exposed. A sequenced hybrid, which applies the 2021 physical/financial split to CCCs, ring-fences CCfDs as non-traded support contracts and defers SEBI-regulated futures until spot liquidity develops, performs best overall.**

**Originality/value: The paper is, to the author's knowledge, the first to integrate CCfD design, fiscal quantification and the securities-law perimeter of India's carbon market in a single framework.**

**Practical implications: The paper proposes a statutory basis, counterparty fund, auction design, indicative term sheet and a CERC–SEBI–BEE coordination mechanism.**

***Index Terms*—carbon contracts for difference; Carbon Credit Trading Scheme; industrial decarbonisation; green hydrogen steel; commodity derivatives; regulatory jurisdiction; SEBI; CERC; India. JEL classification: Q54, Q58, H23, G13, K23, L94**

## I. INTRODUCTION

India's heavy industry is expanding rapidly, and the plants built in this decade are likely to operate for several decades. The conventional blast furnace–basic oxygen furnace (BF-BOF) route for steel emits roughly 1.8–2.2 $tCO_2$ per tonne of crude steel (International Energy Agency [IEA], 2020). Deep abatement requires hydrogen-based direct reduction with electric arc furnaces ($H_2$-DRI-EAF), green ammonia or carbon capture, utilisation and storage (CCUS), all of which carry large capital costs and, for hydrogen, a persistent operating-cost premium (Ministry of Steel, 2025; Richstein & Neuhoff, 2022). India has chosen carbon pricing as a central instrument. The Energy Conservation (Amendment) Act, 2022 empowered the Central Government to specify a carbon credit trading scheme, and the Carbon Credit Trading Scheme (CCTS), 2023 converted the Perform, Achieve and Trade (PAT) scheme into an intensity-based compliance market with an offset mechanism (Government of India, 2022; Ministry of Power, 2023; International Carbon Action Partnership [ICAP], 2025). The CERC (Terms and Conditions for Purchase and Sale of Carbon Credit Certificates) Regulations, 2026, notified on 27 February 2026, now govern trading on power exchanges, and the first

exchange trades were expected in October 2026 (CERC, 2026; Saur Energy, 2026).

Carbon prices in a young, intensity-based market are likely to be low, thin and volatile. Such prices reward operational efficiency but cannot underwrite 15–30-year investments whose abatement costs lie far above near-term market prices (Chiappinelli & Neuhoff, 2020; Helm et al., 2003). This *bankability gap* is the first problem this paper addresses. Germany, the United Kingdom and Canada have each adopted a variant of the Carbon Contract for Difference (CCfD), a long-term contract in which a public counterparty guarantees a strike price per tonne of verified abatement and settles the difference against a market reference price (Richstein & Neuhoff, 2022; Sartor & Bataille, 2019).

A second, less studied problem is legal. CCCs are traded under CERC oversight, yet 'Carbon Credit' has been a notified commodity for derivatives trading under Section 2(bc) of the Securities Contracts (Regulation) Act, 1956 (SCRA) since 2016 (Ministry of Finance, 2016, 2024; SEBI, 2016). A CCfD settled on the CCC price is, in economic form, a 'contract for differences', which is the language of the SCRA's definition of a commodity derivative. India has seen this fault line before: exchange-traded electricity derivatives were stalled for more than a decade by a CERC–SEBI (formerly Forward Markets Commission) dispute that ended only with the Supreme Court's order of 6 October 2021 (Press Information Bureau [PIB], 2021).

The paper therefore asks four research questions:

RQ1. Can the CCTS, as designed, provide the revenue certainty required for first-of-a-kind industrial decarbonisation in India?

RQ2. Which design features of international CCfD programmes are transferable to India?

RQ3. What fiscal exposure would an Indian two-way CCfD create under alternative carbon-price paths and strike prices, and how does it compare with a one-way design?

RQ4. Which regulatory architecture, a CERC-led regime or a CERC–SEBI split modelled on the 2021 electricity settlement, best reduces the risk of future jurisdictional disputes while supporting market development?

The paper makes three contributions. First, it provides an Indian-specific quantification of CCfD fiscal exposure, which the largely European literature does not offer. Second, it brings the securities-law perimeter into the CCfD design debate, showing that instrument design and regulatory jurisdiction cannot be separated in India. Third, it proposes an implementable framework, comprising statutory anchoring, a counterparty fund, allocation rules, safeguards and a coordination mechanism, that can inform the Bureau of Energy Efficiency (BEE), the Ministry of Power, the Ministry of Finance, CERC and SEBI.

Section 2 reviews the literature. Section 3 describes the institutional background. Section 4 sets out the methodology. Section 5 presents results. Section 6 discusses a proposed framework and safeguards, Section 7 draws policy implications, Section 8 notes limitations and Section 9 concludes.

## II. LITERATURE REVIEW

### 2.1 Carbon pricing, uncertainty and investment

The classic instrument-choice literature compares price and quantity instruments under uncertainty (Weitzman, 1974; Hepburn, 2006).

For long-lived investments, however, the central problem is not static efficiency but the credibility of future prices. Helm et al. (2003) argue that governments face a time-inconsistency problem in carbon policy analogous to that identified by Kydland and Prescott (1977): once firms have invested, governments are tempted to relax policy, so investors discount announced carbon prices. Chiappinelli and Neuhoff (2020) show formally that CCfDs can restore time consistency by converting a policy commitment into a contractual one.

Grubb et al. (2014) describe three domains of low-carbon policy: standards and engagement, market pricing, and strategic investment in innovation. Carbon markets operate mainly in the second domain; first-of-a-kind industrial plants belong to the third. This framing explains why emissions trading systems (ETSs) have delivered operational abatement but limited breakthrough investment (Narassimhan et al., 2018).

Rodrik (2014) similarly argues that green industrial policy is needed where market prices fail to reflect learning and coordination externalities.

2.2 Carbon contracts for difference: theory and design

Richstein and Neuhoff (2022) show that CCfDs reduce the cost of capital for low-carbon industrial investment by hedging carbon-price risk, and that two-way designs limit public cost when carbon prices rise. Sartor and Bataille (2019) propose CCfDs for basic materials in Europe, emphasising competitive allocation and the need to avoid over-compensation. Gerres and Linares (2020) discuss how CCfDs interact with free allocation and carbon leakage. Design questions emphasised in this literature include the choice of reference price, the treatment of energy-input risk through indexation, contract length, and the interaction with other subsidies (Clean Air Task Force, n.d.; International Renewable Energy Agency [IRENA], 2024).

The European Commission's Climate, Energy and Environmental Aid Guidelines (CEEAG) and its dedicated CCfD guidance supply a practical rulebook: aid must have an incentive effect, be limited to the funding gap relative to a counterfactual, be allocated competitively where possible, and exclude unabated fossil technologies (European Commission, 2022, 2026).

2.3 Financialisation and the regulation of carbon markets

Mature carbon markets are predominantly derivatives markets. The European Securities and Markets Authority (ESMA, 2024) reports that futures and options together accounted for about 99% of on-exchange EU allowance trading volume in 2023 (futures about 81% and options about 18%). Since January 2018, EU emission allowances have been financial instruments under MiFID II (ESMA, 2022). Quemin and Pahle (2023) warn that financial participants can amplify price swings and weaken the link between allowance prices and fundamentals, which has implications for any CCfD that uses a market price as its reference.

In the United States, allowance programmes are administered by state agencies while the Commodity Futures Trading Commission (CFTC) regulates carbon derivatives, and the CFTC issued guidance on listing voluntary carbon credit derivatives in 2024 (CFTC, 2024), although it withdrew that guidance in September 2025 as unnecessary under its existing listing framework (CFTC, 2025).

2.4 Shared regulatory space

The legal literature on shared regulatory space shows that overlapping mandates can produce either productive redundancy or costly conflict, and that coordination instruments such as memoranda of understanding, joint rulemaking and inter-agency working groups determine which outcome prevails (Freeman & Rossi, 2012). India's electricity-derivatives experience is a clear case of conflict. Forward Markets Commission (FMC) approval of Multi Commodity Exchange (MCX) electricity forward contracts in January 2009 was followed by CERC orders of April 2009 and January 2010 asserting jurisdiction, and by a Bombay High Court judgment of 7 February 2011 holding that neither regulator had exclusive jurisdiction. The matter was resolved only in 2021 (Business Standard, 2021; Regulatory Despatch, n.d.).

2.5 Research gap

The CCfD literature is overwhelmingly European, assumes a mature reference market such as the EU ETS, and treats the regulatory perimeter as settled. The Indian literature on the CCTS is still largely descriptive and practitioner-oriented (ICAP, 2025; IndiaCorpLaw, 2026). Recent policy work notes that the 2021 CERC–SEBI settlement offers a pathway for CCC derivatives once spot liquidity develops, and describes CCfDs as government-backed instruments used in Europe to de-risk industrial decarbonisation (Institute for Energy Economics and Financial Analysis [IEEFA], 2026). To the author's knowledge, however, no study has quantified CCfD fiscal exposure for India or examined how the SCRA commodity notification bears on CCfDs specifically. This paper addresses that gap.

## III. INSTITUTIONAL BACKGROUND

3.1 The Carbon Credit Trading Scheme

The CCTS rests on Sections 14(w) and 14AA of the Energy Conservation Act, 2001, inserted by the 2022 amendment. Table 1 summarises its operating instruments. The National Steering Committee for the Indian Carbon Market (NSCICM) provides oversight, BEE administers the scheme, the Grid Controller of India operates the registry, and Accredited Carbon Verification Agencies (ACVAs) verify emissions (ICAP, 2025; Ministry of Power, 2023). Compliance

obligations are in force for about 490 entities in seven of the nine planned sectors; final targets for iron and steel and for fertilisers, the two sectors most relevant to this paper, were still pending at the time of writing, although draft plant-wise targets for 255 iron and steel units were published for consultation on 26 June 2026 (ICAP, 2026; MoEFCC, 2026).

Table 1 *Operating Instruments of India's Carbon Credit Trading Scheme*

| Instrument | Issuing authority | Function |
|---|---|---|
| Carbon Credit Trading Scheme, 2023 | Ministry of Power | Establishes compliance and offset mechanisms; designates institutions |
| Detailed Procedure for Compliance Mechanism (2024) | BEE | Gate-to-gate Scope 1 and 2 emission-intensity methodology for obligated entities |
| Detailed Procedure for Offset Mechanism (2025) | BEE | Registration of offset projects by non-obligated entities |
| GHG Emission Intensity Target Rules (2025–26) | MoEFCC | Facility-level intensity targets for seven of nine planned sectors (about 490 of about 740 entities); iron and steel and fertilisers pending |
| CERC CCC Regulations, 2026 | CERC | Monthly trading sessions on power exchanges, price band, T+1 settlement, surveillance |
| Registry | Grid Controller of India | Issuance, transfer and retirement of CCCs |

*Note.* Compiled from BEE (2024, 2025), CERC (2026), ICAP (2025, 2026), Ministry of Environment, Forest and Climate Change [MoEFCC] (2025), Ministry of Power (2023) and Saur Energy (2026).

3.2 The electricity-derivatives precedent

A Ministry of Power committee, constituted on 26 October 2018, recommended a division of jurisdiction which the Supreme Court endorsed on 6 October 2021. CERC regulates ready-delivery and non-transferable specific delivery (NTSD) contracts, meaning contracts that must be settled by physical delivery without netting, whose rights and liabilities cannot be transferred, and which are traded only by grid-connected entities. SEBI regulates all other commodity derivatives in electricity.

A SEBI–CERC Joint Working Group (JWG) was to be constituted (PIB, 2021). SEBI approved monthly electricity futures on MCX and the National Stock Exchange (NSE) in mid-2025. The MCX contract is a 50 MWh, cash-settled contract referencing the volume-weighted Indian Energy Exchange (IEX) day-ahead price, and trading began on 10 July 2025 (Mercom India, 2025; NSE, 2025).

## IV. METHODOLOGY

The study adopts a mixed-methods, policy-analytic design (Table 2). Each research question is addressed with the method best suited to it, and the findings are triangulated in the discussion.

Table 2 *Research Design*

| Research question | Method | Data and sources |
|---|---|---|
| RQ1: Bankability of CCTS | Institutional and economic analysis | CCTS instruments; CERC regulations; literature on investment under policy uncertainty |
| RQ2: Transferable design lessons | Comparative case study (five jurisdictions) | Official programme documents, State-aid guidance, secondary literature |
| RQ3: Fiscal exposure | Stylised discounted cash-flow model with scenario and sensitivity analysis | Author's assumptions (Table 3); illustrative price paths |
| RQ4: Regulatory architecture | Doctrinal legal analysis; multi-criteria assessment (MCA) with weighting robustness | SCRA, Energy Conservation Act, notifications, 2021 Supreme Court order, market data from MCX and ESMA |

4.1 Comparative case study

Cases were selected purposively to span different counterparties and allocation models: a ministry-run auction (Germany), a multi-technology subsidy auction (the Netherlands), a dedicated counterparty company (the United Kingdom), an arm's-length investment fund (Canada) and a full-chain CCUS auction (Denmark). Each case was coded on counterparty, sectoral scope, term, settlement symmetry, indexation and risk allocation.

4.2 Stylised fiscal model

Settlement for contract year $t$ is given by Equation 1, where $K_t$ is the strike price, $P_t$ the reference CCC price and $Q_t$ verified abatement. In practice the strike may be indexed as in Equation 2, where $E$ and $H$ are electricity and hydrogen price indices; the base model holds the strike fixed to isolate carbon-price effects.

$$S_t = (K_t - P_t)\,Q_t \quad \text{(two-way)}; \qquad S_t^{1W} = \max(K_t - P_t,\, 0)\,Q_t \quad \text{(one-way)} \tag{1}$$

$$K_t = K_0\left[\alpha\frac{CPI_t}{CPI_0} + \beta\frac{E_t}{E_0} + \gamma\frac{H_t}{H_0}\right], \qquad \alpha+\beta+\gamma = 1 \tag{2}$$

Reference prices follow a geometric path (Equation 3). The present value of public payments and the levelised public cost per discounted tonne, $c^*$, are computed as in Equation 4.

$$P_t = P_1\,(1+g)^{t-1} \tag{3}$$

$$PV = \sum_{t=1}^{T}\frac{S_t}{(1+r)^t}, \qquad c^* = \frac{PV}{\sum_{t=1}^{T} Q_t\,(1+r)^{-t}} \tag{4}$$

Table 3 *Model Assumptions*

| Parameter | Value | Rationale |
|---|---|---|
| Reference project | 1 Mtpa $H_2$-DRI-EAF steel plant | Representative first-of-a-kind project |
| Verified abatement, $Q_t$ | 1.0 and 1.5 $MtCO_2e$ in years 1–2; 1.8 $MtCO_2e$ thereafter | Ramp-up; about 1.8 $tCO_2$ avoided per tonne versus BF-BOF (IEA, 2020) |
| Contract term, T | 15 years | International norm (Table 4) |
| Strike prices, K | ₹6,000, ₹8,000, ₹10,000, ₹12,000 per $tCO_2e$ | Spans plausible abatement-cost range; not estimates |
| Low price path | $P_1$ = ₹300; g = 20% (year 15 ≈ ₹3,852) | Persistent oversupply of CCCs |
| Central price path | $P_1$ = ₹500; g = 27.2% (year 15 ≈ ₹14,514) | Gradual tightening of GEI targets |
| High price path | $P_1$ = ₹800; g = 25% (year 15 ≈ ₹18,190) | Rapid tightening and CBAM alignment |
| Discount rate, r | 7% nominal | Approximate long-term government borrowing cost; cash flows are in current rupees |

*Note.* Initial prices are consistent with early market estimates of ₹250–1,500 per tonne (Saur Energy, 2026). All values are illustrative and are not forecasts.

4.3 Doctrinal analysis and multi-criteria assessment

The doctrinal analysis examines the text of SCRA Sections 2(ac), 2(bc) and 18A, the commodity notifications of 2016 and 2024, the Energy Conservation Act, the CCTS and the CERC 2026 Regulations, and the terms of the 2021 Supreme Court settlement. Three options are then assessed against eight criteria derived from the literature: legal certainty, speed to launch, institutional fit, hedging depth, market-integrity tools, control of speculation, coordination burden and alignment with the 2021 precedent. Scores $s_{ij}$ on a 1–5 scale are the author's qualitative judgements. Weighted values are computed as in Equation 5 under four weighting schemes to test whether rankings are robust.

$$V_j = \sum_{i=1}^{8} w_i\, s_{ij}, \qquad \sum_i w_i = 1 \tag{5}$$

## V. RESULTS

5.1 The bankability gap (RQ1)

The CCTS is well designed for measuring, allocating and trading emissions performance, but three features limit its ability to finance deep abatement. First, intensity targets allow absolute emissions to grow with output, making CCC scarcity dependent on how trajectories are tightened. Second, trading is monthly and liquidity is untested.

Third, India's higher cost of capital magnifies the penalty that lenders impose on uncertain revenue. Figure 1 illustrates the resulting gap between abatement cost and expected CCC prices.

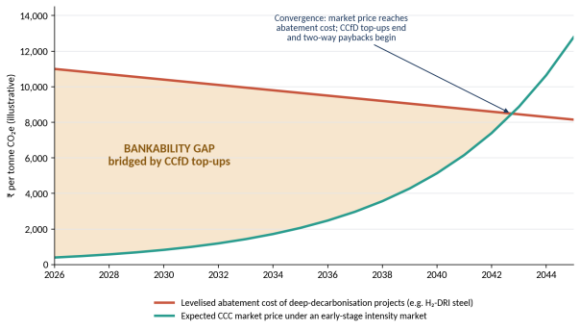


Figure 1 *Stylised Bankability Gap Between Abatement Cost and Expected CCC Prices*

*Note.* Values are illustrative and indicate shape rather than forecasts. The shaded area represents the revenue shortfall that a CCfD would cover. Source: Author's construction.

A CCfD converts this uncertain carbon revenue into a contractual cash flow while preserving the market price signal for all other participants (Figure 2).

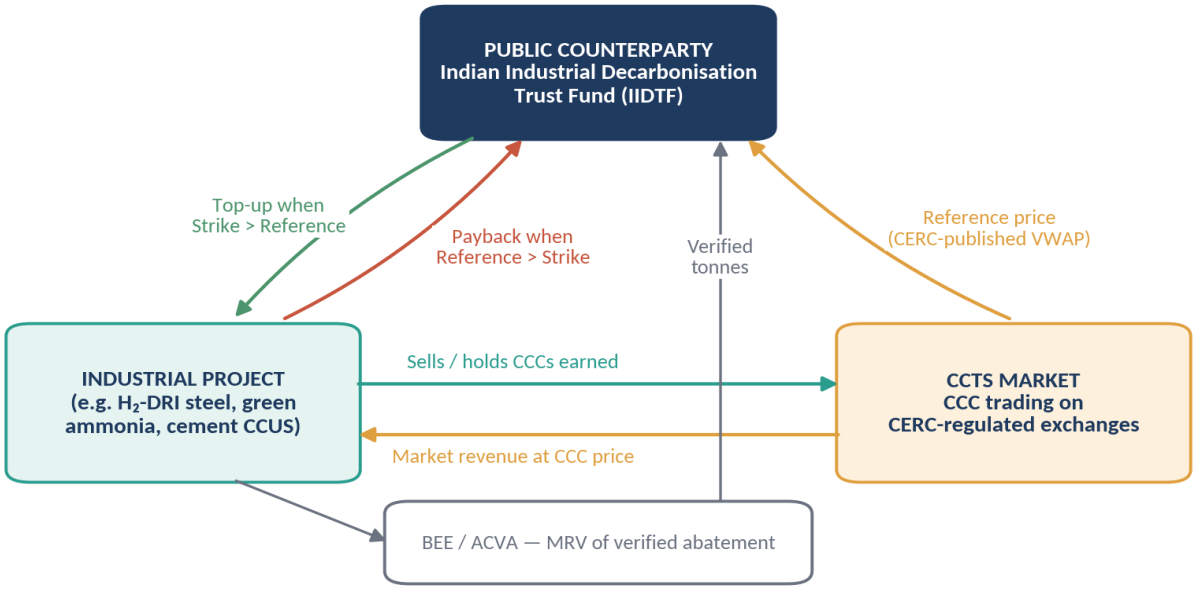


Figure 2 *Flows Under a Carbon Contract for Difference Alongside the CCTS*

*Note.* IIDTF = proposed Indian Industrial Decarbonisation Trust Fund;
VWAP = volume-weighted average price. Source: Author's construction.

### 5.2 Comparative findings (RQ2)

Table 4 *CCfD and Related Programmes in Selected Jurisdictions*

| Jurisdiction | Programme and counterparty | Term | Key design features |
|---|---|---|---|
| Germany | Klimaschutzverträge; federal economy ministry | 15 years | Two-way; technology-neutral auctions; strike indexed to electricity, gas and hydrogen; EUA reference; first round budget about €4 billion, of which up to €2.8 billion was awarded to 15 projects in October 2024 |
| Netherlands | SDE++; Netherlands Enterprise Agency (RVO) | 12–15 years | Multi-technology auction ranked on subsidy per tonne avoided; funding-gap model |
| United Kingdom | Industrial Carbon Capture contracts; Low Carbon Contracts Company | 15 years | Two-way; CPI indexation; UK ETS reference; allocation of $CO_2$ transport and storage risk |

| Jurisdiction | Programme and counterparty | Term | Key design features |
|---|---|---|---|
| Canada | Carbon credit offtakes and CCfDs; Canada Growth Fund | Up to 15 years | Bilateral; protection against carbon-policy change; e.g. CAD 86.50/t offtake with Entropy Inc. |
| Denmark | CCUS Fund; Danish Energy Agency | 15–20 years | Reverse auctions for full capture–transport–storage chain |

*Note.* Compiled from BMWK (2024), Clean Energy Ministerial [CEM] (2025), Department of Finance Canada (2023), Government of Canada (2024), Global CCS Institute (2025), IRENA (2024) and Low Carbon Contracts Company [LCCC] (n.d.).

Table 5 distils seven transferable lessons. Two points are especially relevant for India. The Canadian case shows that where the carbon price is itself policy-dependent, protection against regulatory change is as valuable as price support. In contrast, the United States' reliance on tax credits, whose scope was narrowed by federal legislation in 2025 (Public Law 119-21), illustrates how quickly revenue certainty can erode without a contractual commitment.

Table 5 *Design Lessons from International Experience and Implications for India*

| Lesson | Evidence | Implication for India |
|---|---|---|
| Two-way settlement | Standard in Germany and the UK | Adopt from the outset; recycle paybacks |
| Competitive allocation | Dutch ranking by subsidy per tonne | Sector-specific reverse auctions for pilots |
| Input-cost indexation | German dynamic strike | Index to CPI, CERC power prices and a hydrogen benchmark |
| Tenor matches debt | 12–20 years across the cases in Table 4 | Minimum 15 years; 20 years for CCUS |
| Cross-chain risk allocation | UK transport-and-storage terms | Define compensation for $CO_2$ network delays |
| Policy-risk protection | Canada Growth Fund contracts | Change-in-law clause covering GEI trajectory revisions |
| Anti-over-compensation rulebook | EU CEEAG and CCfD guidance | Funding-gap cap and anti-stacking rules |

*Note.* Source: Author's synthesis of the cases in Table 4 and European Commission (2022, 2026).

5.3 Fiscal exposure (RQ3)

Figure 3 shows the three reference-price paths against the four strike prices. Under the low path, the reference price never reaches any strike, so the contract behaves like a pure subsidy. Under the central path, a ₹10,000 strike is crossed in year 14; under the high path, in year 13.

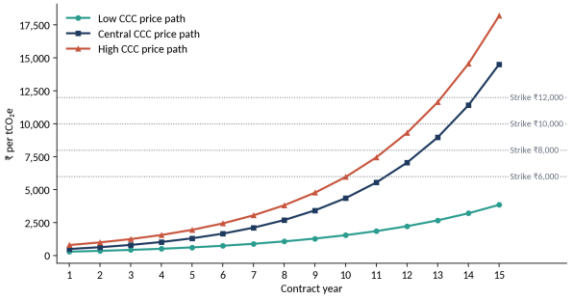


Figure 3 *Reference CCC Price Paths and Strike Prices Used in the Model*

*Note.* Paths follow Equation 3 with parameters in Table 3. Source: Author's calculations.

For the central case (₹10,000 strike, central path), the counterparty pays gross top-ups of ₹15,139 crore and recovers ₹1,066 crore in years 14–15, for a nominal net cost of ₹14,073 crore and a present value of ₹9,921 crore (Figure 4). The levelised public cost is ₹6,449 per discounted tonne of $CO_2e$.

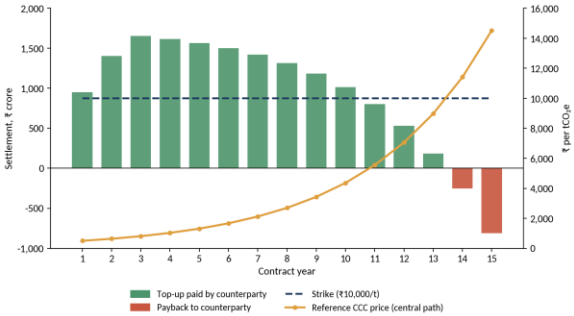


Figure 4 *Annual Two-Way Settlement for the Central Case*

*Note.* Positive values are top-ups from the counterparty; negative values are paybacks to it. Source: Author's calculations.

Table 6 and Figure 5 report the full sensitivity grid. Three results stand out. First, fiscal exposure is dominated by the gap between strike and early-year prices, so competitive discovery of the strike is the most powerful cost lever: each ₹2,000 reduction in strike lowers levelised cost by about ₹2,000 per tonne. Second, two-way settlement weakly dominates one-way settlement: it is never more expensive and becomes substantially cheaper as prices rise, saving 4% of present-value cost in the central case and 11% under the high path at a ₹10,000 strike, and 54% at a ₹6,000 strike under the high path. Third, under the low path the two designs are identical, which shows that the fiscal risk of CCfDs lies in carbon-market *under-performance*. This links CCfD cost directly to the credibility of GEI target-setting. These comparisons hold the strike constant across designs. In an auction, bidders for a one-way contract retain the upside from high carbon prices and could therefore bid a lower strike than for a two-way contract, so the saving from two-way settlement reported here is an upper bound. The stronger case for two-way contracts rests on lower public risk, avoided windfall gains and preserved market incentives.

Table 6 *Present-Value Public Cost of a 15-Year CCfD by Price Path and Strike*

| Price path | Strike (₹/t) | PV one-way (₹ crore) | PV two-way (₹ crore) | Saving (₹ crore) | Levelised two-way cost (₹/t) | Year reference ≥ strike |
|---|---|---|---|---|---|---|
| Low | ₹6,000 | 7,358 | 7,358 | 0 | 4,783 | — |
| Low | ₹8,000 | 10,435 | 10,435 | 0 | 6,783 | — |
| Low | ₹10,000 | 13,512 | 13,512 | 0 | 8,783 | — |
| Low | ₹12,000 | 16,589 | 16,589 | 0 | 10,783 | — |
| Central | ₹6,000 | 5,007 | 3,768 | 1,239 | 2,449 | 12 |
| Central | ₹8,000 | 7,580 | 6,845 | 736 | 4,449 | 13 |
| Central | ₹10,000 | 10,314 | 9,921 | 393 | 6,449 | 14 |
| Central | ₹12,000 | 13,162 | 12,998 | 164 | 8,449 | 15 |
| High | ₹6,000 | 4,078 | 1,876 | 2,202 | 1,219 | 11 |
| High | ₹8,000 | 6,452 | 4,953 | 1,499 | 3,219 | 12 |
| High | ₹10,000 | 9,004 | 8,029 | 975 | 5,219 | 13 |
| High | ₹12,000 | 11,688 | 11,106 | 582 | 7,219 | 14 |

*Note.* PV at 7%. Levelised cost = PV of payments divided by discounted tonnes (Equation 4). Source: Author's calculations.

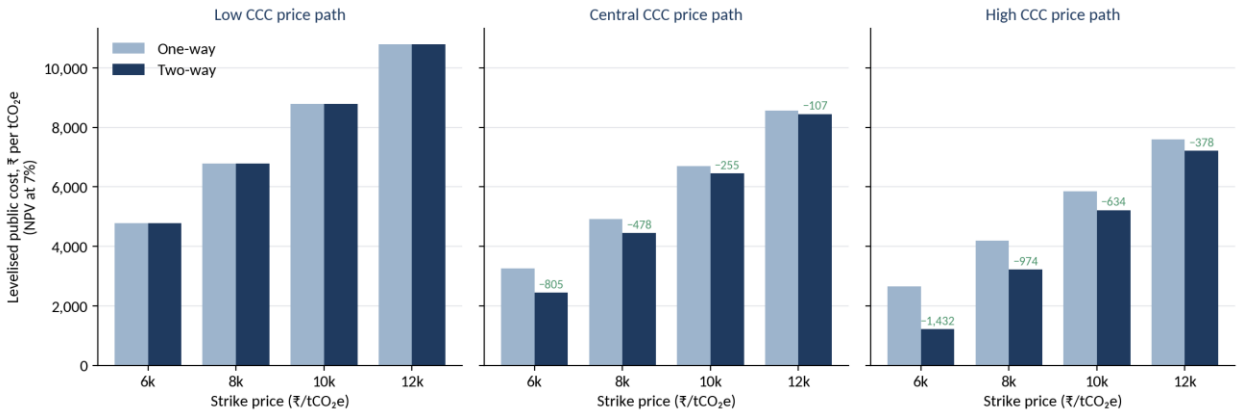


Figure 5 *Levelised Public Cost Under One-Way and Two-Way Designs*

*Note.* Labels show the saving from two-way settlement in ₹ per discounted tonne. Source: Author's calculations.

5.4 Legal analysis: the securities-law perimeter (RQ4)
Table 7 sets out the doctrinal analysis. The central finding is that CCCs and CCfDs sit in a zone of *overlapping plausible jurisdiction*. On one side, CERC has an express role in CCC trading under the CCTS and its 2026 Regulations, which describe CCCs as not being financial instruments in the initial phase. On the other side, the SCRA notification of 2016 listed 'Carbon Credit' as item 62 in the energy group of goods eligible for commodity derivatives (Ministry of Finance, 2016; SEBI, 2016). The 2024 notification superseded that list and retains the entry, at item 73 of its Schedule (Ministry of Finance, 2024).

Commentary is divided on whether the entry reaches CCCs created under the 2022 amendment: one recent analysis states that SEBI "can only regulate the trading of notified commodities, which currently do not include carbon credits" (IndiaCorpLaw, 2026), while other reports that "SEBI has classified carbon credits as goods under the Securities Contracts (Regulation) Act (SCRA), meaning any derivative on a CCC would be a commodity derivative regulated by SEBI" (IEEFA, 2026, p. [page]).

Table 7 *Doctrinal Analysis of Provisions Bearing on CCCs and CCfDs*

| Provision | Content (paraphrased) | Application to carbon | Dispute risk |
|---|---|---|---|
| SCRA s. 2(bc) | Commodity derivative includes a non-ready-delivery contract for notified goods and a contract for differences deriving value from their prices | CCC futures clearly covered if 'Carbon Credit' includes CCCs; a CCfD is economically a contract for differences | High |
| SCRA s. 18A | Derivative contracts are valid if traded and settled on a recognised stock exchange | Off-exchange bilateral CCfDs could face enforceability arguments | Medium |
| S.O. 3068(E), 2016; S.O. 1002(E), 2024 | Central Government lists goods for commodity derivatives | 'Carbon Credit' listed at item 62 in 2016 and at item 73 in the 2024 Schedule, which superseded the 2016 list | Medium |
| EC Act ss. 14(w), 14AA; CCTS 2023 | Scheme for carbon credit trading; CERC role in trading | Supports CERC jurisdiction over CCC spot market | Low (for spot) |
| CERC CCC Regulations, 2026 | Monthly exchange sessions; CCCs not financial instruments in this phase | Silent on derivatives and CCfDs | Medium |
| Supreme Court order, 6 Oct 2021 | Physical delivery and non-transferability tests divide CERC and SEBI roles in electricity | Persuasive template; not binding for carbon | Mitigating |

*Note.* Provisions are paraphrased; the Gazette text is authoritative. Sources: Government of India (1956, 2022); Ministry of Finance (2016, 2024); CERC (2026); PIB (2021).

Figure 6 places carbon on the same timeline as electricity. The electricity dispute imposed a long period without exchange-traded hedging instruments. Once resolved, the market developed rapidly: MCX electricity futures' average daily volume rose from 65,631 MWh in FY2025-26 to 89,213 MWh in FY2026-27 to date, and turnover reached a record ₹245 crore on 4 September 2026 (ANI, 2026) (Figure 7).

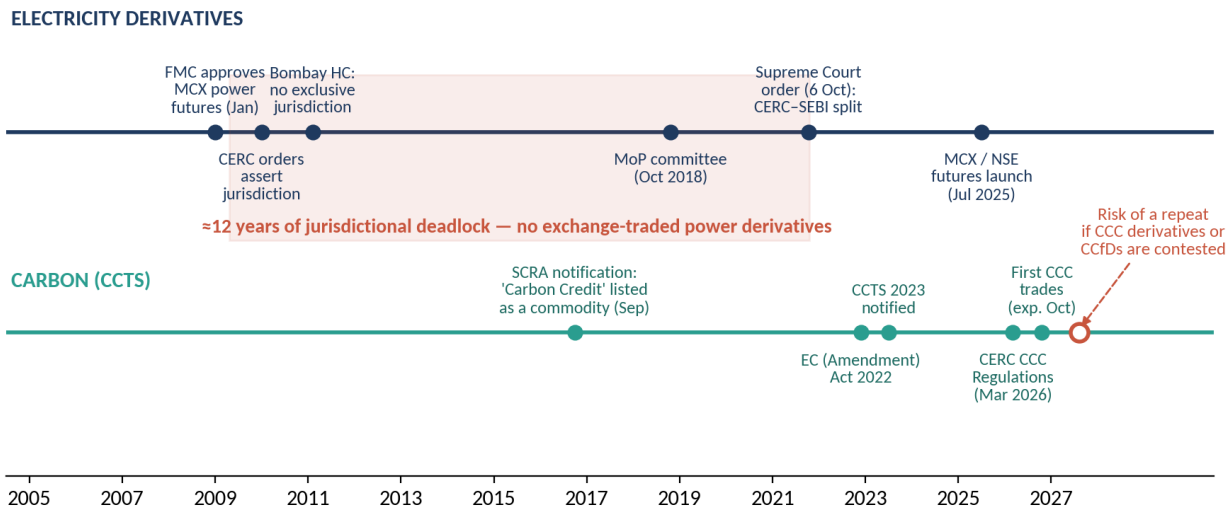


Figure 6 *Jurisdictional Timelines for Electricity Derivatives and the Indian Carbon Market*

*Note.* Sources: Business Standard (2021); CERC (2026); Ministry of Finance (2016); Ministry of Power (2023); PIB (2021); Regulatory Despatch (n.d.); Saur Energy (2026).

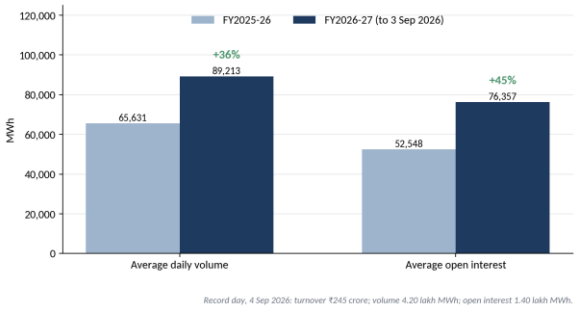


Figure 7 *MCX Electricity Futures After the 2021 Settlement*

*Note.* FY2026-27 data are to 3 September 2026. Source: MCX data reported by ANI (2026).

International evidence reinforces the point that carbon derivatives, not spot trades, dominate mature markets (Figure 8; Table 8).

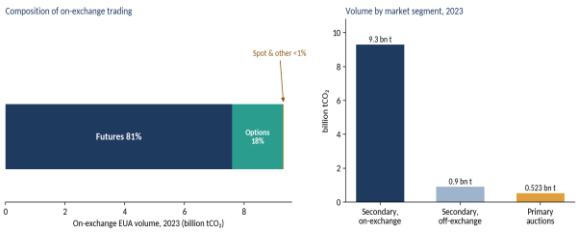


Figure 8 *Structure of EU Carbon Allowance Trading, 2023*

*Note.* Source: ESMA (2024).

Table 8 *Regulatory Models in Major Carbon Markets*

| Jurisdiction | Underlying allowance or credit | Derivatives regulator | Model |
|---|---|---|---|
| European Union | Allowances are MiFID II financial instruments | National financial regulators; ESMA | Integrated financial |
| United Kingdom | Allowances treated as financial instruments | Financial Conduct Authority | Integrated financial |
| United States (state programmes) | State agencies (e.g., California Air Resources Board) | CFTC | Split: programme + financial |
| India, Option A | CERC via power exchanges | None, or CERC | Integrated sectoral |
| India, Option B | CERC via power exchanges | SEBI via stock exchanges | Split on 2021 model |

*Note.* Sources: CFTC (2024, 2025); ESMA (2022, 2024).

5.5 Regulatory options and multi-criteria assessment (RQ4)

Option A (CERC-led). CERC regulates all CCTS transactions. CCfDs are bilateral contracts settled against the CERC reference price, and cash-settled

exchange-traded CCC derivatives are not permitted. The option requires a statutory carve-out declaring that CCTS instruments and CCfDs are not commodity derivatives under the SCRA.

Option B (CERC–SEBI split). The 2021 physical-delivery and transferability tests draw the boundary. CERC regulates CCC spot trading, registry transfers and NTSD contracts; SEBI regulates cash-settled CCC futures and options on stock exchanges. CCfDs remain non-transferable government support contracts outside the SEBI perimeter, and a SEBI–CERC–BEE Carbon JWG coordinates data, surveillance and reference-price integrity (Figure 9).

Sequenced hybrid. The Option B boundary is legislated immediately, with the CCfD exclusion, but SEBI-regulated derivatives are introduced only after one or two compliance cycles of spot trading, with position limits and initial hedger-only participation.

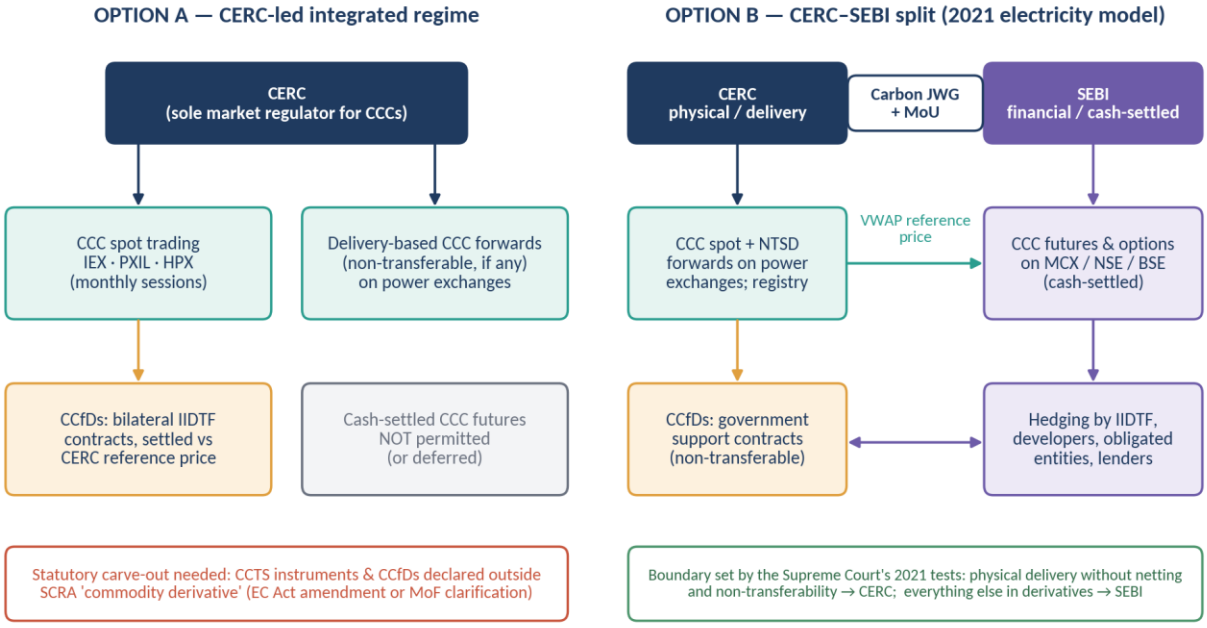


Figure 9 *Architecture of Regulatory Options A and B*

*Note.* NTSD = non-transferable specific delivery. Source: Author's construction.

Table 9 *Advantages and Disadvantages of the Regulatory Options*

| Option | Advantages | Disadvantages |
|---|---|---|
| A. CERC-led | Single regulator and rulebook<br>Fastest route to launching CCfDs<br>Limits speculation in a thin market<br>Aligns carbon and energy regulation | Inconsistent with the SCRA notification unless carved out by statute<br>No exchange-traded hedging; weak forward curve<br>Lacks SEBI's clearing, margining and investor-protection tools<br>Diverges from the 2021 precedent; dispute could reopen |
| B. CERC–SEBI split | Follows a boundary the Supreme Court has endorsed<br>Consistent with the SCRA; enables CCC futures<br>Deep hedging for firms, lenders and the counterparty<br>Matches EU and US practice | Coordination cost and boundary gaps<br>Financialisation may amplify volatility (Quemin & Pahle, 2023)<br>Derivatives on a thin monthly spot market invite manipulation<br>Longer design period |

*Note.* Source: Author's analysis.

Figure 10 and Table 10 present the MCA. Under equal weights, the hybrid scores 3.88, Option B 3.75 and Option A 3.38. The ranking is robust in one important respect: Option A ranks last under every weighting scheme. The hybrid ranks first under three schemes, while Option B edges ahead under investor-priority weights, which reward hedging depth. The difference between B and the hybrid is therefore one of sequencing rather than of design.




Figure 10 *Multi-Criteria Scores of Regulatory Options*

*Note.* Scores are the author's qualitative judgement on a 1–5 scale. Source: Author's analysis.

Table 10 *Weighted MCA Scores Under Alternative Weighting Schemes*

| Weighting scheme | Option A | Option B | Hybrid | Highest |
|---|---|---|---|---|
| Equal weights | 3.38 | 3.75 | 3.88 | Hybrid |
| Investor-priority | 3.00 | 4.10 | 4.05 | B |
| Fiscal/market-prudence | 3.35 | 3.70 | 3.85 | Hybrid |
| Legal-certainty-priority | 2.85 | 4.05 | 4.10 | Hybrid |

*Note.* Weights (legal certainty, speed, institutional fit, hedging, integrity, speculation control, coordination, precedent): investor-priority 0.20/0.15/0.10/0.20/0.10/0.05/0.05/0.15; fiscal/market-prudence 0.20/0.10/0.15/0.05/0.15/0.15/0.10/0.10; legal-certainty-priority 0.35/0.10/0.10/0.05/0.10/0.05/0.05/0.20. Source: Author's calculations.

## VI. DISCUSSION: A PROPOSED FRAMEWORK

The results suggest a CCfD programme that is built on existing CCTS institutions, adds a creditworthy counterparty and settles the regulatory perimeter in advance (Figure 11).

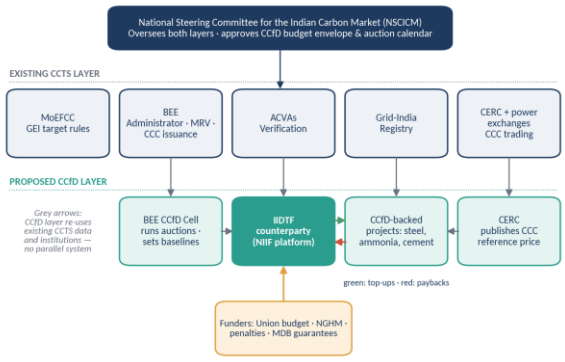


Figure 11 *Proposed Institutional Architecture for CCfDs Within the CCTS*

*Note.* BEE = Bureau of Energy Efficiency; NGHM = National Green Hydrogen Mission; NIIF = National Investment and Infrastructure Fund. Source: Author's construction.

6.1 Legal anchoring and counterparty

CCfDs can be authorised by amending the CCTS under Section 14(w) of the Energy Conservation Act, with BEE as administrator. The amendment should define CCfDs as non-transferable support contracts with a statutory counterparty. The counterparty, an Indian Industrial Decarbonisation Trust Fund (IIDTF), could be housed on the National Investment and Infrastructure Fund (NIIF) platform to provide arm's-length governance similar to the Canada Growth Fund. It would be capitalised from budgetary resources, National Green Hydrogen Mission allocations, CCTS compliance penalties, two-way paybacks and concessional multilateral finance.

6.2 Allocation, indexation and settlement

Contracts should be awarded through sector-specific reverse auctions, beginning with $H_2$-DRI steel and green ammonia and followed by cement CCUS. The results in Section 5.3 show that strike discovery is the dominant cost lever, which strengthens the case for competition. Strikes should be indexed (Equation 2) to CPI, CERC power-price data and a hydrogen benchmark, using prices discovered in Solar Energy Corporation of India (SECI) green hydrogen tenders as an interim reference. The reference price should be the volume-weighted average CCC price on CERC-regulated exchanges, with an administered fallback if volumes fall below a threshold. An indicative term sheet is provided in Appendix A.

6.3 Safeguards

Table 11 *Principal Risks and Proposed Safeguards*

| Risk | Mechanism | Safeguard |
|---|---|---|
| Fiscal exposure | Low CCC prices sustain large top-ups (Table 6, low path) | Two-way contracts; volume caps; NSCICM-approved budget ceiling |
| Reference-price manipulation | Thin monthly market; supported firms benefit from low prices | VWAP over the compliance period; CERC and SEBI surveillance; fallback price |
| Baseline ambiguity | Abatement measured against GEI target or a counterfactual plant | Technology reference plant; net out CCCs earned anyway |
| Double subsidy | Stacking with NGHM, VGF or state support | Funding-gap cap; other aid deducted from strike |
| Fossil lock-in | Blue hydrogen or partial capture | Minimum abatement thresholds; Green Hydrogen Standard |
| CBAM interaction | Top-ups treated as compensation for carbon price paid | Pay on verified abatement; early dialogue with the European Commission |
| Jurisdictional dispute | SCRA coverage of 'Carbon Credit' and contracts for differences | Legislated CERC–SEBI boundary; CCfD exclusion; Carbon JWG |

*Note.* Source: Author's analysis.

The interaction with the EU Carbon Border Adjustment Mechanism (CBAM) deserves emphasis. CBAM allows importers to deduct a carbon price effectively paid in the country of origin, net of rebates or compensation (European Parliament & Council of the European Union, 2023, Art. 9). If CCfD top-ups were characterised as compensation for the CCC price, they could reduce that deduction for Indian exporters of steel, aluminium, cement, fertilisers and hydrogen. Structuring payments as support for verified abatement, rather than as refunds of carbon costs, is therefore part of the design task.

## VII. POLICY IMPLICATIONS

Table 12 translates the findings into a sequenced programme.

Table 12 *Policy Recommendations and Sequencing*

| Phase | Actions |
|---|---|
| Year 1: Design | Amend CCTS to authorise CCfDs; establish IIDTF; legislate CERC–SEBI boundary and CCfD exclusion; constitute SEBI–CERC–BEE Carbon JWG; publish rulebook, indices and reference-price methodology |

| | |
|---|---|
| Years 2–3: Pilot | First two-way auctions for $H_2$-DRI steel and green ammonia; begin CBAM technical dialogue |
| Years 4–6: Scale-up | Add cement CCUS; multi-technology auctions; SEBI approves cash-settled CCC futures once liquidity triggers are met; review fiscal exposure |
| Beyond year 6: Convergence | As CCC prices approach abatement costs, new contract volumes taper and paybacks make the programme largely self-financing |

*Note.* Source: Author's proposal.

Two broader implications follow. First, the credibility of GEI target-setting and the fiscal cost of CCfDs are two sides of the same coin: every tightening of targets that raises CCC prices reduces top-ups and brings paybacks forward. Second, regulatory architecture is not a technical afterthought. The electricity precedent shows that an unresolved jurisdictional question can delay market development by a decade or more. Settling it before long-dated contracts are signed costs little.

## VIII. LIMITATIONS AND FUTURE RESEARCH

The study has several limitations. The fiscal model is stylised: it uses a single representative project, deterministic price paths, a fixed strike and a single discount rate, and it ignores the interaction between CCfD volumes and CCC prices. It also compares one-way and two-way designs at the same strike and so ignores the likely difference in bids between the two designs.

Future work could use stochastic price simulation, project-level cost data from Indian steel and ammonia developers, and general-equilibrium modelling of market feedback. The MCA scores reflect the author's judgement; a Delphi or expert-survey study involving regulators, exchanges, lenders and obligated entities would strengthen them.

The doctrinal analysis relies on statutory text and secondary reporting of the 2021 order; the full order and the current commodity notification should be examined as primary sources. Finally, the CCC market had not begun trading at the time of writing, so empirical analysis of price formation, liquidity and reference-price robustness is an important avenue for future research.

## IX. CONCLUSION

India has built the legal, institutional and market infrastructure of a compliance carbon market in under four years. This paper has argued that the market, on its own, cannot finance the technology change that India's heavy industry requires in this decade (RQ1). International experience offers a tested template of two-way, competitively allocated, indexed contracts with creditworthy counterparties (RQ2). Stylised modelling suggests that such contracts would cost the public roughly ₹2,449–8,449 per discounted tonne under a central price path, with two-way settlement never more expensive than one-way and substantially cheaper if carbon prices rise quickly (RQ3). Finally, because 'Carbon Credit' is a notified commodity under the SCRA and a CCfD is economically a contract for differences, the design of CCfDs cannot be separated from the CERC–SEBI jurisdictional question. A sequenced hybrid that adopts the Supreme Court's 2021 physical/financial split, expressly ring-fences CCfDs and defers SEBI-regulated futures until spot liquidity develops offers the best balance of legal certainty, market development and prudence (RQ4).

## DECLARATIONS

Funding: The author received no specific funding for this work. [Amend if applicable.]

Conflict of interest: The author declares no conflict of interest.

Data availability: Model assumptions are reported in Table 3 and Appendix B; the companion spreadsheet model (CCfD_India_Fiscal_Model.xlsx), which reproduces Tables 6, 10 and 14, is provided as supplementary material.

Declaration of generative AI use: [Describe any use of AI-assisted tools in drafting, editing or analysis, as required by the target journal's policy.]

Acknowledgements: [To be added.]

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APPENDIX A:
Indicative CCfD Term Sheet

Table 13 *Indicative Term Sheet for Pilot Contracts*

| Term | Proposed approach |
|---|---|
| Contract type | Two-way carbon contract for difference; non-transferable government support contract |
| Counterparty | Indian Industrial Decarbonisation Trust Fund (IIDTF) |
| Eligible sectors (pilot) | Primary steel ($H_2$-DRI-EAF), green ammonia; cement CCUS from scale-up phase |
| Tenor | 15 years from commercial operation (up to 20 years for CCUS) |
| Allocation | Sector-specific pay-as-bid reverse auction administered by BEE |
| Strike price | Bid base strike (₹/$tCO_2e$), indexed to CPI, CERC power price and hydrogen benchmark |
| Reference price | VWAP of CCCs on CERC-regulated exchanges over the compliance period; administered fallback below volume threshold |
| Settlement volume | Verified abatement against a technology reference plant, capped at annual contract volume |
| Anti-stacking | Other public support deducted from strike; total capped at audited funding gap |

| Term | Proposed approach |
|---|---|
| Change in law | Compensation for CCTS rule or GEI trajectory changes that reduce contract value |
| Regulatory status | Expressly excluded from the definition of traded commodity derivatives; not listed or transferable |
| Performance security | Bid bond; long-stop date; payback obligations secured by escrow or guarantee |

*Note.* Source: Author's proposal.

APPENDIX B:
Model Data for the Central Case

Table 14 *Year-by-Year Settlement, Central Path, ₹10,000 Strike*

| Year | Reference price (₹/t) | Verified abatement ($MtCO_2e$) | Settlement (₹ crore) |
|---|---|---|---|
| 1 | 500 | 1.0 | 950 |
| 2 | 636 | 1.5 | 1,405 |
| 3 | 809 | 1.8 | 1,654 |
| 4 | 1,029 | 1.8 | 1,615 |
| 5 | 1,309 | 1.8 | 1,564 |
| 6 | 1,665 | 1.8 | 1,500 |
| 7 | 2,118 | 1.8 | 1,419 |
| 8 | 2,694 | 1.8 | 1,315 |
| 9 | 3,427 | 1.8 | 1,183 |
| 10 | 4,359 | 1.8 | 1,015 |
| 11 | 5,544 | 1.8 | 802 |
| 12 | 7,052 | 1.8 | 531 |
| 13 | 8,970 | 1.8 | 185 |
| 14 | 11,410 | 1.8 | -254 |
| 15 | 14,514 | 1.8 | -813 |
| Total | | 25.9 | 14,073 |

*Note.* Settlement = (10,000 − reference) × abatement. ₹1 crore = ₹10 million. Source: Author's calculations.