



CARBON CREDIT SCENARIO IN INDIA: CHALLENGES AND OPPORTUNITIES

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Abstract: India is poised to emerge as a significant player in the carbon market, particularly in the domain of carbon farming credits, owing to its extensive agricultural land and substantial potential for carbon removal and storage. Priced at approximately \$10 per metric ton and with estimated emission reductions of 3 metric tons per hectare, the market's potential value in India surpasses \$5 billion if extended nationwide. This paper explores India's promising position in the carbon market, examining factors such as policy changes, the prospect of a national carbon pricing regime, and strengthened international collaborations. The anticipated growth in awareness and capacity development activities is expected to foster a more inclusive and dynamic carbon market. By integrating cutting-edge technology and innovative solutions, India is poised to lead in climate innovation. The paper also emphasizes the holistic approach of India's carbon market, aligning with sustainable development goals, pursuing adaptation measures, and encouraging voluntary carbon reduction initiatives by businesses. The conclusion underscores the potential revolutionary impact of India's carbon market, contributing significantly to global climate objectives while promoting economic growth and social well-being, contingent on regulatory clarity, financial tools, and a commitment to inclusion.

Index Term - India, carbon market, carbon farming credits, emission reductions, sustainable development, climate resilience, policy environments, national carbon pricing, international partnerships, awareness, capacity development, technology integration, innovation, adaptation measures, voluntary carbon reduction, regulatory clarity, economic growth, social well-being.

I. INTRODUCTION:

Climate change and carbon credits are intricately linked through the concept of emissions trading and the broader effort to reduce greenhouse gas (GHG) emissions. Carbon trading has its roots in efforts to address environmental issues, particularly the need to reduce greenhouse gas (GHG) emissions and combat climate change.

The imperative to address climate change is crucial due to its significant impacts on the environment, societies, and economies worldwide. The escalating threats of extreme weather events, rising sea levels, and ecosystem disruptions highlight the need for global action. The loss of biodiversity and habitat destruction, as well as the economic ramifications of climate change, compromise livelihoods and jeopardize global food security. Climate change exacerbates social inequities, disproportionately affecting vulnerable communities and threatening future generations' well-being. The urgency of this endeavor is not just an ecological responsibility but a fundamental commitment to the future resilience and prosperity of humanity.

The global attempts to address the growing threat of climate change are the foundation of the history of carbon trading. The notion first surfaced in the late 20th century, and it gained popularity in the US with the passage of the Clean Air Act Amendments in 1990, which proposed the ground-breaking concept of cap-and-trade to mitigate acid rain. A turning point was reached in 1997 when the Kyoto Protocol was established, allowing industrialised countries to meet legally-mandated carbon reduction objectives through international emissions trading. One of the main examples of the possibilities of regional cap-and-trade systems is the European Union Emissions Trading Scheme (EU ETS), which was established in 2005. Simultaneously, developing nation initiatives to reduce emissions were made possible under the Kyoto Protocol's Clean Development Mechanism (CDM). Even though it was only around for a brief while, the Chicago Climate Exchange (CCX) showed the possibilities of voluntary carbon trading within the US market. The Paris Agreement, which established a framework for global collaboration in 2015, acknowledged the importance of market-based methods. Since 2015, initiatives to improve carbon trading's efficacy, openness, and integration with international climate plans have taken place, along with changes to national and regional systems. The dynamic journey that the global community has undertaken to develop creative solutions for reducing climate change is embodied in the history of carbon trading.

India has made significant commitments to reduce carbon emissions, aligning with international efforts for sustainable and low-carbon development. It has participated in the Paris Agreement, pledging to reduce carbon intensity and increase non-fossil fuel energy capacity. India's Nationally Determined Contributions (NDCs) outline a strategy to increase renewable energy, particularly solar and wind power, in its energy mix. Initiatives like the National Mission for Enhanced Energy Efficiency (NMEEE) and the National Solar Mission demonstrate India's dedication to a green economy. India has also invested in afforestation projects and sustainable land use practices to enhance carbon sinks. This commitment to sustainable development is deeply embedded in India's developmental narrative, recognizing the need to balance economic growth with environmental stewardship. India's efforts emphasize inclusive and innovative strategies for a resilient and low-carbon future.

II. BACKGROUND:

In light of its dedication to sustainable development and global climate accords, India's involvement with carbon credit programmes has changed. The Kyoto Protocol's Clean Development Mechanism (CDM), a market-based strategy, gave India a framework to actively engage in international efforts to mitigate climate change in the early 2000s. By allowing foreign investment in pollution reduction initiatives, this mechanism promoted the nation's shift to cleaner technologies. Projects related to afforestation, energy efficiency, and renewable energy were noteworthy among these efforts. Launched in 2008, India's National Action Plan on Climate Change (NAPCC) laid the foundation for domestic carbon credit programmes by emphasising the significance of climate mitigation and adaptation. The government Mission for Enhanced Energy Efficiency (NMEEE) and Perform, Achieve, and Trade (PAT) are two government programmes that India has established over the years that set energy efficiency targets for enterprises in order to aid in the country's attempts to reduce carbon emissions. India's dedication to global climate agreements and the creation of national legislation demonstrate the proactive approach taken by the nation in tackling climate change and incorporating carbon credit mechanisms into its goal for sustainable development.

The RPO is a regulatory requirement that mandates a certain percentage of electricity consumption to come from renewable sources. This policy encourages the development of renewable energy projects and indirectly contributes to carbon reduction. The NSM aims to promote solar energy and reduce dependence on fossil fuels. It includes specific targets for solar capacity installation and offers various financial incentives and subsidies to boost solar energy adoption. The GST structure in India provides incentives for renewable energy projects by offering lower tax rates. This encourages investment in cleaner technologies and contributes to the reduction of carbon emissions.

The country's leadership in renewable energy is noteworthy, with ambitious targets set under initiatives like the National Solar Mission. India also co-founded the International Solar Alliance (ISA), exemplifying its commitment to global cooperation in advancing solar energy. Advocating for increased climate finance, technology transfer, and capacity-building, India underscores the importance of supporting developing nations in their climate endeavors.

III. LITERATURE REVIEW

(CHUTE, 2023) A recent study report suggests that in the near future, Europe will likely be the largest buyer of carbon credits, while China and India will likely be the top sellers. Therefore, the main way to make money through the selling of carbon credits is through carbon trading. It typically benefits nations or sectors of the economy that exceed their carbon emission ceilings and require more carbon credits. By emitting less carbon than their maximum quota, similar industry(s) or country(s) can use carbon trading to purchase additional units of CERs or carbon credits from other industries or nations that have already stored carbon credits in their wallets. As a result, carbon trading provides a way to close the gap between the supply and demand for carbon credits. Where may carbon credits be traded, is the question now? Since it is a developing nation, India can gain from carbon trading and its credits in the following ways:

Renewable energy projects can be profitably funded with the proceeds from carbon credits obtained through carbon trading. Making appropriate use of carbon credits is another way to take energy-saving measures. By establishing sectors dedicated to the production of renewable energy goods, carbon credits also have the benefit of creating jobs for the populace.

(Carbon credit markets, 2023) A Carbon Credit and Offset

One metric tonne of carbon dioxide is represented by one carbon credit, which can be exchanged, retired, or sold. An organisation is probably allotted a certain number of credits to apply towards its cap if it is subject to a cap-and-trade system (such as the California Cap and Trade Programme). The organisation can trade, sell, or store the remaining carbon credits if it emits fewer tonnes of carbon dioxide than is allotted. The buyer buys the seller's allotment of emissions when a credit is sold. A very real decrease in emissions—from actions you might not be aware of, like reducing consumption.

In addition to producing a carbon credit, a carbon offset actually lowers the amount of carbon dioxide in the atmosphere. The distinction is that a project with distinct limits, a clearly defined title, project documentation, and a verification strategy produces the credit. Generally speaking, carbon offsets produce reductions outside of the company and, more significantly, outside of any legal obligation. Typical projects include planting trees or maintaining forests, constructing wind farms, and funding truck stop electrification initiatives to cut down on exhaust pollution. Both credits and offsets reduce carbon dioxide emissions and help the earth in terms of climate change since carbon dioxide has an influence on the entire planet rather than just a local one.

By lowering greenhouse gas emissions, carbon markets make it possible to trade emission units, also known as carbon credits, which are documents attesting to emission reductions. Through trading, higher-cost emitters can compensate businesses that can cut emissions at a lesser cost. Carbon market mechanisms incentivize investors and consumers to select lower-carbon routes by placing a price on carbon emissions and bringing attention to the environmental and social consequences of carbon pollution. Carbon markets fall into two basic categories: voluntary and cap-and-trade. Organisations that exceed the mandated cap on greenhouse gas emissions under cap-and-trade are required to either pay a fee or acquire surplus credits to make up the difference. The trade of carbon credits takes place outside of the regulatory framework thanks to voluntary markets.

(PINTO, 2023) India's central government is working on developing a national carbon credit trading scheme to help domestic companies reduce emissions. The global market for carbon credits is estimated to be around US\$50 billion by 2030, and the government's decision-making is influenced by financial considerations. The next step is the development of rules and regulations to formalize participation in the scheme. While carbon capture and utilization (CCUS) is not currently included, decarbonisation technologies will be needed for India to meet its climate change goals and could be included in future policies. The CCUS Report, released by NITI Aayog, provides a detailed survey of the domestic international CCUS landscape and the financial and commercial mechanisms needed for domestic viability. The inauguration of two National Centres of Excellence in Carbon Capture and Utilization crystallizes the growing importance of carbon capture as a decarbonisation technique, with the government providing financial support. However, policy, legal, and regulatory frameworks will also be needed for embedding carbon capture technologies as decarbonisation pathways.

(CHERIAN, Published on 2023) In June 2023, India made significant progress towards its net-zero commitments. The Ministry of Environment, Forests, and Climate Change introduced the 'draft Green Credit Programme Implementation Rules, 2023' on 26th June, and the Ministry of Power notified the Carbon Credit Trading Scheme, 2023 on 28th June. The voluntary market involves environmentally conscious companies participating voluntarily, while the compliance market involves obligated entities adhering to emission reduction laws. The Ministry of Power's notification introduced the Carbon Credit Trading Scheme, 2023, which aims to establish an Indian carbon market using a cap-and-trade mechanism. The scheme includes features such as sector and obligated entity identification, emission intensity targets, and the Bureau of Energy Efficiency as its administrator. The regulatory aspect is managed by the Central Electricity Regulatory Commission (CERC) and the meta register maintained by the Grid Controller of India Ltd. The Draft Green Credits Programme Implementation Rules, 2023, cover a broader range of activities beyond greenhouse gas emissions reduction or removal, including tree plantation, water conservation, sustainable agriculture, waste management, air pollution reduction, mangrove conservation, ecomark labeling, and building sustainable buildings.

IV. CARBON CREDIT MECHANISM

The carbon credit trading system is a market-based mechanism designed to incentivize companies and organizations to reduce their greenhouse gas (GHG) emissions. The core idea behind this system is to assign a financial value to the right to emit a certain amount of carbon dioxide or its equivalent into the atmosphere. Here's an explanation of how the carbon credit trading system works:

Setting Emission Reduction Targets: Governments or regulatory bodies set overall emission reduction targets to limit the total amount of greenhouse gases released into the atmosphere. This could be part of international agreements, national policies, or regional regulations.

Allocation of Emission Allowances: Entities, such as companies or industries, are allocated a certain number of emission allowances, which represent the maximum amount of greenhouse gases they are allowed to emit within a specified timeframe. These allowances are often distributed based on historical emissions, industry benchmarks, or through auctioning.

Cap-and-Trade System: The heart of the carbon credit trading system is the cap-and-trade principle. The total number of emission allowances corresponds to the "cap." If a company emits more than its allocated allowances, it must purchase additional allowances from those with surplus allowances. This creates a financial incentive for companies to reduce their emissions.

Creation of Carbon Credits: Entities that successfully reduce their emissions below their allocated allowances can generate carbon credits. Each carbon credit typically represents the reduction or removal of one metric ton of carbon dioxide equivalent (CO₂e). These credits are independently verified and certified by accredited bodies.

Trading on Carbon Markets: Carbon credits can be traded on carbon markets. Companies that exceed their emission allowances can purchase these credits to offset their excess emissions. Conversely, companies with surplus allowances can sell their credits, creating a market-driven mechanism for emission reduction.

- **Clean Development Mechanism (CDM):** The Clean Development Mechanism, established under the Kyoto Protocol, allows developed countries to invest in emission reduction projects in developing nations. These projects generate Certified Emission Reductions (CERs), which can be traded internationally.
- **Monitoring, Reporting, and Verification (MRV):** Robust monitoring, reporting, and verification systems are crucial to ensure the integrity of the carbon credit trading system. Independent third-party verifiers verify emission reductions and ensure that projects adhere to the principles of additionality and permanence.
- **International and Domestic Compliance Markets:** Carbon markets can operate at both international and domestic levels. International compliance markets allow countries to meet their emission reduction targets through trading, while domestic markets focus on specific regions or countries.
- **Innovation and Technology Adoption:** The carbon credit trading system encourages innovation and the adoption of cleaner technologies. Companies are incentivized to invest in projects that reduce emissions, such as renewable energy installations, energy efficiency improvements, and reforestation initiatives.

- By integrating financial incentives with environmental responsibility, the carbon credit trading system aims to drive a transition toward a low-carbon economy, encouraging sustainable practices and contributing to global efforts to mitigate climate change.
- Process of Carbon Trade:
- Assigned Amounts (AA): The developed Annex 1 nations' greenhouse gas 'caps' or percentage are mentioned in Annex B and are referred to as Assigned Amounts under the Kyoto Protocol.
- Units of Amount Assigned (AAUS): The volume of the initial assigned amount is expressed in discrete units known as Assigned amount units (AAUs), which are registered in the nation's national registry. Each AAU is comparable to a permission to release one metric tonne of carbon dioxide.
- Operators: These nations then impose limits on the emissions from sites that are managed by regional companies and other groups, who are collectively referred to as "operators."
- Clearing House (Trade): Every operator is allotted a certain number of credits, each of which entitles the owner to release one metric tonne of carbon dioxide or a comparable amount of greenhouse gas. Businesses who are set to surpass their quotas can purchase the excess permits as credits, either privately or on the open market. Operators that have not yet used up their allotted allowances can sell their unused allowances as carbon credits.
- Mechanism for Clean Development (CDM): The businesses adopt greener practices and cut back on their emissions. For this reason, the Clean Development Mechanism (CDM) system encourages businesses and governments to support environmentally beneficial practices that reduce greenhouse gas emissions. A component of CDM is carbon trading.

The Clean Development Mechanism (CDM) has played a pivotal role in India's efforts to address climate change and promote sustainable development. Under the Kyoto Protocol, India, as a developing country, became eligible to participate in the CDM, which allowed it to attract foreign investment in projects that reduce greenhouse gas emissions. The mechanism has been instrumental in facilitating technology transfer, fostering cleaner energy practices, and encouraging the adoption of environmentally friendly technologies in the country. Numerous CDM projects have been implemented in India, spanning sectors such as renewable energy, energy efficiency, and waste management. These initiatives not only contribute to global efforts to combat climate change but also provide valuable co-benefits, including improved air quality, enhanced energy security, and sustainable development. By leveraging the CDM, India has been able to harness international collaboration, financial support, and technological expertise to advance its climate mitigation goals, demonstrating the mechanism's significance in fostering a cleaner and more sustainable future for the nation.

V. IMPLEMENTATION CHALLENGES

India faces several technical challenges in measuring and verifying emissions reductions, reflecting the complexity of its diverse economy and the scale of its development initiatives. One major challenge arises from the heterogeneous nature of industries and sectors, making it difficult to establish standardized measurement methodologies. In sectors like agriculture and forestry, where practices vary widely, accurately quantifying emissions poses a significant technical challenge. Additionally, the lack of comprehensive, up-to-date, and accessible data impedes precise baseline determination and hinders the accurate measurement of emissions reductions.

The widespread use of traditional and informal technologies in various sectors further complicates the monitoring process. Small and medium enterprises, which constitute a significant portion of India's industrial landscape, often lack the resources and infrastructure for continuous emissions monitoring. The integration of modern, emissions-reducing technologies faces resistance and implementation challenges in these settings.

In dynamic sectors like transportation, accurately measuring emissions reductions is hindered by the diversity of vehicles and fuels used across the country. Developing effective monitoring systems for these sectors requires sophisticated technology and infrastructure, particularly in urban areas.

Geographic diversity adds another layer of complexity. Remote and less-developed regions may lack the necessary infrastructure for real-time monitoring, making it challenging to capture emissions data accurately. Calibration of monitoring instruments and ensuring data consistency across diverse geographies remain formidable technical challenges.

To address these issues, India needs to invest in improving data infrastructure, adopting standardized measurement methodologies, and promoting the use of advanced monitoring technologies. Collaborative efforts involving the government, private sector, and international partners are crucial for overcoming these technical challenges. Establishing a robust and transparent system for measuring and verifying emissions reductions is essential for India's effective participation in global climate initiatives and achieving its sustainable development goals.

India faces several institutional and regulatory challenges in the field of carbon trading, which can impact the effective implementation and growth of carbon markets. Here are some key points outlining these challenges:

- The lack of a robust regulatory framework for India's carbon trading sector leads to uncertainty and hinders the growth of the market.
- India's lack of a national carbon pricing mechanism, like a carbon tax or cap-and-trade system, makes it difficult for businesses to incorporate carbon costs into their decision-making processes.
- Incomplete data on emissions, particularly in small and medium enterprises, hinders accurate baselines and emissions reduction monitoring, and the absence of a robust monitoring infrastructure complicates the verification process.
- The Clean Development Mechanism (CDM) project approval process can be complex and time-consuming, potentially deterring smaller entities with limited resources, due to its complexity.
- The uneven distribution of benefits from carbon trading projects raises concerns about social and environmental equity, as local communities may not always receive direct benefits from emission reduction projects.
- Many businesses and stakeholders lack awareness and understanding of carbon trading mechanisms, affecting the successful implementation of projects due to limited institutional capacity and technical expertise.
- The risk of carbon leakage, where industries move to regions with less stringent regulations, could potentially undermine the effectiveness of domestic emission reduction efforts.
- Balancing carbon trading initiatives with national development goals is a complex task, particularly in sectors crucial for economic growth, ensuring emission reduction measures do not hinder growth.
- India's potential in global carbon trading is limited due to insufficient international linkages, necessitating the development of robust connections to expand opportunities and ensure market liquidity.
- Political and policy uncertainties can create instability in carbon trading, necessitating consistent and long-term regulatory commitment.
- The challenges of fostering investor confidence in India's carbon markets require a coordinated effort from government bodies, private enterprises, and international partners.

One major barrier to the broad acceptance and effective execution of emission reduction programmes in India is the dearth of knowledge and inadequate capacity building in the area of carbon credits. Even while the idea of carbon credits and market-based strategies to mitigate climate change is becoming more widely accepted, many businesses—especially small and medium-sized ones—are unaware of the advantages and possibilities that come with taking part in carbon trading. Businesses' inability to participate successfully is hampered by a lack of information and technical competence about the complexities of project planning, monitoring, and verification procedures.

The problem is further made worse by the lack of extensive educational programmes and outreach attempts. The possible financial rewards and co-benefits of carbon credit initiatives for sustainable development are not well known to many stakeholders. In addition to impeding the expansion of the carbon market, this ignorance also reduces India's ability to achieve its emission reduction objectives.

Building capacity is equally important as carbon credit initiatives need to be implemented successfully, which calls for a sophisticated understanding of compliance regulations, monitoring technology, and methodology. Training programmes and resources are few, despite the critical need for qualified individuals with experience in carbon accounting and verification procedures.

International organisations, trade groups, and governmental agencies must work together to provide training materials, support capacity-building initiatives, and launch awareness campaigns in order to meet these issues. In addition to enabling carbon credit projects to reach their full potential, bridging the knowledge

gap and improving stakeholder skill sets would support India's sustainable development objectives and climate change response.

VI. Carbon market in India

According to PAT regulations, the Central Government must issue ESCerts for the quantity difference between the announced target and accomplished SEC when a designated consumer exceeds the notified SEC objectives in the compliance year. The DCs are instructed to buy ESCerts equal to the amount of the deficit if their SEC is greater in the compliance year than the announced objective. The following list includes the different parties associated with the PAT scheme:

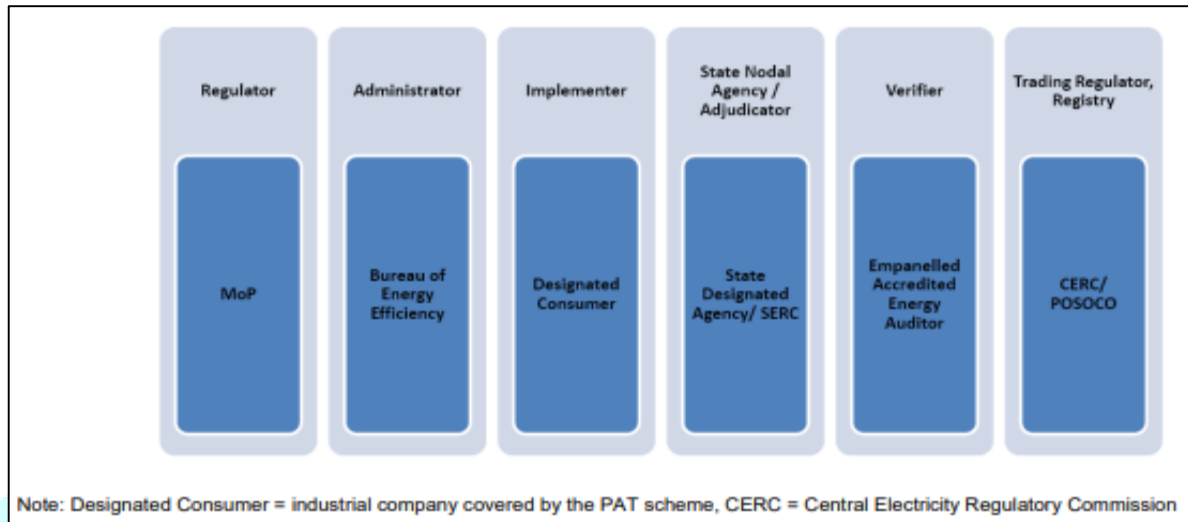


Fig 1 Key Stakeholder of PAT

Source: Draft Blueprint on “National Carbon Market”

In addition to the organisations listed above, the two exchanges that offer trading platforms—Indian Energy Exchange (IEX) and Power Exchange India Limited (PXIL)—also play a significant position in escerts trading. Figures 4 and 5 show the PAT governance process and trading mechanism.

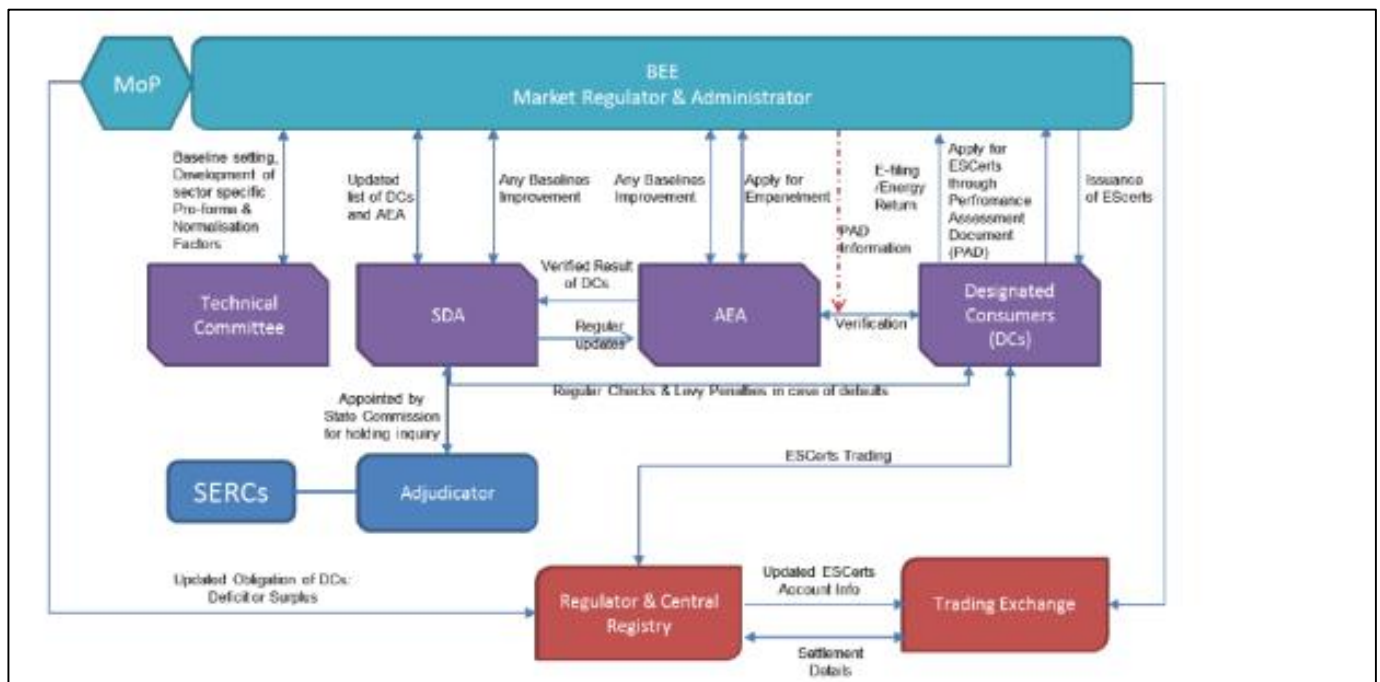


Figure 4 Governance process of PAT in India

The trading process overview is shown below

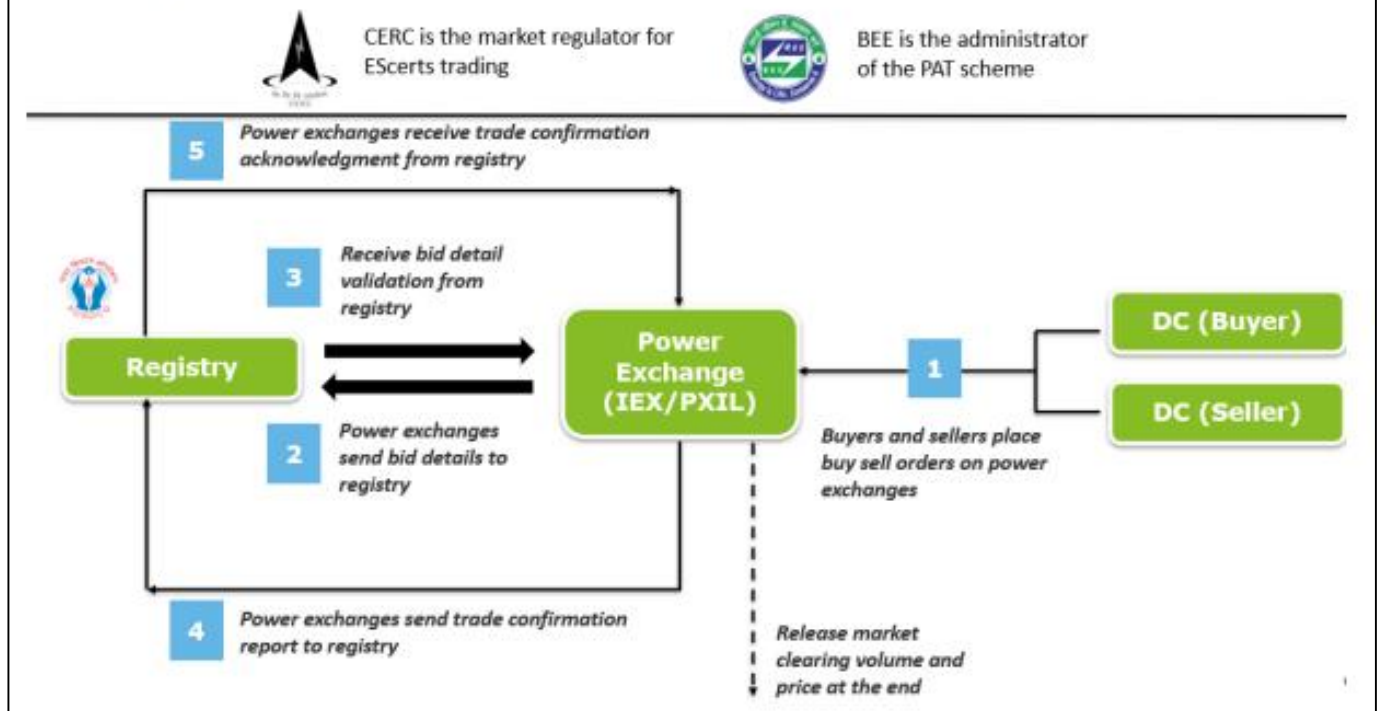


Fig 2 PAT Trading Overview

Source: Draft Blueprint on “National Carbon Market”

VII. LET’S UNDERSTAND SOME FACTS:

India is expected to see a growth in the carbon farming credits market, with the country having the highest estimated emission reductions among countries with projects pending under VM0042. The number of projects is second highest in the world, behind China. Many of the applicants are startups, while others are subsidiaries of major Indian agrochemical companies and joint ventures between Indian seed giants and Indigo Agriculture methodology developer. The industry is also attracting attention from overseas companies, such as Japanese ones. Initiatives to avoid greenhouse gas emissions from rice cultivation and field burning are specific to India.

Table 1: Application for VCS certification under methodology VM0042 contrywise

	Estimated Annual Emmission Reduction(MT of CO Equi.)	Number of projects
India	1,04,65,177	10
China	43,62,789	16
Switzerland	40,21,000	1
Argentina	11,00,000	1
US	10,12,173	2
Paraguay	10,00,000	1
Mexico	9,50,000	1
South Africa	8,56,045	5
Denmark	7,50,000	1
Australia	2,32,924	1
Kenya	2,00,000	1
UK	1,07,209	1
Brazil	78,085	1
Italy	40,682	3
lithuania	15,188	1
Germany	2,500	1
Israel	294	1
Global Total	251,94,066	48

Source: Compiled by MGSSI based on verra data feb 7, 2023

Table 2: Indian project submitted for certification under VM0042

Project	Estimated annual emission reductions MT CO ₂ Equivalent	Area (hectare)
Varaha Climate AG Pvt. Ltd	47,96,219	20,00,000
Grow Indigo Pvt Ltd	42,67,622	15,34,000
Boomitra INC (2 project	7,50,000	2,00,000
Suminter India Organics	2,75,748	52,031
Geneity Infocom Service Pvt Ltd	1,73,250	40,000
Mahanadi Compressed Biogas (DBG) Pvt Ltd	64,457	-
Landmark Agri Export Pvt Ltd	58,722	8,085
Multiple proponents	52,520	1,15,654
Biowin Agro Research	26,639	11,560
Total	1,04,65,177	39,61,330

Source: MGSSI 7 Feb 2023

The Indian government is promoting carbon farming due to the rising cost of chemical fertilizers, which has led to a rise in subsidies. Traditionally, the government has kept chemical fertilizer prices low, but the subsidy amount has risen due to international price hikes. In FY2022, the subsidy exceeded the original budget due to Ukraine war-related price hikes, putting pressure on public finances. The government plans to reduce fertilizer subsidies in FY2023, aiming to lighten the fiscal burden. This subsidy policy has allowed farmers to overfertilize, preventing the industry from introducing carbon farming. However, the policy is now heading in the opposite direction, with the cost burden for chemical fertilizer-oriented farmers expected to increase in the future.

India is expected to see a rise in business opportunities due to the increasing adoption of carbon farming. Technologies for credit certification, such as measuring, collecting, and calculating field data, and agricultural materials like bio-pesticides and carbon-storing crops, are emerging as potential business opportunities. However, if the transition to carbon farming results in lower yields, it could signal a setback for farmers, who are not fulfilling their primary role of food production. This could lead to the development of technologies that maintain yields even when fertilizer use is reduced.

Financial incentives beyond carbon credits could also be a new business. The entire value chain could be developed, connecting farmers with consumers who appreciate and are willing to pay a premium for their efforts. A sustainable finance scheme with preferential interest rates could also be explored.

India's unique social challenges, such as being the world's leading greenhouse gas emitter from agriculture, could also provide business opportunities. The country has the world's largest number of cattle and produces the world's largest amount of methane emissions from enteric fermentation. While there is significant scope for reduction, prominent initiatives have not emerged yet. In the UK, Mootral, a methane emission-reducing feeds developer, has developed a VCS-certified methodology and is generating carbon credits from its activities.

Table 3: Global GHG emission from agriculture (2020)

Rank	Country	GHG emission Vol (MT of CO Equi.)	Global Share (%)
1	India	776	13%
2	China	662	11%
3	Brazil	540	9%
4	US	386	6%
5	Pakistan	212	4%
6	Indonesia	158	3%
7	Argentina	140	2%
8	Ethiopia	134	2%
9	Australia	106	2%
10	Russia	104	2%
11	Mexico	102	2%
Ref	Japan	23	0%
-	Other	2689	45%
	Global	6032	100%

Based on IPCC Agriculture data

Source: Compiled by MGSSI based on FAO data (Jan 9, 2023)

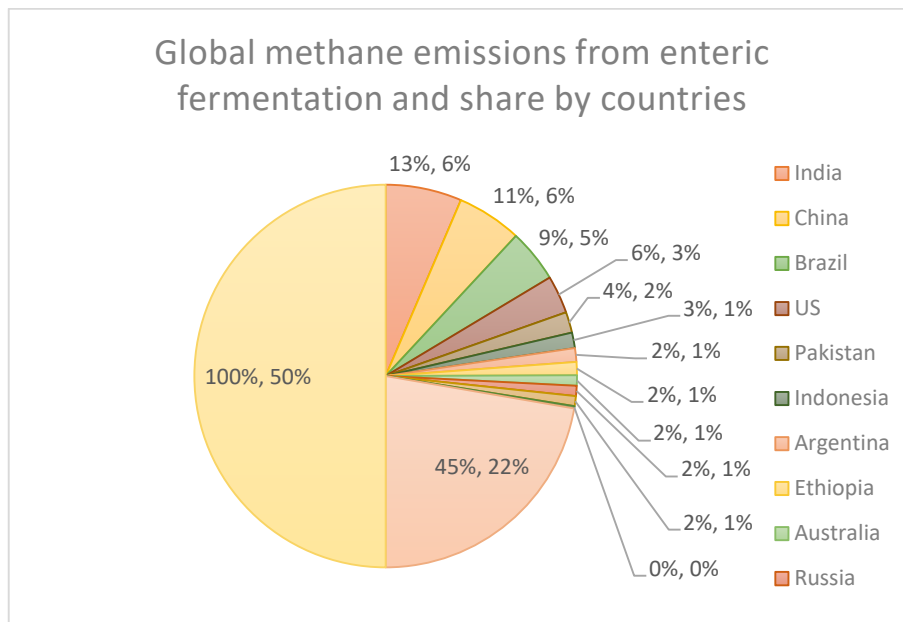


Fig 3 Global methane emissions from enteric fermentation and share by countries
Compiled by MGSSI based on FAO data(Jan 9, 2023)

Rice cultivation in India is a major source of methane emissions, similar to China's. The alternate wetting and drying (AWD) irrigation strategy helps avoid methane emissions and saves water by involving multiple cycles of draining and flooding. However, due to irrigation subsidies, Indian farmers are less motivated to save water. Uncontrolled use of irrigation water is the main cause of water shortages in the country. Therefore, the introduction of AWD and other methods is essential for managing Scope 3 emissions and natural capital management. Companies should focus on these approaches.

India is introducing new businesses to reduce field burning as an air pollution control measure, as it contributes to methane and nitrous oxide emissions. Reducing burning is eligible for carbon credits, adding value to existing businesses and increasing corporate value.

Table 3: Comparison of AMS III AU application status and methane emissions from rice cultivation in India and China

	Estimated annual emission reductions for project submitted under AMS - III. AU			Methane emission from rice cultivation		% estimated reduction over total emission (a/b)
	Total (a) MT CO2 Equivalent	Registered	Registration verification approval request	Emission vol (b) MT CO2 Equi	Global emission share (%)	
China	1,52,99,705	21,53,616	40,21,424	14,92,56,663	21.80%	10.3%
India	7,90,436	-	52,158	13,30,05,600	19.40%	0.6%

Source:AMS III AU it is a methodology certify by CDM. To reduce methane emission from rice cultivation through direct seeding and the introduction of a water management technique called alternate wetting and drying (AWD) Compiled by MGSSI based on on Verra data (feb 7, 2023) and FAO data(Feb 7, 2023)

Carbon farming credits are expected to grow globally, particularly in India, with its vast agricultural land area and potential for carbon removal and storage. The estimated price for carbon farming credits is around \$10 per metric ton (CO2 equivalent), with emission reductions in India estimated at 3 metric tons per hectare. If extended throughout India, the market could be worth over \$5 billion. India is also a significant market for carbon farming, as modern agriculture contributes to global environmental damage, air pollution, water shortages, and food security threats. While traditional forest carbon credits, such as afforestation, are primarily used in South America and Southeast Asia, India is likely to become the main stage for carbon farming credits due to its vast farmland and environmental improvement potential.

VIII. LESSONS LEARNED AND BEST PRACTICES:

India's experience with carbon trading has shown important best practices and lessons that may be used to both successful climate mitigation and sustainable development. As a best practice, a diverse portfolio of projects spanning many sectors—such as afforestation, energy efficiency, and renewable energy—has arisen, offering resilience against market volatility. Stakeholder support for carbon trading programmes increases when they are integrated with larger sustainable development objectives, which provide co-benefits for the environment and society. Simplifying project approval procedures has worked well to draw in a wide spectrum of participants, particularly for smaller projects. It has been determined that funding capacity-building initiatives and awareness campaigns is essential for increasing involvement and making sure stakeholders are aware of the workings and advantages of carbon trading.

A emphasis on long-term policy commitment combined with the deployment of cutting-edge technology and techniques has increased the efficacy of carbon reduction initiatives. Encouraging third-party certification and verification bolsters the integrity of the market, and cooperation amongst different stakeholders creates a positive environment. Global cooperation and more trading prospects are made possible by the investigation and development of connections with international carbon markets. Benefit-sharing and community involvement, together with adaptable compliance procedures, have shown to be essential in fostering inclusiveness and societal acceptance in the carbon market. India's changing experience with carbon pricing serves as a reminder of how crucial it is to match long-term effects with a multidimensional strategy and to match climate aims with more general sustainable development objectives.

IX. Conclusion:

India is expected to become a major market for carbon farming credits, with its vast agricultural land and potential for carbon removal and storage. The estimated price for these credits is around \$10 per metric ton, with emission reductions in India estimated at 3 metric tons per hectare. If extended throughout India, the market could be worth over \$5 billion. India's vast farmland and environmental improvement potential make it a significant player in the carbon farming credits market.

In conclusion, India's carbon market seems to have a bright and revolutionary future, which is consistent with the country's dedication to climate resilience and sustainable development. India is positioned to have a significant impact on the global carbon market due to its changing policy environments, possible implementation of a national carbon pricing regime, and enhanced international partnerships. We expect more engagement from a variety of industries as awareness and capacity development activities continue to grow, which will promote a more dynamic and inclusive economy. It is anticipated that the successful implementation of emission reduction initiatives would be driven by the integration of cutting-edge technology and creative solutions, placing India at the forefront of climate innovation.

A comprehensive strategy for tackling the problems posed by climate change is further demonstrated by the pursuit of adaptation and resilience measures as well as the connection of carbon market activities with more general sustainable development goals. Businesses are expected to adopt voluntary carbon reduction initiatives as corporate leadership in sustainability increases, which will fuel market demand even more. The future of the carbon market in India has the potential to be a revolutionary force that will greatly contribute to global climate objectives while supporting economic growth and social well-being. This can be achieved via regulatory clarity, financial tools, and a commitment to inclusion.

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