

CLEAN DEVELOPMENT MECHANISM : INDIAN STEP AHEAD FOR SUSTAINABLE ENVIRONMENT

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Abstract The Kyoto Protocol established the Clean Development system (CDM), a cooperative system that might help developing nations achieve sustainable development by encouraging environmentally conscious investment from firms and governments in affluent nations. An overview of the CDM's history, composition, and project cycle is given in this publication, which also looks at the benefits and potential value for participating developing nations like India. The Ozone layer is being weakened by pollution brought on by an increasing population. On our earth, every species is in danger of being extinct. The primary conclusions are: With the aid of the Kyoto Protocol, three formal methods for global emission reduction were established: Joint Implementation (JI), Clean Development Mechanism (CDM), and International Emissions Trading (IET). It raises public awareness, and with the aid of certified emission reduction units, some environmental organizations developed the idea of carbon trading. The CDM offers both industrialized and developing nations a win-win scenario. Businesses in India such as Gujarat Fluoro Chemicals, Tata Steel, NTPC, ONGC, and others can obtain several facilities abroad by using CERs. Through the exchange of credits and reduction of GHG emissions, carbon trading and CER "claims" to avert the impending disaster. Therefore, it can be concluded that imposing carbon prices with refunds is an effective strategy to address the ~~emissions~~ ~~emissions~~ issue.

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Since reducing greenhouse gas (GHG) emissions is a worldwide public good and the location of emission reductions has no bearing on the global stock of GHG, the CDM's premise is that reductions in emissions should be made where they can be done for the least amount of money. The findings shed light on potential difficulties in navigating market mechanisms in the future and show how the Carbon Offset Management (CDM) program has provided nearly 20 years of knowledge and expertise in the area of global carbon offset governance.

Keywords: CDM, Sustainable Development, Green House, Kyoto Protocol, Ozone layer

1. Introduction:

The rate at which population is growing is concerning. Humanity will inevitably disappear into thin air as things change. The surroundings are changing. There is a hole in the ozone layer. On our earth, every species is in danger of being extinct. As the population grows, so do the needs for clothing, food, and shelter. Consequently, there are more factories and more production, which leads to more pollution. Since the early 1970s, efforts on a global scale to enhance environmental governance have accelerated. From this juncture on, scientists started to postulate that rising global temperatures are caused by carbon dioxide emissions. As a result, a number of environmental organizations became more concerned, and this led to the creation of "World Climate Conferences," where the main topics of discussion were the greenhouse gas emissions that are the primary cause of global warming and the possible harm that climate change could do to society. With the aid of emission reduction projects, CDM enables the companies to obtain certified emission reduction (CER). One ton of CO₂ is equivalent to each credit. To meet their emission reduction targets, these credits can be sold to other Indian or foreign organizations. The purpose of the Clean Development Mechanism's structure is to enhance emission reductions and sustainable development. It has been created in a number of organizations using renewable energy to increase energy efficiency and replace coal with clean solutions.

Countries must fulfill specific qualifying requirements in order to be eligible to participate in the CDM. The acceptance of the Kyoto Protocol, the creation of a National CDM Authority, and voluntary participation in the CDM are the three fundamental conditions that all Parties must satisfy. The establishment of the allocated amount under Article 3 of the Protocol, a national system for the estimation of greenhouse gases, a national registry, an annual inventory, and an accounting system for the sale and purchase of emission reductions are additional requirements that industrialized nations must meet.

In order to gather precise emissions data, CDM programs also need to have a monitoring strategy. The monitoring plan should be able to track the risks associated with baseline and project emissions and should give assurance that the emission reductions and other project objectives are being met. It also serves as the foundation for any further verification. Either the project developer or a professional agent can create the monitoring strategy. An authorized technique must be followed in the creation of the baseline and monitoring plan. If the project's participants favor a novel approach

Simple math underlies the CDM's core idea: rich nations can invest in clean abatement opportunities in poor nations and get credit for the subsequent reductions in emissions, which lessens the amount of domestic cutbacks required. Developed nations will pay less to comply with the Protocol thanks to the CDM, but poor countries will also gain from greater investment flows and the requirement that these investments support sustainable

development goals. As part of the package, the CDM promises to address development priorities and activities, which incentivizes poor nations to participate. This acknowledges that global climate protection will remain a challenge for all nations unless they can achieve sustainable development [4].

Need of the study:

The study offers an understanding of climate change from a scientific perspective. It provides details on the Kyoto Protocol and carbon trading, highlighting the significance of the Clean Development Mechanism study. It gives the truth and lies about CDM in India and offers a number of solutions for this crucial process [5].

As per Cormier, a World Bank specialist in environmental project setup for South Pacific Asia, Indian enterprises and establishments are establishing novel CDM and emission reduction items to capitalize on the emerging carbon trading industry. The expert stated that the worldwide market for carbon trading under the Clean Development Mechanism (CDM) is now estimated to be worth \$5 billion annually. This might reach \$100 billion if the Intergovernmental Panel on Climate Change (IPCC)'s proposal to reduce carbon emissions by 50% is carried out.

Scope of the Study

As the primary focus of India's development, this study aims to investigate the socio economic components of CDM projects that fulfill sustainable development objectives and how to effectively alleviate rural poverty in India. Nonetheless, the review's primary conclusion states that, in a global context, the CDM does not significantly contribute to sustainable development; the study is restricted to analyzing rural settlements in the study area that are already self-sustaining in terms of social auditing and energy auditing [6].

Literature Review:

China and India are on same footing when it comes to CDM advancement. Additionally, he clarified that India is the world's top supplier of CDM credits. The global need for energy is enormous due to the massive increase in the economy. These days, the main players in these credit discussions are China and India [7].

In his work "A Realistic Policy on International Carbon Offsets," states that all of China's CDM projects, including wind, hydropower, and natural-gas power plants, contend that they are unable to produce the anticipated outcomes without the necessary additional money. Additionally, they said that while China might be able to secure its own finance, the Kyoto Protocol's accepted idea of carbon trading would not work. Therefore, it is necessary to support large-scale projects in the fields of infrastructure development, rural electrification, and public transport in order to achieve sustainable development and reduce climate change [8].

According to article, the Kyoto Protocol's brainchild, the CDM is a tool for bringing rich and developing nations together for their mutual benefit or a win-win scenario for both. A pilot programme for both sustainable environmental development and economic success is CDM. However, a lot of professionals are calling attention to CDM's numerous drawbacks and restrictions [9].

During the Rio de Janeiro Earth Summit in 1992, participants voiced their concerns about pollution and greenhouse gas emissions as the primary causes of climate change. Several methods were being proposed to address these issues, and CDM was one of them. Naturally, a lot of people were unhappy with CDM's performance and even chastised it. The writers' attention was drawn to members who provided solutions to reduce greenhouse gas emissions and environmental concerns [10].

The hydro power plant is classified as a small project if its capacity is less than 15 MW and as a large project if its capacity is more than 15 MW.

A wealth of literature and reports exist on CDM and CER, however there is a dearth of information about India. The study's research gap relates to investments in CDM and CER,

which are beneficial for reducing emissions and have other advantages, particularly for India [11].

Objectives:

1. To conduct a thorough analysis of the Clean Development Mechanism (CDM) idea
2. To examine the causes of the relatively low CDM project success rate.
3. To offer recommendations for enhancing CDM initiatives in India

Hypothesis:

1. There is significant impact of CDM and CER investment in India low in reducing emissions.
2. There is no significant or CDM and CER investment in India higher in reducing emissions.

2. Methodology:

Only a collection of secondary sources, such as reference books, research papers from journals, websites, blogs, and newspaper articles, are used in this study. The observation and the research aspects provide the own analysis

Fundamentally, the Clean Development Mechanism (CDM) model is a special concept that combines environmental and financial mechanisms. In order to accomplish sustainable development, an organisational set of units with operational and functional duties is linked to the same CDM model.

Regarding this, the following organisational model is meant to be proposed by working groups in the public and commercial sectors. These model descriptions are taken straight from the literature and adjusted to the main goals of the study.

Climate change: Every day, the sun provides us with light and energy, of which 30% is deflected back into space and the remaining 70% penetrates the earth's surface to warm it. Infrared radiation is the energy that the earth produces. This radioactivity is soluble in a variety of fumes, including carbon dioxide, methane, nitrous oxide, halocarbons, ozone, and others, but it is unable to cross the troposphere. The "enhanced greenhouse effect" results from this. According to some scientists, temperatures in the next century will climb by 5 to 10 degrees Fahrenheit unless GHG emissions are significantly decreased. Research on greenhouse gases from 1950 indicates that the ocean's impact on global warming is twenty two times greater than that of the troposphere. Scientists have noticed that our surroundings is regularly upsetting and damaging. As a result, the Kyoto Protocol was created to preserve the environment and implement CDM.

In summary, global temperature will achieve a new equilibrium if greenhouse gas emissions are drastically reduced, providing some degree of predictability. This needs to be carried out not just locally but also worldwide using CDM, one of the useful factors.

Kyoto Protocol: The main industries that use fossil fuels to generate electricity, such as steel, cement, textiles, and coal-based electricity, are accountable for greenhouse gas emissions. This has a detrimental effect on the ecosystem and raises the ability of the environment to absorb infrared radiation. As a result, more people are concerned of how the environment is changing, and numerous environmental organisations have investigated different ideas to mitigate climate change. These consist of carbon trading, carbon credits, carbon offsets, and clean development strategies. The Kyoto Protocol, an international accord addressing climate change that brought together 170 countries, and the later Marrakesh Accords were created from these ideas

Three methods have been created under the Kyoto Protocol to mitigate the negative environmental consequences of greenhouse emissions. These mechanisms allow impacted countries to earn carbon credits for their respective purposes. These include

Joint Implementation (JI): A developed nation may fund the carbon initiatives of another developed nation in accordance with Article 6 of the Kyoto Protocol.

Clean Development Mechanism (CDM): A developed nation may fund GHG reduction initiatives for other developing nations in accordance with Article 12 of the Kyoto Protocol. These nations have a comparable effect on the global climate since they produce less carbon.

International Emissions Trading (IET): All parties to the Kyoto Protocol are permitted to sell carbon credits with one another under Article 17.

Clean Development Mechanism: increased economic expansion leads to increased industrialization, which increases atmospheric carbon emissions. Climate change and greenhouse gas emissions are directly related to it. This graph displays the carbon emissions.

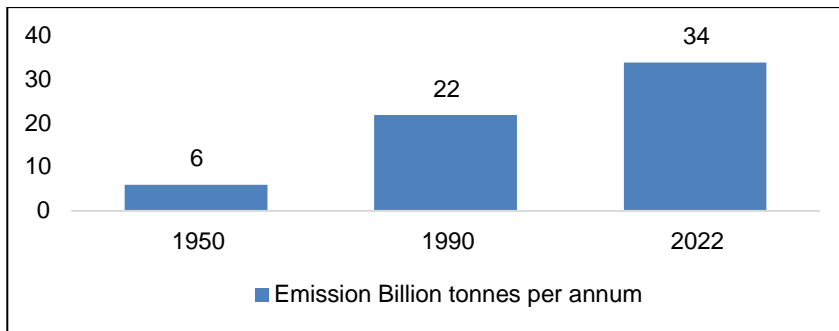


Figure 1 illustrates how, in 1950, greenhouse gas emissions were just 6 billion tonnes annually. However, as industry grew and enterprises ignored the Central Pollution Control Board's regulations, emissions skyrocketed to 34 billion tonnes annually in 2022. The graph indicates that annual greenhouse gas emissions are increasing daily.

Figure 1: Yearwise GHGs Emission Graph

The Clean Development Mechanism is one of the instruments for greenhouse gas management included by the Kyoto Protocol. It assists developing nations in achieving their greenhouse gas reduction goals and in acquiring "Certified Emission Reduction Units" (CERs). Through this mechanism, industrialised nations can allocate their more fruitful greenhouse gas projects to developing nations' efforts to reduce emissions. Developing nations can potentially market these pollution reductions to businesses and other nations who are interested. All of these procedures also assist developing nations in achieving sustainable development; for instance, they enable these nations to promote and export low emission technologies while simultaneously creating their own. Kyoto cannot meet its emission reduction goals without CDM.

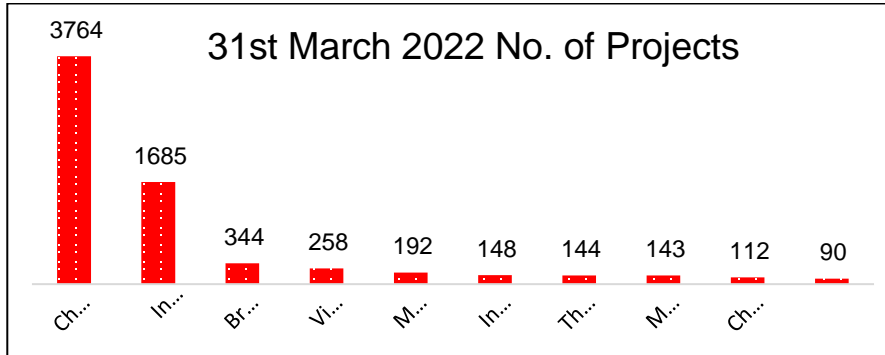


Figure 2: CDM Projects registered by the top ten countries

Figure 2 demonstrates how many nations have signed up for the CDM initiative in order to take use of the CDM procedure. With 1685 registrations from different enterprises lowering GHG emissions, India comes in second. However, China holds the top spot with 3764 projects registered under the CDM. India has been granted a certain number of "Certified Emission Reductions" for the project that has been implemented, amounting to 2588 issuances [19].

Since energy projects and power plants contribute significantly to pollution, many nations have addressed sustainability by lowering emissions from these sources. As of March 31, 2022, 75.25% of projects in the global energy sector are being worked on in the CDM. Agriculture is carried out in CDM at 2.32%, manufacturing at 4.32%, handling and disposal at 10.71%, and other industrial project activities [20].

India and CDM:

India cut emissions by 50% of its overall "certified emission reduction" following the Kyoto Protocol's implementation in 2006. However, by 2014, the overall percentage had dropped to 11.2%. But it hit 69.5% once more in 2015. but dropped once further to 19.5% in 2022. There are ups and downs in the CDM registration process due to its complexity. For "standardised emission reduction," 70.8 lakh projects have been approved by 2020 in Tamil Nadu, 59.3 lakh in Madhya Pradesh, 43 lakhs in Karnataka, 35 lakhs, 30.5 lakhs, and 25.6 lakhs in Gujarat, Andhra Pradesh, and Maharashtra, in that order. Additionally, 2.4 lakh projects were approved for CER in Chhattisgarh [21].

A company's right to carbon credits under the Kyoto Protocol is determined by the theoretical difference in emission levels when it adopts cleaner technology compared to old ones. These credits can be exchanged on international markets.

According to Cormier, a World Bank specialist in building up environmental emission reduction projects in South Pacific Asia, Indian enterprises and institutions are establishing new CDM and emission reduction products to capitalise on the emerging carbon trading market. According to the expert, the worldwide market for carbon trading under the Clean Development Mechanism (CDM) alone is currently worth \$5 billion annually. "This could reach up to \$100 billion if the Intergovernmental Panel on Climate Change (IPCC)'s recommendation to reduce carbon emissions by 50% is carried out." [22].

According to experts from the World Bank, India is the second largest country after China in terms of registered CDM projects (1094 registered projects total, with nearly 90% claimed by the energy industries). India is also a highly preferred location for buyers of credits from developed countries as it provides a much more effective option for them to meet their carbon emission targets

Currently, the CDM is neither making emissions neutral nor reducing them; rather, it is increasing due to a number of mechanisms designed for technology transfer. Since transportation—such as the transportation of windmill spare parts, shipping, local transportation, and other transportation sectors are more polluting than other sectors, there

is a growing need for more environmentally friendly mitigation processes. This is occurring as a result of serious shortcomings in the current CDM emission reduction initiatives explain the table1.

Table 1: CDM Investment World level and India level

Sr. No.	Parameter	India	World
1	Total projects registered under CDM (units) 7,979 1,376	1,376	7,979
2	Total CERs issued (in million units)	253	1995
3	Total capital investment in projects still active (in million USD)	100732	396728
4	Total capital investment in all projects to date (in million USD)	113,495	546,643
5	Percentage of capital investment still active	89%	73%

Source: CDM Registry Issuance Report 2019, UNFCCC

Testing of Hypothesis

1. There is significant impact on CDM and CER investment in India is low in reducing emissions.
2. There is significant on CDM and CER investment in India is higher in reducing emissions explain the table2

Table 2 : Hypothesis of Hypothesis

Regression Statistics	
Testing Multiple R	0.9721
R Square	0.9341
Adjusted R Square	0.9832
Standard Error	103.23
Observations	40

ANOVA					
	Df	SS	MS	F	Significance F
Regression	1	1.11E+12	1.14E+12	127.3574	0.00978
Residual	2	2.16E+09	1.06E+10		
Total	3	1.14E+10			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	1241.061	6841.658	0.1741	0.8176	-31370.5239	32645127	-31316.37256	3200540321
Variable 1	0.23471	0.23457	11.2875	0.056782	0.1537128	0.3723584	0.13524781	0.34235891

Regression analysis and ANOVA are used to justify the "P" value of 0.00978. With one degree of freedom, the "F" value is 127.6981, which is greater than the "P" value. As a result, the alternative hypothesis, "H1: There is significant on CDM and CER investment in India is higher in reducing emissions," is accepted and the null hypothesis, "H0: There is significant impact on CDM and CER investment in India is low in reducing emissions," is

rejected.

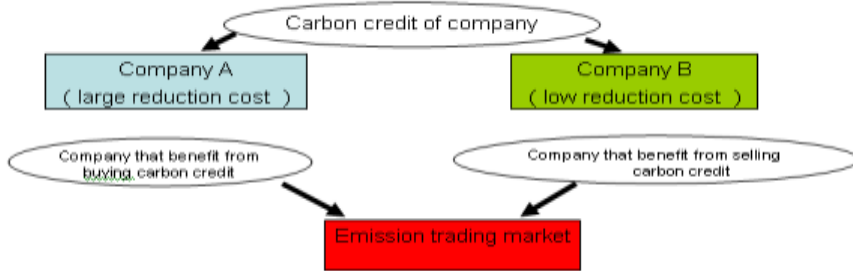


Figure 3 Emission of Target Market

In Figure 3, the purchasers of these carbon credits will be classified into A, B, and C groups based on the quantity of carbon credits they are willing to purchase. Big businesses like steel producers and thermal power plants are typically classified as class buyers.

Sustainable Development in India: The Kyoto Protocol permits the purchase of carbon credits from CDM eligible countries by 35 wealthier nations. While Brazil and India are developing nations and are therefore not subject to this agreement, international organisations from rich nations are nonetheless able to purchase carbon credits from these nations through the CDM mechanism. An abundance of facilities, including simple credit and development advantages like social and environmental visibility, are available to several organisations in India through the use of CDM and CER. Several other power boards, including ONGC, Tata Steel, NTPC, BHEL, and Fluoro Chemicals, have also applied for CDM registration and, consequently, CER. Among other things, Indian projects with fewer carbon dioxide emissions than they otherwise would be able to verify as clean energy projects have the ability to produce and sell CERs.

Climate change Mechanism: The notion of carbon trading and CDM has long been associated with an accurate and advantageous resolution to the grave and unavoidable predicament that the coming generations will have to face. However, it is also interpretable in both directions. Through the exchange of credits and reduction of GHG emissions, carbon trading "claims" to avert the impending disaster.

3. Discussion

The atmosphere's emissions of fossil fuels must be reduced in order to combat climate change; trading permit facilities cannot do this. Geothermal, solar, and wind energy. It seems cap and trade has done little to reduce greenhouse gas emissions and has instead increased energy price volatility. In actuality, utilities receive windfall profit in the billions.

Any activity can be changed in the global economy. As such, it is nearly hard to detect whether a harmful action is changed. A carbon offset doubles the profit on the sale of a refrigerant's hazardous byproduct, making the refrigerant itself twice as profitable.

The 2011 India Carbon Congress emphasised the significance and importance of carbon trading through 2020 for the EU, India, and other countries. The CDM is currently going through ups and downs, and in order to control CO₂ emissions, national or global targets must be updated to take into account international negotiations, some of which have been successful and many of which have been lowered. In addition to growing and causing controversy, intergovernmental trade in sectors of carbon trading that form markets has improved. Do the current emissions trading methods, which are implemented through the CDM, make sense? In what way are they measurable? How can a nation develop

appropriate policies for a sustainable approach to putting Green Initiatives into practice? To what end is the enormous money for the clean development mechanism headed? What are green investments' advantages and disadvantages?

4. Conclusion:

A shifting climate is a warning sign for every life on the planet. It is possible to avert the planet's symbolic extinction. The alternative premise that "Indian CDM and CER investments are superior globally in reducing emissions" is the main subject of the research investigation. It has been suggested that more constructive and successful strategies for reducing greenhouse gas emissions are CDM and CER. When considered internationally, India's implementation of CDM and CER registration and investment is quite effective. Numerous instances have been produced by research. A methodical approach to reducing pollutants and making the environment cleaner is provided by CDM and CER. As a result, the null hypothesis, which states that "Indian CDM and CER investment is less in reducing emissions globally," is rejected.

It is challenging to predict the full scope of advantages that developing nations may receive from the CDM, but it is evident that the programme has immense potential to advance sustainable development and boost inflows of foreign capital. It can also help with addressing local and regional environmental concerns and furthering social goals with careful planning and the creation of a national CDM strategy. When finance for GHG emission reduction initiatives may be constrained by other development objectives, the CDM enables developing nations to take part in the global effort to address climate change.

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