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A role of Green Bonds in Co2 Emission from Fossil Fuels and its emerging challenges in India

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Abstract

This study focus on a role of of Green Bonds in Co2 Emission form Fossil Fuels and its emerging challenges in India. All countries around the world are struggling in some way or other with climate change. Recently we have witnessed the unprecedented climate changes all over the world.As India's green energy sector prepares to take off, it is important to assess the landscape and chart the way forward. Reforms in this area have been underway for more than a decade. Researchers have tried to describe the overall effect of green bonds on Co2 emission, problems faced by India, and futuristic approach for green bonds. . This study will use Karl Pearson's correlation to further elaborate on the relationship between Green Bonds and Co2 emission from fossil fuels. SPSS software is used for data processing.The fund raiser needs to understand the urgency of this sector and work accordingly to it. An additional disclosure is needed with this type of bonds in balance sheet because their purpose is to invest only in green projects.

Key Words- Green Bonds, Green Financing, SDG, CO2 emission

Introduction

One of the most precious gifts we have on our earth is the ecosystem of nature. But knowingly or unknowingly somehow, we all have harmed the nature and now we can see the harmful effects of harming our nature. All countries around the world are struggling in some way or other with climate change. Recently we have witnessed the unprecedented climate changes all over the world. Almost all the countries and world organisations have admitted that climate issue need to be addressed urgently. But as the climate started showing its evil side it seems like we are quite late for this. The government and organisations are trying to work on certain agendas like UN

has created a dedicated program for SDG i.e., UNEP. It will help to attain the SDG till 2030. Beside of commitment by almost every major economy of the world and many organisations are working on climate change but we still are lagging behind the time. The main obstacles here are lack of funding to the green projects. As the initial capital inflow of green projects is high it makes these projects more vulnerable and most of the green projects are considered as the risky projects by Basel.

Due to lack of finding and capital hinderance the green projects are moving forward with speed of sloth and lack of loan by banks further deteriorated this process of green financing.

In 2008 the World Bank came up with a solution for green projects funding and the first green bond issued was in 2013. It was clearly a new hope of getting funds from these bonds for green projects. Many countries had issued green bonds for their green projects as of now all the major economies of the world have issued and raised the funds by it. The funds by green bonds are around USD 1889.7 billion. The major projects are getting funds for new projects. Can all this help to reduce CO2 emission?

Green Bonds

Green Bond is a debt instrument issued to finance the green projects which have positive impact on climate and environment. **ICMA** define the green bonds as "A "green bond" is differentiated from a regular bond by its label, which signifies a commitment to exclusively use the funds raised to finance or re-finance "green" projects, assets or business activities"

We forum defines the Green Bonds as "Green bonds work like regular bonds with one key difference: the money raised from investors is used exclusively to finance projects that have a positive environmental impact, such as renewable energy and green buildings."

Co2 emission

In today's world Co2 emission is not an alien word to define, some of the basic definition of Co2 emissions are - **Europa** define Co2 emission as "Carbon dioxide emissions or CO2 emissions are emissions stemming from the burning of fossil fuels and the manufacture of cement; they include

carbon dioxide produced during consumption of solid, liquid, and gas fuels as well as gas flaring". **OECD** define it as "Carbon dioxide (CO2) is a colourless, odourless and non-poisonous gas formed by combustion of carbon and in the respiration of living organisms and is considered a greenhouse gas. Emissions means the release of greenhouse gases and/or their precursors into the atmosphere over a specified area and period of time". If we see the technical definition of Co2e **the Environmental Protection Agency** defines Co2e as "Carbon dioxide equivalent or CO2e means the number of metric tons of CO2 emissions with the same global warming potential as one metric ton of another greenhouse gas, and is calculated using Equation A-1 in 40 CFR Part 98".

India's Green Initiative

As India's green energy sector prepares to take off, it is important to assess the landscape and chart the way forward. Reforms in this area have been underway for more than a decade and While this is clearly a tremendous development, India is still dependent on oil and gas imports.

Namami Gange Programme

The Namami Gange Programme, aimed at rejuvenating the River Ganga, does not specifically involve the utilization of Green Bonds or directly focus on reducing CO2 emissions. The primary objectives of the program are to address the pollution and degradation issues faced by the Ganga and ensure its long-term sustainability as a clean and healthy river system.

However, it is worth noting that certain components of the Namami Gange Programme indirectly contribute to environmental sustainability and can potentially have an impact on reducing CO2 emissions.

For example, the program emphasizes afforestation initiatives along the riverbanks. By promoting the cultivation of medicinal plants and trees, it aims to restore the river's biodiversity and improve the overall ecological balance. Afforestation can help sequester carbon dioxide from the atmosphere, thereby contributing to mitigating climate change.

In addition, the Namami Gange Programme focuses on wastewater management infrastructure, including the construction and upgradation of sewage treatment plants (STPs) and sewage network systems. Proper treatment of sewage helps in reducing the pollution load on the river and improves water quality. While this component does not directly target CO2 emissions, it contributes to environmental conservation and the overall health of the ecosystem.These projects, while not directly tied to the Namami Gange Programme, can complement its efforts by promoting sustainability and environmental conservation.

Namami Gange Programme itself does not incorporate Green Bonds or explicitly target CO2 emissions reduction, certain components indirectly contribute to environmental sustainability. Exploring the potential utilization of Green Bonds to finance projects aligned with the program's objectives could further enhance its environmental impact and contribute to CO2 emission reduction efforts.

Swachh Bharat Abhiyan

Under the Swachh Bharat Abhiyan, waste management is a significant component, and proper waste management practices can help reduce greenhouse gas emissions, including CO2. The implementation of waste-to-energy plants is an example of a project that can be funded through Green Bonds. These plants convert organic waste into biogas or electricity, reducing the release of methane, a potent greenhouse gas, from landfills. By utilizing Green Bonds, these waste-to-energy projects can receive financial support, encouraging their implementation and contributing to the reduction of CO2 emissions.

Additionally, the Swachh Bharat Abhiyan's emphasis on promoting sustainable practices and cleanliness can indirectly lead to a reduction in CO2 emissions. For instance, the campaign promotes the use of toilets, which reduces the need for open defecation in rural areas. This not only improves public health and sanitation but also helps protect water sources from

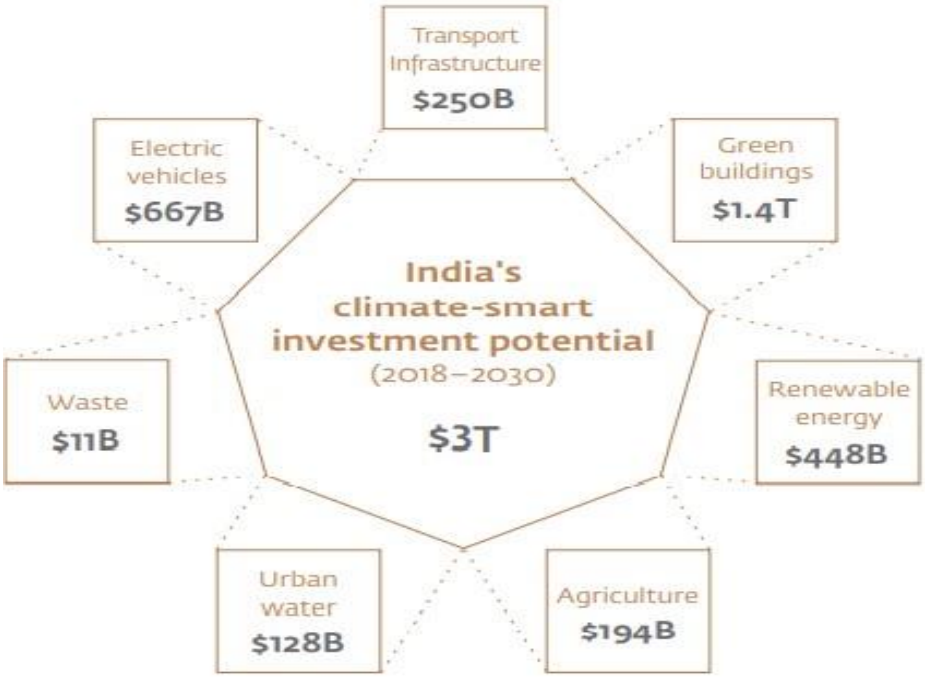
contamination, leading to healthier ecosystems. Consequently, the preservation of ecosystems contributes to carbon sequestration and the maintenance of overall environmental balance.

The potential use of Green Bonds within the Swachh Bharat Abhiyan can provide financial resources to support projects that contribute to CO2 emission reduction. These projects may include the establishment of waste management infrastructure, waste-to-energy plants, renewable energy installations, and sustainable transportation initiatives. By channeling investments through Green Bonds, the campaign can access funds specifically designated for environmentally beneficial projects, thereby furthering its objectives of cleanliness and contributing to CO2 emission decrease.

It is significant to note that while the Swachh Bharat Abhiyan indirectly supports the reduction of CO2 emissions through waste management and sustainable practices, the direct impact on CO2 reduction may vary depending on the scale and effectiveness of the implemented projects. The utilization of Green Bonds can make easy the financing of such projects, reinforcing the mission's commitment to environmental sustainability.

Investment opportunities in green projects in India

In order to reach its carbon emissions pledges, India needed finance and investment, much of it front loaded. The McKinsey research predicts that as much as 3.5–six percent of GDP will be needed. This forecasts US$7.2 trillion of green investments necessary under the current Line of Sight scenario in the years through 2050. A additional US$4.9 trillion would be needed under an expedited scenario.



Source: IFC (World Bank)

Green bonds have the potential to attract foreign investment in India's renewable energy sector. As global investors become increasingly conscious of environmental risks, they are actively seeking investment opportunities that align with their sustainability objectives. Green bonds provide a transparent and credible investment avenue for such investors, assuring them that their funds are directed towards projects with clear environmental benefits. This influx of foreign investment can help accelerate the expansion of renewable energy infrastructure in India and contribute to the country's efforts in reducing carbon emissions.

Green bonds play a pivotal role in India's carbon emission reduction efforts. They provide a dedicated source of financing for green projects, encourage private sector involvement, and attract foreign investment in renewable energy initiatives. By leveraging the power of green bonds, India can accelerate its transition towards a more sustainable and low-carbon future.

By channelling investments into renewable energy projects, Green Bonds enable the expansion of clean energy capacity, which in turn displaces the use of fossil fuels for power generation. This helps in reducing CO2 emissions, as renewable energy sources have a lower carbon footprint compared to conventional fossil fuel-based power generation.

Green bonds play a crucial role in addressing carbon emissions in India by providing a financing mechanism for environmentally sustainable projects. India faces significant challenges in reducing its carbon footprint while still meeting its growing energy demands. Green bonds offer a unique solution to bridge this gap by attracting investments towards renewable energy, energy efficiency, and other climate-friendly initiatives.

Secondly, green bonds provide a mechanism to incentivize private sector participation in India's sustainability efforts. Companies can issue green bonds to finance their own renewable energy projects or initiatives aimed at improving energy efficiency. This not only reduces their carbon footprint but also aligns their business practices with environmental goals. By encouraging businesses to issue green bonds, India can foster a culture of sustainability in the corporate sector, leading to more widespread adoption of green practices.

Recent Literature review

- **Miroshnichenkoa& Brand (2021)** in their study, "Banks Financing the Green Economy: A Review of Current Research." The purpose of this study is to make generalize and systematize results for green projects by banks. A historical approach is applied in this study. The authors concluded that responsible banking contributes to financial stability. The study also suggests that regulators must keep an eye on green credit through environmental stress testing.

- **Fatica& Panzica (2021)** have done this study, "Green bonds as a tool against climate change?". The study concluded that the results are mixed for bonds when pooled together. The non-refinancing bonds give strong evidence.

- **Maltais&Nykvist (2020)** have done this study, "Understanding the role of green bonds in advancing sustainability."The study aims to understand the factors that attract investors and issuers of green bonds and to shed light on how green bonds affect the organization's sustainable work. The researchers surveyed 20 questions with nine issuers of bonds from the public and private sectors. The study concluded that green bonds are low-risk financial instruments for green projects, and they help investors raise funds at a low cost.

- **Ngwenya &Simatele's (2020)** have studied, "The emergence of green bonds as an integral component of climate finance in South Africa."The study concluded that South Africa should adopt the new mechanisms of green projects, green bonds have shown positive results worldwide, and now South Africa needs to adapt them to finance the green projects.

- **Flammer (2020)** has studied "Green Bonds: Effectiveness and Implications for Public Policy." The purposes of the study are to divide the market of green bonds based on time, countries, industries, and needs, to examine the effectiveness of green bonds, and to study the implications of public policies. A sample of 217 corporates is collected for the study.

The study concluded that green bonds helped in carbon footprints, and certification by third parties plays a vital role in the green bond market.

- **Yang et al. (2019)** study, "Green financial policies and capital flows."This study aims to analyze the production differences between direct measures and green-credit regulations, which serve as an indirect measure to encourage the growth of renewable energy sources. The study's findings are that government needs to focus on the green rates policy as per market interest rates to counter any adverse effects of the green rates policy. The study also concluded that the amount of capital held by renewable energy companies and the amount of tax due under the carbon tax are positively correlated.

- **Khan et al. (2019)** study, "Managing risk in green building projects: toward a dedicated framework."The study concluded few risks associated with green projects: high initial cost, inflation cycle, and lack of experience of contractors. The study suggested a framework is needed to be provided for green projects.

- **Heine et al. (2019)** study, "Financing Low-Carbon Transitions through Carbon Pricing and Green Bonds."The study suggested that an intertemporal model that needs to be set up will help get funds from green bonds and green tax. The green bonds will help to reduce climate damage.

- Green Finance in India: (2019) report was published with objectives of developing green projects in India and globally. Data for this study was collected through both public awareness and financing options. The report concluded that green finance is one of the fastest emerging shared priority policies. A comprehensive information system is required to coordinate between all the stakeholders for long-term goals.

Research Scope

The study covers the role of green bonds in combating the Co2 emission in India. Green Bonds was started with a futuristic outlook to combat the Co2 emission but it is not that much effective in India's case. Researchers have tried to describe the overall effect of green bonds on Co2 emission, problems faced by India, and futuristic approach for green bonds.

Signification of study

This study is to make recommendations to India - How India can acknowledge the futuristic opportunities of green bonds. This study will help to understand the relationship between green bonds and Co2 emission. The green bonds can play a vital role in reducing the Co2 emission especially in developing nations where the capital inflow is low as compared to developed nations and India is the second most populated country of the world (world bank 2022), fifth largest economy of the world and world's third largest emitter of Co2.

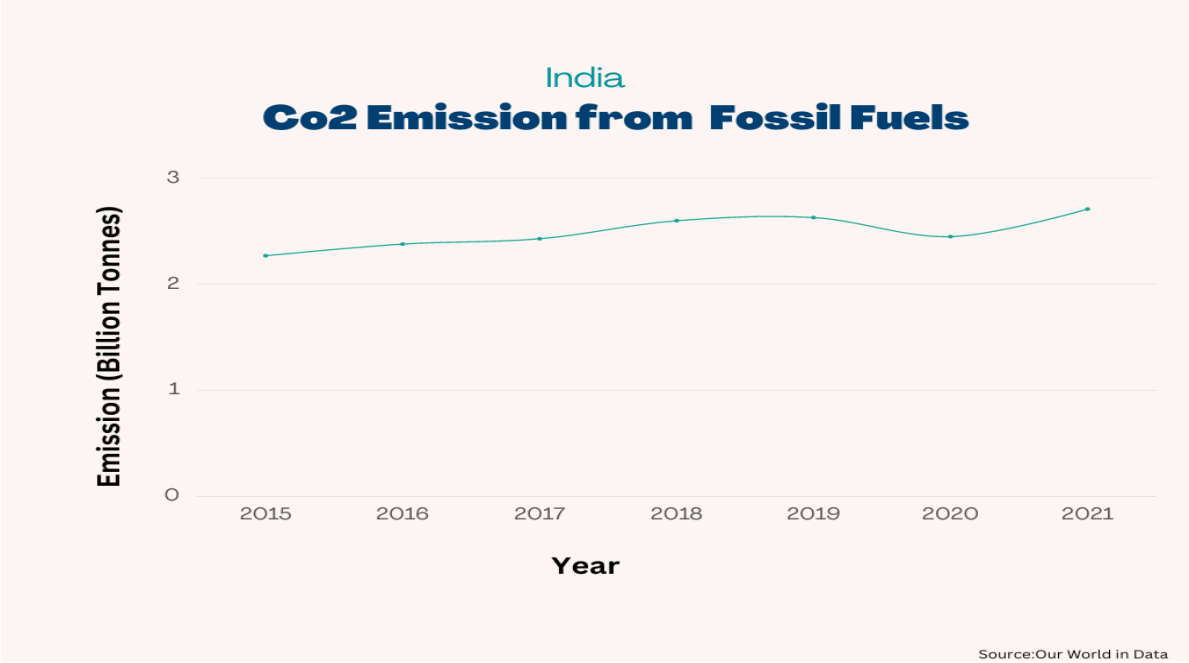
Objective of the study

1. To understand the role of green bonds in carbon emission.
2. To analyze the relationship between carbon emission and the green bond in India.
3. To highlight the difficulty faced by India concerning green bonds and controlling carbon emissions.

Research Methodology

The research methodology used in this study is based on secondary data collected from ourworldindata (University of Oxford) for Co2 emission from fossil fuels and the number of funds raised by issuing green bonds by the Climate Bonds form climate-bonds. The researchers have used two-line graphs side by the side of a country to represent the CO2 emission from fossil fuels. This study will use Karl Pearson's correlation to further elaborate on the relationship between Green Bonds and Co2 emission from fossil fuels. SPSS software is used for data processing.

Theoretical result

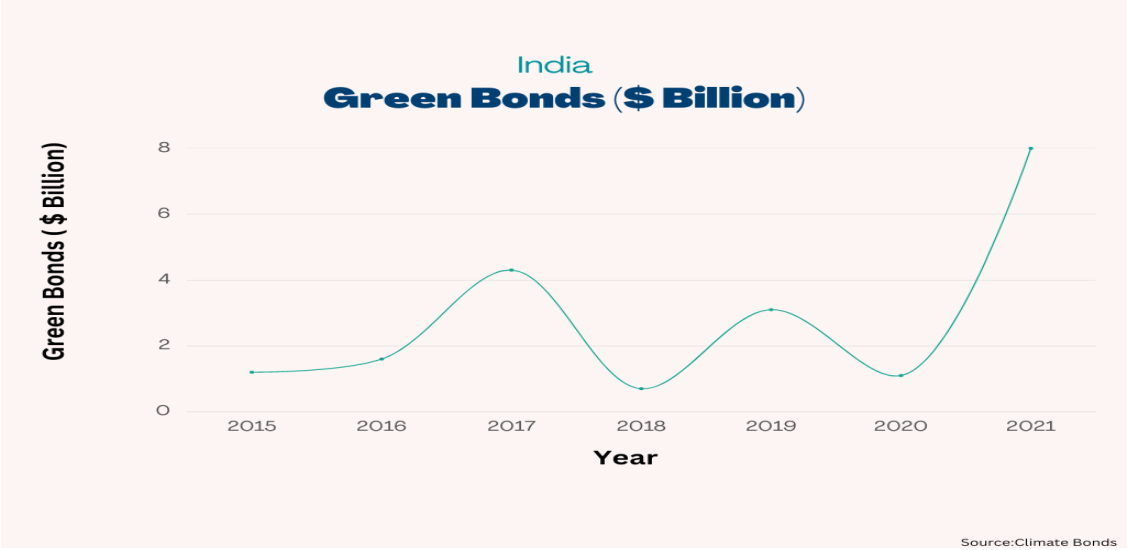


Source – Climate bonds (https://www.climatebonds.net/market/data)

Fig 1

The figure 1 represent the Co2 emission from fossil fuels in India from 2015 to 2021. In the year 2015 the co2 emission was 2.27 billion tonnes, in 2016 it was 2.38 billion tonnes, in 2017 it was 2.43 and till 2019 it showed an upward trend it rosed to 2.63 from 2.27 billion tonnes in 2015.

The percentage increment was almost 16% in Co2 emission from fossil fuels in India. 2020 was slow year for economic activity and India witnessed a downward trend to 2.45 billion tonnes but when economy started opening in 2021, we can see a sudden rise in Co2 emission from fossil fuels from 2.45 billion tonne in 2020 to 2.71 in 2021. The overall increment in Co2 emission from fossil fuels in India after the introduction of green bonds in 2015 is almost 20% in 2021.



Source – Climate bonds (https://www.climatebonds.net/market/data) Fig 2

The figure 2 represent the data of green bonds in India from 2015 to 2021. India is one of the first Asian country to raise the funds through green bonds. The first green was issued in 2015 with USD 1.2 Billion, and India continued to issue the green bonds till 2021.

In 2017 India issued the green bonds of USD 4.3 Billion, in 2019 the value of green bonds were USD 3.1 Billion and in 2021 India issued the record green bonds with USD 8 Billion. The overall increment in the green bonds in India is 566% after the introduction of Green bonds in 2015 to 2021.

Correlations			
		Carbon fossil	Green bonds 0.582
Carbon fossil	Pearson Correlation	1	
	Sig. (2-tailed)		0.171
	N	7	7
Green bonds	Pearson Correlation	0.582	1
	Sig. (2-tailed)	0.171	

The table provided displays the correlation coefficients for the variables "Carbon fossil" and "Green bonds." Correlation analysis is a statistical method used to assess the strength and direction of the association between variables. Correlation coefficient between "Carbon fossil" and "Green bonds" is 0.582.

Descriptive Statistics			
	Mean	Std. Deviation	N
Carbon fossil	2.4957	0.15576	7
Green bonds	2.8571	2.60311	7

The mean of the "Carbon fossil" variable is 2.4957, representing the average value of the data. The standard deviation is 0.15576, indicating how the data points are spread around the mean. A smaller standard deviation suggests that the data points are closely grouped around the mean. The "Carbon fossil" variable consists of 7 data points, denoted as N.

The mean of the "Green bonds" variable is 2.8571, representing the average value of the data points. The standard deviation is 2.60311, indicating a higher degree of variability or dispersion compared to the "Carbon fossil" variable. The "Green bonds" variable also consists of 7 data points.

Firstly, in terms of the mean, "Green bonds" (2.8571) have a slightly higher average value compared to "Carbon fossil" (2.4957). This suggests that, on average, the values associated with "Green bonds" tend to be higher than those of "Carbon fossil."

Moving on to the standard deviation, "Green bonds" (2.60311) exhibit a significantly higher value than "Carbon fossil" (0.15576). The higher standard deviation for "Green bonds" indicates a greater dispersion or variability in the data points, implying that the values associated with "Green bonds" are more spread out compared to "Carbon fossil."

Based on the provided descriptive statistics, it can be concluded that "Green bonds" have, on average, higher values and greater variability compared to "Carbon fossil." However, it is essential to recognize that these findings are solely based on the provided statistics and may require further analysis or additional information to draw more definitive conclusions.

Coefficients								
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	2.396	0.081		29.448	0.000	2.187	2.605
	Green bonds	0.035	0.022	0.582	1.598	0.171	-0.021	0.091
a. Dependent Variable: Carbon fossil								

The standardized coefficient (Beta) of 0.582 represents the estimated change in the dependent variable, measured in standard deviations, associated with a one-standard deviation increase in "Green bonds." This allows for comparing the impact of different predictors on the dependent variable using a standardized scale..

ANOVA[a]						
Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	0.049	1	0.049	2.555	.171
	Residual	0.096	5	0.019		
	Total	0.146	6			
a. Dependent Variable: Carbon fossil						
b. Predictors: (Constant), Green bonds						

The F-statistic compares the mean square for the regression to the mean square for the residual. In this scenario, the F-statistic is 2.555, obtained by dividing the mean square for the regression by the mean square for the residual.

Findings of the study

There is a negative correlation between the funds raised by the Green Bonds for green projects and the CO2 emission from fossil fuels. During this study the researchers have found that India has started to raise the funds in 2015 through green bonds with USD 1.2 Billion an it rosed to USD 8 Billion in 2021. The funds increased by 566% but if see the overall increment of the Co2 emission from fossil fuels form 2015 to 2021 is 20%.

These investments not only contribute to reducing carbon emissions but also help in achieving national and international climate goals. Green bonds provide the necessary financial support to realize these commitments.

Green bonds in India also attract international investors who are increasingly seeking sustainable investment opportunities. The country's focus on renewable energy and sustainable development presents a promising market for green bonds. This influx of capital from domestic and international investors helps in financing projects that address climate change and contribute to the reduction of carbon emissions.

Conclusions

Green Bonds are financial instruments specifically designed to fund projects with environmental benefits, including renewable energy, energy efficiency, and climate change mitigation. In the context of fossil fuels, Green Bonds can be utilized to finance projects that facilitate the transition to cleaner energy sources and reduce CO2 emissions.

India has been actively promoting green finance initiatives to address its environmental challenges and support sustainable economic growth. The government has introduced various policies and incentives to encourage venture in green projects.

Recommendations

“Green bonds are a type of debt issued by public or private institutions to finance themselves and, unlike other credit instruments, they commit the use of the funds obtained to an

environmental project or one related to climate change" the definition is given by **Iberdrola,**this clearly defines that a green bonds as debt instruments that are raised in debt form if companies won't show any positive effect, then people will hesitate to subscribe for these bonds. If companies will continue to raise the funds for green projects and it won't show any direct effect on Co2e it will further decrease the morale of the investors in green projects and will affect the capital flow in green projects in long term.

The fund raiser needs to understand the urgency of this sector and work accordingly to it. An additional disclosure is needed with this type of bonds in balance sheet because their purpose is to invest only in green projects. A transparent system at world needs to be developed for this project and a Basel norm type committee can be made to regulate the funds, to provide guidelines and to assist private and public players with this project. The PPP models can also play a vital role in this sector.

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