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Research Paper

A Comparative Analysis of the Indian Green Bond Market and Global Trends

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ABSTRACT

Sustainable finance includes a range of financial instruments, investments, and decision-making that integrate environmental, social, and governance (ESG) factors into the management and allocation of capital. The goal of sustainable finance is to support long-term sustainable economic activities and green projects. Green bonds are a type of sustainable financial instrument which supports projects that help mitigate climate change and environmental degradation. They are used to finance renewable energy, energy efficiency, and other climate-related initiatives. Apart from this, sustainable bonds and sustainable linked bonds have also emerged in recent times, issue proceeds of which are invested not just in green projects but also in projects with social benefits. As per the report of Climate Bond Initiative, from 2006 to 2024, the cumulative value of these bonds issued was 55.9 billion USD in India which was merely 0.99% of the global market. The global market recorded a cumulative value of 5660.3 billion USD for the same time period. In January 2023, for the first time, the Government of India issued sovereign green bonds worth 80 billion INR. On the other hand, Securities Exchange Board of India (SEBI) records show that 8873 crore INR has been raised by several public and private companies by issuing green and sustainability linked bonds as on 30.09.2025. In this backdrop, this study aims to compare India's position with respect to its global counterparts in the market for green bonds by collecting secondary data. The paper also highlights the potential for green bonds and offers policy recommendations to streamline its usage in India which subsequently will help achieve the sustainable development goals.

Keywords: *Economic Activity, Green Bonds, India, Sustainable Investment*

Sustainable finance are those financial decisions and investments which integrate environmental, social and governance (ESG) factors into the management of capital in different projects. The core principles of sustainable finance can be categorised as: **Environmental** considerations **(E),** mainly focus on energy efficiency, mitigating climate change, addressing pollution and other environment risks and preserving biodiversity; **Social** responsibility considerations **(S)** cover issues like human rights, labour standards, inclusivity, employee engagement, and community relations. Good **governance (G)** of public and private institutions – including management structures, employee relations, executive remuneration and shareholder rights – plays a significant role in ensuring the

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inclusion of social and environmental considerations in the decision-making process. The goal of sustainable finance is to direct long-term investment towards sustainable economic activities, while generating return and managing risks.

Sustainable financial instruments can be categorised into six types: 1. Green Bonds, 2. Green Loans, 3. Sustainability-Linked Bonds, 4. Sustainability-Linked Loans, 5. Sustainability Bonds, 6. Social Bonds.

In a world where global warming and climate change are an alarming issue, green bonds have emerged as a popular investment tool. **Green bonds** are a type of sustainable financial tool which supports projects that help mitigate climate change and environmental degradation. These are also known as climate bonds. The money is used to finance green projects or climate friendly projects. These bonds may have some tax incentives. Green bonds are mostly help finance projects ranging from energy efficiency and pollution control to sustainable agriculture and forestry to protecting terrestrial and aquatic ecosystems. The World Bank issued its first green bond in the year 2008. Today, more than 50 countries have issued green bonds, with the United States being the largest source.

Sustainability bonds are financial instruments where proceeds are used to finance a combination of environmental and social projects or activities. These bonds are required to follow the Sustainability Bond Guidelines from International Capital Market Association (ICMA), which are aligned with Green Bonds Principles and Social Bonds Principles. They can be unsecured, backed by the creditworthiness of the corporate or government issuer, or secured with collateral on a specific asset.

A **sustainability linked bonds** (SLB) are a type of debt instruments where the proceeds from issuance are intended for general corporate purposes or other purposes. The objectives of these bonds are measured through predefined Key Performance Indicators (KPIs). They are evaluated by achieving predefined Sustainability Performance Targets (SPTs). The structural characteristics of these instruments are based on whether the issuer achieves sustainability metrics within a given timeframe. The Sustainability-linked Bond Principles, published by the International Capital Market Association in June 2020 have five core components: 1. Selection of KPIs, 2. Calibration of SPTs, 3. Bond characteristics, 4. Reporting, 5. Verification.

In India the green bond market is expanding rapidly, with a significant increase in sovereign and corporate issuances to fund different energy efficient and green projects. In January 2023, for the first time, the Government of India issued sovereign green bonds worth 80 billion INR. The government has issued sovereign green bonds to finance green projects along with many other private players in these field. As per the report of Climate Bond Initiative, from 2006 to 2024, India's cumulative value of aligned green, social, sustainability, and sustainability-linked (GSS+) bonds issued was 55.9 billion USD**,** which was merely 0.99% of the global market. The global market recorded a cumulative value of 5660.3 billion USD for the same time period. Securities Exchange Board of India (SEBI) records show that 8873 crore INR has been raised by several public and private companies by issuing green and sustainability linked bonds as on 30.09.2025. Although growing, the Indian green bond market in still in a nascent stage. It requires predefined policy and market interventions to accelerate its growth.

LITERATURE REVIEW

A review of some existing literatures is presented here: **Rao & Santoshi (2021)** found that green bond market has developed rapidly in India. They found that India ranked fourth in the amount issued on Green Bonds as a percent of all bond issuance among the 12 countries. To understand the perception of Indian retail investors of green bonds, **Prajapati, D. *et al* (2021)** surveyed around 125 Indian eligible investors in the Indian bond market and concluded that ESG rating and credit rating of the green bond issuers are the key factors that influence an individual's investment decision. Tax incentives and awareness of green bonds also affect an investor's decision. **Prakash, N. & Sethi, M. (2021)** investigated the financing gap for 'green' projects linked to planet-related SDG targets in India and found that firm guidelines in line with India's climate action plans are required to consider green bonds a viable financing option. A study by **Verma & Bansal (2023)**, using secondary data, concluded that the issue of green bonds positively effects the stock price. It generates a strong positive sentiment among the investors. Using both primary and secondary data, **Aggarwal, S. et al. (2025)** investigated the impact of income and other socio-economic factors on the perception of retail investor towards investment in green bond. The study found a significant male dominance among green bond investors in India. The study also analysed the impact of factors like Environmental consciousness (EC), Concern for wellbeing (CWB), Religious value and commitment (RVC) on green bonds investor intention (GBII). After considering the research articles, it is seen that there is a research gap in analysing the allocation of green bond funds across different sectors both globally and in India. In this backdrop, the present study has tried to highlight the gap.

Objectives of Study

The specific objectives of study are as follows:

- To elaborate the concepts of green bond, sustainability bond and sustainability linked bonds.
- To analyse the sector-wise allocation of funds raised from issuing green bonds in Global market.
- To analyse the sector-wise allocation of funds raised from issuing green bonds in India.
- To compare Indian green bond market trend with global market trend.

RESEARCH METHODOLOGY

The study is mainly exploratory in nature which is conducted by analyzing several articles published in reputed journals. For the analysis of green bonds fund, secondary data has been collected from the official website of Climate Bonds Initiative. Secondary data represents cumulative funds raised by issuing green bonds during time period of 2006 to 2024. Other websites like Securities Exchange Board of India (SEBI), Reserve Bank of India (RBI) have also been visited to collect data on Indian green bond market. MS Excel has been used for analysis of the data.

Analysis and Findings

Analysis of green bond funds and funds allocation to various sustainable sector has been done in the section presented below:

Table 1: Sector-wise Allocation of Funds - Globally

Sl. No	Sector	Funds (million USD)	Percentage
1	Low Carbon Transport	158447	53.17
2	Low Carbon Buildings	66571	22.34
3	Solar	30294	10.17
4	Transport Buildings Grids R&D	10627	3.57
5	Wind	10163	3.41
6	Water Infrastructure	6693	2.25
7	Electrical Grids and Storage	5938	1.99
8	Marine Renewable Energy	3407	1.14
9	Geothermal	1998	0.67
10	Forestry	1736	0.58
11	Bioenergy	1064	0.36
12	Agriculture and allied	332	0.11
13	Steel	330	0.11
14	Shipping	247	0.08
15	Hydropower	150	0.05
16	Waste Management	17	0.01
	Total	**298014**	

Source: Climate Bond Initiative, Results complied by authors.

Table 1 reflects the inflow of funds towards several sustainable and ecofriendly sectors and projects which is raised by issuing green bonds mainly. The sectors under this sustainable funding are Agriculture, Bioenergy, Electrical Grids and Storage, Energy, Forestry, Low Carbon Transport, Geothermal, Hydropower, Low Carbon Buildings (Residential), Low Carbon Buildings (Commercial), Low Carbon Buildings (Upgrades), Marine Renewable Energy, Protected Agriculture with Water Infrastructure, Shipping, Solar, Solar Transport, Solar Wind, Solar Electrical grids and Storage, Solar Water Infrastructure etc. It can be observed that the funds are flowing towards many broad sectors which fulfils the aims of sustainable investment policy. For the purpose of analysis, several related sectors are merged into one sector like investment in low carbon buildings includes residential, commercial and upgrades which is combined under low carbon buildings. Highest flow of funds towards low carbon transport followed by low carbon buildings reveals the importance of low carbon usage globally. More than 50% of total fund goes towards low carbon transport. Among other studied sectors, solar is only one sector which attracts funds of more than 10% of total green bond funds i.e. 10.17%. Whereas, other sectors like Agriculture and allied, Steel. Shipping, Hydro power and waste management are quite lagging behind in terms of inviting green bond investment flow. Investment flow should be increased towards these sectors to boost the goal of sustainable investment and for overall growth of these sectors.

Table 2: Region-wise Allocation of Funds Globally

Region	Country	Funds (million USD)	Percentage
Asia	China, Hong Kong, Japan, South Korea, Kazakhstan, India, Malayasia, Philippines, Singapore, Thailand, Vietnam, United Arab Emirates	74453	25.06
East Asia	China, Hong Kong, Japan, South Korea	52842	17.78
Central Asia	Kazakhstan	15	0.01
South & South East	India, Malayasia, Philippines, Singapore, Thailand, Vietnam	17774	5.98

Region	Country	Funds (million USD)	Percentage
Asia			
Middle East Asia	United Arab Emirates	3822	1.29
Europe	United Kingdom, France, Germany, Sweden, Switzerland, Norway, Netherlands, Hungary, Italy, Luxembourg, Poland, Spain, Belgium, Greece	123137	41.44
East Europe	Cyprus, Greece, Hungary, Poland	4193	1.41
West Europe	Belgium, France, Germany, Italy, Luxembourg, Netherlands, Norway, Spain, Sweden, Switzerland, United Kingdom	118944	40.03
European Economic Area	----------	568	0.19
Africa	Egypt, Morocco, Nigeria, Kenya, South Africa, Ivory Coast, Mauritius	4396	1.48
North America	USA, Mexico, Barbados Island, Costa Rica, Dominican Republic	45588	15.34
South America	Brazil, Chile, Bolivia, Colombia, Panama, Peru	10492	3.53
Oceania	Australia and New Zealand	38508	12.96

Source: Climate Bond Initiative, Results complied by authors.

Table 2 is showing the region-wise allocation of green bond funds globally. Individual country-wise secondary data has been collected from the official website of Climate Bond Initiative. Data has been segregated into 13 regions with respective countries for the purpose of analysis. It can be observed that European region has attracted highest volume of green bond funds followed by Asian region. 41.44% of global green bond funds flow towards European countries like United Kingdom, France, Germany, Sweden, Spain, Italy etc. European region has further been analysed as east and west Europe. Fund flow towards east European countries e.g. Cyprus, Greece, Hungary, Poland is very low as compared to west European countries. It is 1.41% and 40.03% of total global green bond funds for east and west European region respectively. Among other regions only Asian region countries have significant investment in green bond funds which is 25.06%. An interesting observation is that east Asian countries like China, Hong Kong, Japan, South Korea have impressive green bond investment worth 52842 million USD reflecting importance of sustainable investment as recognized and imposed by these countries. Whereas it is only 5.98% of global funds for South and South East Asian countries where six countries i.e. India, Malayasia, Philippines, Singapore, Thailand and Vietnam have been grouped. North American region has attracted 9.21% of funds followed by Oceania region i.e. 7.78% only. African countries have very low investment in green bond funds which is not even 1% of global green bond funds. It can be recommended that regions and countries with significant green bond funds should take more initiative to attract more investment in these bonds in their own countries as well as in those countries like Egypt, Morocco, Nigeria, Kenya, South Africa, Ivory Coast, Mauritius etc. which are lagging behind to attract the same.

Table 3: Sector-wise Allocation of Funds in India

Sl. No	Sector	Funds (million USD)	Percentage
1	Solar	6630	59.47
2	Low Carbon Transport	3766	33.78
3	Low Carbon Buildings	548	4.92
4	Wind	193	1.73
5	Water Infrastructure	12	0.11
	Total	**11149**	

Source: Climate Bond Initiative, Results complied by authors.

Table 3 represents overall Indian Scenario of green bond funds. India has only 11149 million USD of green bond funds during the period 2006-2024. Further it can be observed that investment flows towards five sustainable sectors only namely Solar, Low Carbon Transport, Low Carbon Buildings, Wind and Water Infrastructure. The solar sector has the highest value of green bond funds worth 6630 million USD. It is 59.47% of total green bond funds invested in India followed by low carbon transport sector i.e. 33.78%. Investment flow towards other sectors is less significant i.e. 4.92%, 1.73% and 0.11% in Low Carbon Buildings, Wind and Water Infrastructure respectively.

Table 4: Comparison of Sector-wise Allocation of Funds between India and Global

Sl. No.	Sector	India (%)	Global (%)
1	Solar	59.47	10.17
2	Low Carbon Transport	33.78	53.17
3	Low Carbon Buildings	4.92	22.34
4	Wind	1.73	3.41
5	Water Infrastructure	0.11	2.25

Source: Climate Bond Initiative, Results complied by authors.

Table 4 presents the sector-wise comparison of allocation of green bond funds between Indian and Global market. Global market has a total of 16 sustainable sectors (Table 1) with green bond funds whereas it is only five sectors in case of India. Indian market emphasizes on solar sector with highest contribution of 59.47% whereas for global it is highest in the low carbon transport sector. India has also significant investment flow in low carbon transport i.e. 33.78% of total green bond funds in India. It can be recommended that policymakers should take initiatives to encourage the flow of green bond funds in other sustainable sectors in India and promote this kind of investment in sustainable sectors to fulfil the goal of sustainability.

Table 5: Green Bond Issuance in ESG Category

Year of Issue	2017	2018	2019	2020	2021	2022	2023	2024	2025
Amount Raised (In Rs. Crs)	667	180	865	0	1387	1935	794	1125	2070

Source: Securities Exchange Board of India, Results Computed

There are several public and private ltd. companies which issue green bonds in India. Securities Exchange Board of India has published relevant information on green bond funds in ESG (Environmental, Social and Governance) category i.e. name of the issuer, date of issue, amount raised, coupon rate etc. This is shown in Annexure 1. Some of the companies are L&T Infrastructure Finance Company Ltd, Tata Cleantech Capital Limited, Indian Renewable Energy Development Agency Limited, Yarrow Infrastructure Private Limited, Rattanindia Solar 2 Private Limited, Malwa Solar Power Generation Private Limited,

Avaada Solarise Energy Private Limited, Clean Sustainable Energy Private Limited, Vikas Telecom Private Limited, Dme Development Limited, KPI Green Energy Limited, Samunnati Financial Intermediation & Services Private Limited etc. Highest return has been provided by Samunnati Financial Intermediation & Services Private Limited with 11.25% coupon rate followed by Tata Cleantech Capital Limited with 8.74%. Apart from this, many municipal corporations are also offering these funds like Ghaziabad Nagar Nigam, Indore Municipal Corporation, Ahmedabad Municipal Corporation, Vadodara Municipal Corporation etc. In table 5 (above), the trend of funds raised by issuing green bonds (Public and private companies and other organisations e.g. municipal corporations) has been presented from 2017 to 2025. It shows a fluctuating trend in fund raising activity. There is a sharp decline in 2018 where funds raised dropped to Rs. 180 crores from Rs. 667 crores in 2017. This is followed by a significant rebound in 2019 with Rs.865 crores. The year 2020 marked as no investment in green bond, possibly due to the Covid -19 pandemic, followed by a massive surge of Rs.1387 crores and Rs.1935 crores in 2021 and 2022 respectively. The investment has reached to peak till 2025 with Rs.2070 crores.

CONCLUSION AND RECOMMENDATION

This study aims to compare India's position with respect to its global counterparts in the market for green bonds by collecting secondary data. Sector-wise allocation green bond funds have been analysed first. It is found that some sectors like low carbon transport and building attracted significant capital from green bond issuers. Fund flow towards some sectors e.g. shipping, hydropower, waste management etc. should be increased as an initiative of sustainable development. Region-wise allocation of finds has also been checked for different countries across the globe. African countries like Egypt, Morocco, Nigeria, Kenya, South Africa, Ivory Coast, Mauritius have very lower share of green bond fund as compared to other regions. Countries with lower green bond fund should adopt policies to attract sustainable funds. A comparison of Indian and Global market has also been done. It is found that there are only five sustainable sectors in India with green bond finance. Finally, public and private ltd. companies and municipal corporations have been identified with green bond debt. The trend of green bond issuance by these companies and municipal corporations is very volatile from 2017 to 2025. The present significantly contributes to the present literature of green bond investment and recommends the following to the policy makers and investors.

- Global warming, water crisis, environmental pollution, excess utilization of resources, exhaustion of natural resources are major issues now a days. This imposes greater importance on sustainability as well as sustainable finance. Policy makers should encourage more sustainable investment schemes in the market which will lead to overall growth and development of sustainable sectors.
- Greater return on sustainable investment will attract more investors. More the coupon rate on green bonds more will be the investment flow.
- Apart from traditional investment schemes, campaigns should be done for sustainable investment like sustainable bonds, green bonds, ESG mutual funds.
- Risk averse investors should opt for green bonds with very lower risk involved.
- More sustainable sectors with green bond finance should be identified in India.

It can be concluded that above recommendations will guide investors and policy makers regarding green bond investment. However, the study suffers from certain limitations like lack of availability of proper data on green bond fund, time constraint, confidential data etc. Further a detailed study on green bond fund can be done covering Indian market and a comparison of all sustainable investments can also be made.

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Conflict of Interest

The author(s) declared no conflict of interest.

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ANNEXURE -1

Sr. No.	Issuer	Issuance Date (Date of Allotment)	Amount Raised (In Rs. Crs)	Coupon (%)
1	L&T Infrastructure Finance Company Ltd	29-06-17	667	7.59%
2	Tata Cleantech Capital Limited	18-12-18	180	8.74%
3	Indian Renewable Energy Development Agency Limited	03-01-19	275	8.51%
4	Indian Renewable Energy Development Agency Limited	17-01-19	590	8.47%
5	Ghaziabad Nagar Nigam	31-03-21	150	8.10%
6	Yarrow Infrastructure Private Limited	01-07-21	581	6.49%
7	Priapus Infrastructure Limited	01-07-21	16	6.49%
8	Rattanindia Solar 2 Private Limited	01-07-21	227	6.49%
9	Malwa Solar Power Generation Private Limited	01-07-21	197	6.49%
10	Citra Real Estate Limited	01-07-21	19	6.49%
11	Sepset Constructions Limited	01-07-21	197	6.49%
12	Avaada Solarise Energy Private Limited	02-03-22	499	6.75%
13	Clean Sustainable Energy Private Limited	02-03-22	334	6.75%
14	Fermi Solarfarms Private Limited	02-03-22	337	6.75%
15	Avaada SataraMH Private Limited	02-03-22	270	6.75%
16	Vikas Telecom Private Limited	30-08-22	495	7.65%
17	Indore Municipal Corporation	20-02-23	244	8.25%
18	Mindspace Business Parks Reit	15-03-23	550	8.02%
19	Ahmedabad Municipal Corporation	06-02-24	200	7.90%
20	Vadodara Municipal Corporation	06-03-24	100	7.90%
21	Samunnati Financial Intermediation & Services Private Limited	05-12-24	50	11.25%
22	Dme Development Limited	11-12-24	775	7.23%
23	Pimpri Chinchwad Municipal Corporation	04-06-25	200	7.85%
24	Larsen & Toubro Limited	19-06-25	500	6.35%
25	Mindspace Business Parks REIT	20-08-25	550	7.41%
26	KPI Green Energy Limited	11-09-25	670	8.50%
27	Muthoot Capital Services Limited	17-10-25	150	8.40%
	TOTAL		9023	