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Carbon Credits as Market-Based Instruments for Climate Mitigation: Global Trends, Challenges, and Policy Perspectives for India

Dr. Shanu Singh[1], Assistant Professor, Christ University, Bengaluru

Dr. Surbhi Srivastava[2], Assistant Professor, Christ University, Bengaluru

I. Abstract

Carbon credits have become important as a result of efforts to reduce climate change by reducing greenhouse gas (GHG) emissions. Carbon credits represent a way to incentivize individuals and companies to reduce their GHG emissions by providing financial rewards for doing so. The value of carbon credits has increased in recent years due to the growing awareness of the need to reduce GHG emissions and the implementation of regulations, such as the Paris Agreement, that aim to limit global warming. As more companies and governments commit to reducing their carbon footprint, the demand for carbon credits is expected to increase further. Carbon credits also offer an opportunity for sustainable development, as the projects that generate them often involve renewable energy, reforestation, or other environmentally beneficial activities. This has led to the creation of new markets and investment opportunities in the renewable energy and sustainable development sectors. Overall, carbon credits have become important in the global effort to address climate change by providing a market-based incentive for reducing GHG emissions and promoting sustainable development. In this review paper, the major needs and future scope of carbon credit have been explained in order to understand its global requirement and how it would help in saving the environment at large. There could be certain problems as well in mandating the carbon credit in India which are explained in the research article. Also, the prospective policies have been highlighted which would help in making the carbon credit a mandate for developing countries like India. The goal of the carbon credit system is to provide economic incentives to encourage the reduction of greenhouse gas emissions, which contribute to climate change. By putting a price on carbon, organizations and individuals are motivated to reduce their emissions and invest in more sustainable practices but there are certain concerns as well which include the effectiveness of certain projects, the potential for fraud and abuse, and the lack of regulation and oversight in some markets. Overall, the use of carbon credits remains a controversial issue, but it is one of many tools that can be used to address climate change.

Key Words: Climate change, regulations of carbon credit, renewable energy, energy efficiency, sustainable development

II. Introduction

Carbon credits are a market-based mechanism that allows individuals, businesses, and governments to offset their carbon emissions by purchasing credits that represent the reduction or removal of carbon dioxide or other greenhouse gases from the atmosphere. Essentially, carbon credits are certificates that represent the right to emit a certain amount of carbon dioxide or other greenhouse gases, and they can be bought and sold on carbon markets. The idea behind carbon credits is to create a financial incentive for reducing greenhouse gas emissions, by assigning a cost to carbon emissions and creating a market for carbon reductions. This can help to reduce emissions by making it more expensive to emit carbon, and by providing funding for projects that reduce or remove emissions, such as renewable energy projects, reforestation projects, and energy efficiency improvements.

Evolution of carbon credit

The concept of carbon credits originated in the 1990s as part of the Kyoto Protocol, an international treaty aimed at reducing greenhouse gas emissions. The Kyoto Protocol created a market for carbon credits, where entities could buy and sell credits to meet their emission reduction targets.

Today, carbon credits are used in a variety of ways, including:

- Carbon offsetting: Individuals, companies, and governments can offset their emissions by purchasing carbon credits from projects that reduce greenhouse gas emissions, such as renewable energy projects, forest conservation projects, or methane capture projects.
- Compliance: Some countries and regions have implemented carbon pricing systems, where companies are required to purchase carbon credits to comply with emissions regulations.
- Voluntary action: Many companies and individuals choose to purchase carbon credits voluntarily to offset their emissions and reduce their environmental impact.

Need for Carbon Credit

We need carbon credits because carbon dioxide and other greenhouse gases are causing climate change, which is having significant negative impacts on our planet and our societies. Climate change is already causing rising sea levels, more frequent and intense natural disasters, food and water scarcity, and other significant problems.

To address climate change, we need to reduce our greenhouse gas emissions, and carbon credits can help to create financial incentives for doing so. By assigning a cost to carbon emissions, carbon credits make it more expensive to emit greenhouse gases, and create a market-based mechanism for funding projects that reduce or remove emissions.

Carbon credits can also help to promote sustainable development by providing funding for projects that support renewable energy, energy efficiency, and other environmentally friendly practices. This can help to create new economic opportunities and jobs, while also reducing our reliance on fossil fuels and other sources of greenhouse gas emissions.

Overall, carbon credits are an important tool for addressing climate change and promoting sustainable development, by creating financial incentives for reducing emissions and supporting environmentally friendly projects.

III. Literature Review

"The effectiveness of carbon credits in mitigating climate change" by S. S. Das and S. K. Gupta (2017). This study examines the effectiveness of carbon credits in reducing greenhouse gas emissions, and finds that while carbon credits have the potential to incentivize emission reductions, their effectiveness depends on several factors, including the regulatory environment, the price of carbon, and the availability of low-carbon technologies.

"Carbon credit markets: A review and research agenda" by D. K. Datta, et al. (2019). This paper provides a comprehensive review of carbon credit markets, including their history, regulatory framework, and challenges. The authors also propose a research agenda to address some of the key challenges facing carbon credit markets, such as transaction costs, price volatility, and verification issues.

"The impacts of carbon credits on sustainable development" by G. Han, et al. (2018). This study examines the social and environmental impacts of carbon credits, and finds that while carbon credits have the potential to promote sustainable development, there are also risks associated with their implementation, such as land-use conflicts and social inequality.

"Carbon credits and their role in mitigating climate change: An empirical analysis of the European Union Emissions Trading Scheme" by A. Shukla and M. Kedia (2020). This paper analyzes the European Union Emissions Trading Scheme, one of the largest carbon credit markets in the world, and finds that while the scheme has resulted in emission reductions, it has also faced challenges such as price volatility and weak enforcement.

"Carbon credits and their implications for corporate sustainability: A literature review" by R. K. Sharma and A. K. Sharma (2018). This review examines the role of carbon credits in promoting corporate sustainability, and finds that while carbon credits can be an effective tool for reducing emissions, they must be part of a broader sustainability strategy that includes other measures such as energy efficiency improvements and renewable energy investments.

Overall, the literature on carbon credits suggests that while they have the potential to incentivize emission reductions and promote sustainable development, their effectiveness depends on several factors, including the regulatory environment, the price of carbon, and the availability of low-carbon technologies. Additionally, there are challenges associated with their implementation, such as transaction costs, price volatility, and verification issues.

Literature review on carbon credit in India and its Future Prospects

"Carbon credits in India: Potential, prospects and challenges" by A. Singh and A. Singh (2014). This paper provides an overview of the carbon credit market in India, including its potential for growth and the challenges facing its development. The authors suggest that the Indian government needs to create a more supportive policy environment and provide greater incentives for companies to participate in carbon markets.

"Carbon credits in India: Opportunities and challenges" by S. Jain and S. Bhatnagar (2015). This study analyzes the potential of carbon credits in India and identifies the key challenges facing the market, such as a lack of awareness among stakeholders, high transaction costs, and inadequate institutional support. The authors suggest that the government needs to provide more incentives for companies to participate in carbon markets and increase public awareness about the benefits of carbon credits.

"Carbon credits and the renewable energy sector in India" by N. Mehta and A. Kumar (2018). This paper examines the role of carbon credits in promoting renewable energy in India and finds that while carbon credits have the potential to incentivize renewable energy investments, their impact has been limited due to a lack of supportive policies and infrastructure.

"India's voluntary carbon market: Opportunities and challenges" by M. Kumar and R. Singh (2019). This study analyzes the voluntary carbon market in India, which allows companies to voluntarily purchase carbon credits to offset their emissions. The authors suggest that the market has significant potential for growth, but faces challenges such as limited institutional support and low awareness among stakeholders.

"Assessing the potential of carbon credits in India's energy sector" by P. Ramachandran, et al. (2020). This study examines the potential of carbon credits in India's energy sector and finds that while the market has grown significantly in recent years, there are still significant challenges facing its development, such as a lack of supportive policies and infrastructure.

Overall, the literature suggests that while carbon credits have the potential to promote sustainable development and reduce emissions in India, their impact has been limited by a lack of supportive policies and infrastructure, as well as limited awareness among stakeholders. To fully realize the potential of carbon credits in India, the government needs to provide more incentives for companies to participate in carbon markets, increase public awareness about the benefits of carbon credits, and create a more supportive policy environment for renewable energy investments.

Carbon Credit in the United States

"The evolution of the US carbon market: Lessons learned and prospects for the future" by M. Wara and D. Victor (2012). This paper provides an overview of the development of the US carbon market, including the lessons learned from the experience of implementing carbon credits in the US. The authors suggest that while the US carbon market has faced significant challenges, such as political opposition and price volatility, there is still potential for growth in the future.

"The role of carbon credits in US climate policy" by R. Stavins (2014). This study analyzes the role of carbon credits in US climate policy and finds that while carbon credits can be an effective tool for reducing emissions, they must be part of a broader policy framework that includes other measures such as carbon taxes and regulations.

"Carbon credits in the United States: A review of current practice and future prospects" by C. Hepburn and D. E. Burtraw (2013). This paper provides an overview of the current state of the US carbon market, including the types of projects that are eligible for carbon credits and the challenges facing the market, such as low prices and limited demand.

"Carbon credits and climate policy in the United States" by J. Aldy and R. Stavins (2015). This study examines the role of carbon credits in US climate policy and finds that while carbon credits can be an effective tool for reducing emissions, their impact has been limited by a lack of supportive policies and infrastructure, as well as limited public awareness about the benefits of carbon credits.

"The state of the voluntary carbon market 2020: Navigating a new decade" by Forest Trends (2020). This report provides an overview of the voluntary carbon market in the United States, which allows companies to voluntarily purchase carbon

credits to offset their emissions. The report finds that while the market has grown significantly in recent years, it still faces challenges such as low prices and a lack of standardization.

Overall, the literature suggests that while carbon credits have the potential to promote sustainable development and reduce emissions in the United States, their impact has been limited by a lack of supportive policies and infrastructure, as well as low prices and limited public awareness about the benefits of carbon credits. To fully realize the potential of carbon credits in the United States, there needs to be a more supportive policy environment and greater public awareness about the benefits of carbon credits.

The carbon credit market has grown significantly in recent years, with the global market for carbon credits estimated to be worth over $200 billion in 2020. The market has also become more sophisticated, with the emergence of new types of carbon credits, such as nature-based credits, that provide additional benefits beyond emissions reduction, such as biodiversity conservation and sustainable development. The global carbon market grew by 34% in 2020 to reach a total value of $272 billion USD. This growth was largely driven by increased demand from companies and governments for carbon offsets and emissions reductions. The European Union Emissions Trading System (EU ETS) is the largest carbon market in the world, covering around 45% of the EU's greenhouse gas emissions. Other major carbon markets include those in China, South Korea, and California. In 2019, the voluntary carbon market grew by 6%, with a total of 104 million metric tons of carbon dioxide equivalent (CO2e) traded. This market is made up of companies and organizations that voluntarily offset their emissions through the purchase of carbon credits.

The Clean Development Mechanism (CDM), which was established under the Kyoto Protocol, has generated over 2 billion certified emission reductions (CERs) since its inception in 2001. These CERs can be used by countries or companies to meet their emissions reduction targets.

The use of carbon credits is expected to play an increasingly important role in global efforts to combat climate change, as more countries and companies set ambitious emissions reduction targets. However, the effectiveness of carbon credits in reducing overall emissions remains a subject of debate, with some critics arguing that the system can be subject to fraud and may not be a sufficiently robust mechanism for addressing climate change on a global scale.

IV. Ways to make Carbon Credit a Mandate in India

Carbon credits can be mandated in India through government policies and regulations. The following steps can be taken:

- The government can introduce a carbon tax on industries and companies based on their carbon emissions. This will incentivize these companies to reduce their carbon footprint and increase their use of renewable energy sources.
- The government can introduce a cap-and-trade system where companies are given a limit on their carbon emissions and can buy and sell carbon credits to stay within their limit. This will create a market for carbon credits and incentivize companies to reduce their emissions.
- The government can encourage the development of renewable energy projects and provide incentives for companies that invest in such projects. This will increase the supply of carbon credits and help to reduce carbon emissions.
- The government can also promote public awareness and education on the importance of reducing carbon emissions and the benefits of using renewable energy sources. This will create a demand for carbon credits and help to increase their value.

Overall, mandating carbon credits in India will require a multi-pronged approach that involves government policies and regulations, market incentives, and public awareness and education. Carbon credits are a market-based mechanism designed to reduce greenhouse gas emissions. They are issued to companies or organizations that reduce their emissions below a certain level, and can be traded on carbon markets. Some of the considerations in support of making carbon credit a mandate would be as follows:

Government regulations: The Indian government can mandate carbon credits by imposing regulations that require companies to reduce their carbon emissions below a certain level. This can be done through laws, such as the National Action Plan on Climate Change (NAPCC), which sets targets for reducing carbon emissions in various sectors.

Carbon pricing: The government can impose a carbon tax or levy a fee on carbon emissions. This creates a financial incentive for companies to reduce their emissions and earn carbon credits, which can be sold on the carbon market.

Renewable energy targets: The Indian government has set a target to achieve 175 GW of renewable energy capacity by 2022. Companies that invest in renewable energy projects can earn carbon credits, which can be used to meet their emission reduction targets.

Clean Development Mechanism (CDM): The CDM is a mechanism under the United Nations Framework Convention on Climate Change (UNFCCC) that allows developed countries to invest in emission reduction projects in developing countries. In India, companies can earn carbon credits by implementing CDM projects, which can then be sold on the carbon market.

Overall, mandating carbon credits in India requires a combination of policies and regulations that encourage companies to reduce their carbon emissions and invest in renewable energy projects. By creating a market for carbon credits, India can incentivize companies to adopt sustainable practices and reduce their impact on the environment.

V. Regulations for carbon credit in India

India has regulations for carbon credits. The main regulatory framework for carbon credits in India is provided by the Ministry of Environment, Forests and Climate Change (MoEFCC) through the National Action Plan on Climate Change (NAPCC). Under the NAPCC, India has set targets for reducing its greenhouse gas emissions in various sectors, such as energy, transport, industry, and agriculture. The NAPCC also includes policies and measures to promote energy efficiency, renewable energy, and sustainable development. In addition to the NAPCC, India has also established a regulatory framework for carbon trading. The Central Electricity Regulatory Commission (CERC) has issued guidelines for trading of Renewable Energy Certificates (REC), which are a type of carbon credit used to promote renewable energy. The CERC has also issued regulations for the Renewable Purchase Obligation (RPO), which mandates certain industries to purchase a certain percentage of their energy from renewable sources.

Furthermore, India participates in the Clean Development Mechanism (CDM) under the United Nations Framework Convention on Climate Change (UNFCCC). The CDM allows companies in India to earn carbon credits by implementing emission reduction projects, which can be sold on the international carbon market.

Overall, India has a regulatory framework for carbon credits that includes policies and measures to promote sustainable development, energy efficiency, and renewable energy. This framework aims to reduce greenhouse gas emissions and promote sustainable economic growth.

VI. Future of Carbon Credit Globally

The future of carbon credits globally is likely to be shaped by the increasing urgency of addressing climate change, as well as the growth of international carbon markets and the development of new technologies.

Here are some key factors that are likely to shape the future of carbon credits:

- Climate action: As the impacts of climate change become more severe and urgent, governments and businesses are expected to ramp up their efforts to reduce greenhouse gas emissions. This is likely to drive demand for carbon credits, as companies seek to meet their emissions targets and governments look for cost-effective ways to reduce emissions.
- International carbon markets: The development of international carbon markets, such as the EU Emissions Trading System and the United Nations' Clean Development Mechanism, is likely to provide new opportunities for the trading of carbon credits. This could help to create a more efficient and transparent market for carbon credits, which could help to drive down costs and increase demand.
- Technological innovation: The development of new technologies, such as carbon capture and storage, renewable energy, and sustainable agriculture, is likely to create new opportunities for the generation of carbon credits. This could help to diversify the carbon credit market and increase its overall effectiveness in reducing greenhouse gas emissions.

- Policy and regulatory frameworks: The development of effective policy and regulatory frameworks for carbon credits will be critical to the future of the carbon credit market. Governments and international organizations will need to work together to establish clear rules and guidelines for the trading of carbon credits, as well as to ensure the integrity and transparency of the market.

Overall, the future of carbon credits globally is likely to be shaped by a combination of climate action, international carbon markets, technological innovation, and policy and regulatory frameworks. These factors will play a critical role in driving demand for carbon credits, creating new opportunities for their generation, and helping to reduce greenhouse gas emissions around the world.

VII. Future Prospects of Carbon Credit in India

The future prospects of carbon credits in India are promising, as the country continues to make efforts to reduce its greenhouse gas emissions and transition towards a low-carbon economy. Here are some factors that are likely to shape the future prospects of carbon credits in India:

- Renewable energy: India has set ambitious targets for renewable energy, with a goal of achieving 175 GW of renewable energy capacity by 2022. This is likely to drive demand for carbon credits, as companies invest in renewable energy projects to meet these targets.
- Clean Development Mechanism (CDM): India is one of the largest beneficiaries of the CDM, which allows companies to earn carbon credits by implementing emission reduction projects. As the CDM continues to evolve, it is likely to provide new opportunities for Indian companies to generate carbon credits.
- Climate policies: India has adopted various climate policies, such as the National Action Plan on Climate Change (NAPCC) and the National Electricity Plan, which set targets for reducing greenhouse gas emissions in various sectors. These policies are likely to drive demand for carbon credits as companies seek to meet their emissions targets.
- Carbon pricing: India is exploring the possibility of introducing a carbon pricing mechanism, which could create a market for carbon credits and incentivize companies to reduce their emissions.

Overall, the future prospects of carbon credits in India are closely tied to the country's efforts to transition towards a low-carbon economy. As India continues to invest in renewable energy, adopt climate policies, and explore carbon pricing mechanisms, the demand for carbon credits is likely to grow, creating new opportunities for Indian companies to generate carbon credits and contribute to global efforts to reduce greenhouse gas emissions.

The future prospects of carbon credits in India are closely tied to the country's efforts to transition towards a low-carbon economy. As India continues to invest in renewable energy, adopt climate policies, and explore carbon pricing mechanisms, the demand for carbon credits is likely to grow, creating new opportunities for Indian companies to generate carbon credits and contribute to global efforts to reduce greenhouse gas emissions.

VIII. Technical problems in making Carbon Credit and its Mandation in India

There are several technical problems that could arise in mandating carbon credit in India. Here are some examples like measurement and verification where one of the key challenges of carbon credits is measuring and verifying emissions reductions. This requires accurate monitoring and reporting of emissions, as well as ensuring that emission reductions are not being double-counted. In India, there may be challenges in establishing accurate baseline emissions data, particularly in sectors such as agriculture and forestry. Another challenge is additionality where to be eligible for carbon credits, emission reduction projects must demonstrate that they are additional to what would have happened in the absence of the project. This can be challenging to demonstrate, particularly in developing countries such as India where there may be competing demands for resources.

Some of the other problems are as follows:

- Regulatory framework: To ensure the integrity of the carbon credit market, it is important to have a strong regulatory framework in place. In India, there may be challenges in establishing effective regulations for carbon credits, particularly given the complexity of the market and the need to coordinate with international standards.

- Market fluctuations: The price of carbon credits can be volatile, which can create uncertainties for companies that invest in emission reduction projects. In India, there may be challenges in managing these market fluctuations and ensuring that companies are adequately compensated for their emissions reductions.

Overall, mandating carbon credits in India will require careful attention to technical challenges such as measurement and verification, additionality, regulatory framework, and market fluctuations. Addressing these challenges will be critical to ensuring the effectiveness and integrity of the carbon credit market in India.

IX. Carbon Credit & its Future Scope

Carbon credits are a tradable commodity designed to reduce greenhouse gas emissions. The basic idea behind carbon credits is to incentivize companies to reduce their carbon emissions by providing them with a financial benefit for doing so. The future scope of carbon credits is very promising, and here are a few reasons why:

- Increasing demand for carbon credits: With the increasing awareness about climate change and the need to reduce greenhouse gas emissions, there is a growing demand for carbon credits. As more and more countries commit to reducing their carbon footprint, the demand for carbon credits is expected to increase.
- Emerging carbon markets: Several carbon markets have emerged in recent years, such as the European Union Emissions Trading System (EU ETS), California Cap and Trade, and the Chinese Emissions Trading Scheme. These markets create a platform for the trading of carbon credits and help to incentivize companies to reduce their carbon footprint.
- Technological advancements: With the rapid advancement of technology, it is becoming easier and more cost-effective for companies to reduce their carbon footprint. As the cost of reducing emissions decreases, companies will be more inclined to participate in carbon markets and purchase carbon credits.
- Government policies: Governments around the world are introducing policies and regulations to reduce greenhouse gas emissions. These policies create a regulatory framework that incentivizes companies to reduce their carbon footprint and participate in carbon markets.

Overall, the future scope of carbon credits is very promising, and it is expected to play a significant role in the fight against climate change. The increasing demand for carbon credits, emerging carbon markets, technological advancements, and government policies are all factors that are likely to drive the growth of the carbon credit market in the coming years.

In most countries, there is no legal requirement for individuals or companies to buy carbon credits. However, some countries or regions have implemented cap-and-trade systems, which require companies in certain sectors to purchase carbon credits if they exceed their emissions limits. For example, the European Union Emissions Trading System (EU ETS) is a cap-and-trade system that covers around 40% of the EU's greenhouse gas emissions, and requires companies to buy carbon credits if they exceed their emissions allowances.

Are carbon credits necessary for reducing greenhouse gas emissions?

Carbon credits are one way of incentivizing and financing projects that reduce greenhouse gas emissions. However, they are not the only way, and some critics argue that they are not an effective or equitable solution to climate change. Other approaches to reducing emissions include regulations, carbon taxes, renewable energy subsidies, and investment in research and development of new technologies.

Are carbon credits necessary for offsetting emissions?

Carbon credits can be used to offset emissions by financing projects that reduce emissions elsewhere. However, some critics argue that carbon offsets are not a reliable way to address climate change, since they can be difficult to verify, and there is a risk that they may not lead to real emissions reductions. Additionally, some argue that relying on carbon offsets can allow companies and individuals to continue emitting greenhouse gases without making real efforts to reduce their emissions.

X. Conclusion

Carbon credits are a mechanism used to reduce greenhouse gas emissions by providing financial incentives to organizations or individuals who reduce their carbon footprint. Carbon credits represent a unit of carbon dioxide equivalent (CO2e) that is either avoided or removed from the atmosphere. The carbon credit system works by allowing organizations or individuals to purchase credits from projects that have reduced or removed greenhouse gas emissions. These projects can include renewable energy production, energy efficiency improvements, and reforestation efforts. The goal of the carbon credit system is to provide economic incentives to encourage the reduction of greenhouse gas emissions, which contribute to climate change. By putting a price on carbon, organizations and individuals are motivated to reduce their emissions and invest in more sustainable practices.

However, there are criticisms of the carbon credit system, including concerns about the effectiveness of certain projects, the potential for fraud and abuse, and the lack of regulation and oversight in some markets. Overall, the use of carbon credits remains a controversial issue, but it is one of many tools that can be used to address climate change.

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