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Can Carbon Markets Strengthen Renewable Deployment?

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ABSTRACT

India's transition towards a low-carbon economy relies heavily on market-based instruments, such as the Renewable Energy Certificate (REC) Mechanism and the Carbon Credit Trading Scheme (CCTS), which share similar objectives in achieving low-carbon economic development through climate mitigation. However, these two schemes have different institutional frameworks that govern them. This research investigates how CCTS can support the accelerated development of renewable energy, or if the overlapping governance will lead to Fragmentation. This study uses a mixed-methods approach of an institutional analysis of policy documents, regulatory reports and data to compare the legal foundations, market design, compliance structures and monitoring systems of the REC and CCTS schemes. Findings from this study indicate that carbon markets can be used as complementary measures to strengthen investment signals and transparency for renewable energy certificates, however, this requires effective institutional co-ordination. If harmonized registries are not established, clear environmental attribute ownership is not established, and coherent policy sequencing does not occur, then overlapping instruments could reduce incentives. Furthermore, this study includes broader implications for emerging economies seeking to adopt Layered climate policy frameworks.

Introduction

India's shift toward cleaner forms of energy is also critical to global climate governance. India, as the world's third largest emitter of greenhouse gases, and as one of the fastest-growing economies in the world, is being asked to address both its growing demand for energy services and reduce the carbon content associated with those services (UNFCCC, 2022). To this end, India has set a target date of 2070 to reach net zero emissions; and, by 2030, it will have 500 GW of power-generating capability from sources other than fossil fuels. In terms of renewable generating capacity, India has made significant strides over the last several years and now stands at approximately 205.5 GW of total renewable capacity as of November 2024 (PIB, 2024). It is anticipated that the country will have reached or exceeded an additional 55.5 GW of installed renewable generating capacity by early 2026 and much of that growth is expected to be generated from additions to the country's solar fleet (MNRE, 2025).

Table 1: Growth of Renewable Energy Capacity in India

Year/Month	Total RE (GW)	Solar (GW)	Wind (GW)	Addition (GW)
Nov 2024	205.5	94.2	~48.2	-
Nov 2025	254.0	132.9	54.0	44.5 (RE)
Dec 2025	203.6 (RE*)	-	-	+112 (5-yr)
Feb 2026	~260+	143.6	55.1	~6 (YTD)

Source: PIB, 2025; MNRE, 2025; TOI, 2026

However, despite such significant gains, there are still significant gaps in how quickly India is advancing relative to the country's long-term goals for increasing renewable generation, which underscores the need for better coordination among government agencies responsible for implementing policies designed to support that goal (NITI Aayog, 2023). The Renewable Energy Certificate (REC) mechanism supports compliance with Renewable Purchase Obligations through tradable certificates (CERC, 2010), while the Energy Conservation (Amendment) Act, 2022 introduced the Carbon Credit Trading Scheme (CCTS), marking a shift toward carbon pricing. The REC and CCTS represent different stages in policy development: whereas the REC is rooted in the renewable energy sector, the CCTS seeks to establish a cross sectoral market. While both mechanisms are aimed at reducing the effects of climate change (i.e. mitigating climate change), there are concerns regarding the potential overlap and confusion regarding

price signals between mechanisms that coexist at this point in time. The existence of a carbon-pricing mechanism may also result in the renewal of competitiveness; however, the overall effectiveness of carbon pricing will depend largely on regulatory certainty, market structure and relative price levels. This paper contends that the absence of an institutional framework to foster co-ordination between overlapping mechanisms may erode the value of the incentive and diminish the level of confidence investors have in the market.

Carbon Pricing and Renewable Energy Interaction

Carbon pricing and its impact on renewable energy deployment have been widely studied in environmental economics. It functions as an economic signal by assigning a cost to carbon emissions, thereby internalizing the environmental externalities of fossil fuel use and improving the competitiveness of low-carbon technologies (Nordhaus, 2017). In theory, effective carbon pricing could reduce the need for technology-specific subsidies by enabling markets to allocate resources efficiently and encourage greater investment in renewables. However, empirical evidence presents a more complex picture. Experience from the European Union Emissions Trading System (EU ETS) shows that carbon prices must be sufficiently high and stable over time to drive investment in renewable infrastructure (Asselt, 2010). In its early phases, price volatility and over-allocation of allowances weakened long-term investment signals. This highlights the importance of credible markets, predictable regulation, and robust monitoring and verification systems. These findings have fuelled debate on whether carbon pricing can replace technology-specific policies such as feed-in tariffs or renewable portfolio standards. While some argue that combining instruments may lead to inefficiencies, others contend that complementary policies are necessary to address innovation barriers and market failures that carbon pricing alone may not resolve (Fischer & Newell, 2008; Barbier, 2019; Acemoglu et al., 2012; Rozenberg & Stern, 2020).

Renewable Energy Certificate Markets

The Renewable Energy Certificate (REC) allows for Renewable Purchase Obligations (RPOs) to be fulfilled through a market based on the separation of the environmental value of renewable electricity from its production (CERC, 2010); however, in practice, global experience has shown many structural issues with this type of program including excess supply of certificates, poor enforcement of certificate requirements and volatile prices (REN21, 2017). As is evident in India's case where an overabundance of renewable energy certificates and a lack of consistent enforcement of RPOs have resulted in very little price discovery and consequently significantly decreased investors' willingness to invest in renewable energy projects. Furthermore, state level fragmented markets and bureaucratic uncertainty contribute to

diminished effectiveness of REC programs (Jain, 2015). Therefore, it appears that REC markets are unlikely to be transformed unless there is significant regulatory oversight and demand discipline (Gupta & Shrimali, 2017).

Institutional Governance of Carbon Markets

The success of carbon markets will depend upon a credible and robust regulatory framework including effective institutional coordination and sufficient "governance capacity". Regulatory fragmentation and overlapping authorities may erode the trust of buyers and sellers in carbon markets and therefore impact their overall efficiency. to increase trust and improve market functioning, it is recommended to establish MRV systems and transparent registries.

The Indian Context: Policy Layering and Transition

India's climate policy architecture has developed gradually over time. The renewable energy certificate (REC) mechanism targets renewable energy in the power sector. The perform, achieve and trade (PAT) scheme focuses on industrial efficiency (BEE, 2012). The introduction of the Carbon Credit Trading Scheme is a broader shift toward carbon-based governance (IEEFA, 2025; Prayas Energy Group, 2025). As of yet, there is limited research that examines how the REC and CCTS interact with each other. Assessing institutional compatibility between these two schemes will help determine whether India's policy framework is moving toward coherence or creating more regulatory overlap (Sustainable Futures Collaborative, 2025).

Methodology

The current study has utilized a combination of both qualitative institutional analysis with secondary quantitative Data using a mixed-methods approach. Instead of modelling emissions in the study, the focus is on the governance interaction between two specific mechanisms; the Renewable Energy Certificates (REC) mechanism and the Carbon Credits Trading Scheme (CCTS); which are part of India's overall framework for carbon policy. The qualitative portion of this study was conducted by examining legal mandates, regulatory structures, compliance requirements, market design and monitoring systems, acknowledging that the effectiveness of these mechanisms depend heavily upon administrative coherence and enforcement. The quantitative component of this study used secondary data such as Issuance and trade volumes of RECs, growth in renewable capacity, and projected scope of CCTS to provide descriptive context instead of establishing causation. The data sources were legislative texts; notifications

from the Bureau of Energy Efficiency (BEE) and the Central Electricity Regulatory Commission (CERC); government releases; reports from research institutions and international organizations

Institutional Architecture of REC and CCTS

In addition to increasing the capacity of regulatory bodies to oversee activities related to CCTS, however, there is the potential for increased bureaucracy or overlap with respect to mandates among these agencies. Therefore, it is expected that clarification of agency responsibility for oversight functions will need to occur in order to maintain regulatory efficiency and ultimately the credibility of the market.

Legal Foundations and Regulatory Authority

The REC Mechanism was established through the Electricity Act, 2003 and came into operation in 2010 through CERC; it is based on the regulatory framework for electricity, with compliance to be monitored by CERC and SERCs, although there will be some oversight provided by BEE. In contrast, the carbon credit trading scheme (CCTS), which has been established by virtue of the Energy Conservation (Amendment) Act, 2022 (MOP, 2022), will have BEE as its primary coordinating agency and may also involve CERC or even SEBI. These two mechanisms reflect fundamentally different approaches to policy development; the REC mechanism was developed from within the electric power sector regulatory environment, whereas the CCTS was created in response to climate-related policies, and therefore present both potential avenues for convergence and risks of institutional disconnection (Mondaq, 2023).

Traded Instruments and Measurement Basis

The REC uses a certificate which is an example of one MWh of renewable electricity generated over a base line. The REC will capture the environmental aspect of renewable generation; however, it will be based on the amount of renewable electricity that was generated rather than as an avoidance of greenhouse gas emissions. On the other hand, the CCTS will have carbon credits expressed as (tCO_2e) (BEE, 2023). Therefore, this change from an energy-based system to a carbon-based system is a paradigm shift. Carbon based units provide for cross sectorial comparisons and could potentially link with international systems under article 6 of the Paris agreement (UNFCCC, 2015). However, because there are two different types of certificates that can exist at the same time for the same project/ activity (the energy-based REC and the carbon-based CCS), then we need to establish accounting rules that would prohibit double counting of the environmental attributes (Climate Focus, 2021).

Market Design and Compliance Structure

Renewable Energy Certificates are based on an obligation for renewable purchases; they rely greatly on enforcement to generate a large number of demands. Due to weak enforcement and significant variability in states' implementation of obligations to purchase renewables, there has been a history of oversupply and great price fluctuations. The CCTS uses a baseline and credit model that provides many opportunities for mitigation while providing additional administrative burdens. The success of this program will depend upon having uniform MRV protocols across sectors.

Monitoring, Reporting, and Verification (MRV)

REC monitoring is based on renewable generation metering and certification, which gives it an objective technical basis; however, it is confined to the electricity industry and does not include industrial emissions. The CCTS has proposed a single, national carbon registry that would provide a digital measurement reporting verification (MRV) system for emissions in all sectors (BEE, 2023). Ultimately its success will be dependent upon transparent processes, standardization of methodologies and coordination with both BEE and regulatory bodies. If there is no data interoperability between REC and CCTS systems then the administrative fragmentation of these two systems will likely continue to affect confidence and liquidity in the market (World Bank, 2020).

Synergies and Structural Tensions

In this context, the necessity of designing carbon markets such that they build upon existing policy mechanisms (i.e., renewable-specific) as opposed to replacing them becomes clear.

Potential Complementarity

Carbon pricing will enhance renewable energy development as it increases the costs of carbon intensive energy production and will encourage a shift to cleaner resources. Moderate pricing can even cause changes in dispatch choices especially in systems that are dominated by coal. A credible and escalating carbon price (such as that which would be expected under a CCTS) should increase the long-term competitiveness of renewable projects (Metcalf, 2019). Additional revenue streams such as carbon credits generated from these types of projects can further enhance the financial viability of both established renewable technologies and emerging renewable technologies. A national carbon registry system along with standardized measurement reporting verification (MRV) systems will provide an institutional framework that will enable greater transparency and accountability (Mehling et al., 2018).

Additionally, if the national registry is aligned with Article 6 mechanisms, then this could potentially create opportunities for international investment into these projects.

Structural Tensions and Risks

Although there could be a number of synergy opportunities in this area, a few fundamental areas of conflict exist. The risk of double-counting exists when RECs and carbon credits are generated by the same reduction and no formal rules exist as to how they should or will be counted. If overlapping compliance obligations create increased levels of regulatory complexity; then these can cause distortion in price signals. Due to weak enforcement of Renewable Purchase Obligations (RPOs), REC demand is suppressed and creates an uneven incentive environment (CEEW, 2021). Finally, while India has both the BEE and Electricity Regulators, this institutional fragmentation may reduce the ability for institutions to coordinate with one another and further slowdown the implementation process (Prayas Energy Group, 2025). As other countries have shown through their experiences of allowance over-allocation, it can also lower carbon prices.

Policy Design Implications

As indicated by the prior discussion, however, the ability of India's emerging carbon market to spur rapid growth in the development and deployment of renewable energy systems will be determined more so by the extent of effective institutional coordination in this area; thus, some important policy considerations are identified below.

Harmonization of Registries and Environmental Attribute

The primary institutional goal is to achieve a consistent system in how environmental attributes (renewable energy certificates/RECs) are tracked with respect to how they will be accounted for on the proposed carbon registry (under CCTS). To avoid "double-counting," clear regulations need to be developed as to who owns the right to claim an attribute generated by a renewable generator. It may be possible to establish a rule requiring renewable generators to either claim an REC or claim a carbon credit for the same unit of generation unless other forms of accounting adjustments have been implemented (ICAP, 2024). Implementing a single digital registry which can track renewable generation and emission reductions would provide enhanced transparency in addition to reducing unnecessary administration. Experience from international registries indicates that fragmented systems create reduced environmental accountability and investor confidence (World bank,2020).

Sequencing and Gradual Integration

Policy sequencing will need to occur in a way that does not create immediate instability by abruptly laying down CCTS atop of an already unstable REC structure (CEEW, 2021). Prior to scaling the carbon market, reform of RPO enforcement and stabilization of REC demand must either take place prior to, at the same time as, or subsequent to increasing levels of carbon market activity. In addition, strengthening compliance disciplines within the REC framework would help increase credibility for renewable energy in general, which would be helpful for renewable specific certificate programs being integrated with carbon pricing mechanisms (Nishith Desai Associates, 2022). Ultimately, if carbon pricing becomes both economically robust and economy-wide (i.e., affects all sectors), renewable-specific certificate markets could possibly be streamlined. However, this would require an evidence based, and a gradual process (Goulder, 2013).

Aligning with International Carbon Markets

Under Article 6 of the Paris Agreement, India can attract foreign investment in green energy (UNFCCC, 2015). But linking internationally will require an accurate method to measure how much carbon emissions are reduced in each country so that countries don’t count reductions twice. Therefore, it isn't just an issue domestically regarding institutional clarity of RECs and carbon credits; there needs to be a way to clarify this for credible international cooperation on reducing carbon emissions.

Conclusion

The objective of this paper was to evaluate whether the Carbon Credit Trading Scheme (CCTS), in combination with the Renewable Energy Certificate (REC) mechanism will promote an increase in the development of renewable energy in India. Although carbon pricing has the potential to improve the competitive position of renewables in theory, it does not necessarily do so in practice. REC and CCTS have differing legal bases and therefore create risks such as double counting of credits, overlaps in terms of compliance requirements and fragmentation. In addition to these challenges, without a common registry for tracking credits, clear definition of environmental attributes associated with those credits and better enforcement of rules, overlapping mechanisms may dilute or even eliminate signals to investors. Thus, India's transition towards a single national carbon market represents a long-term evolutionary process, which requires strong coordination among institutions, greater transparency regarding how the policy is implemented and greater policy coherence. On a broader scale, the results indicate that developing countries need credible governance structures to be able to use carbon markets effectively;

i.e., in order to establish a level of confidence among all stakeholders, including government agencies, businesses, consumers, etc. that they operate transparently and fairly and provide credible price signals.

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