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The Role of Green Bonds in Promoting Sustainable Development in India

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ORIGINAL ARTICLE

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ABSTRACT

The study evaluates the evolving role of green bonds in promoting sustainable development in India from 2015 to 2024. As industrialization accelerates and environmental challenges intensify, green bonds have emerged as innovative financial tools to channel investments into eco-friendly projects. This research employs a descriptive and analytical research design based exclusively on secondary data sourced from SEBI, the World Bank, and the Climate Bonds Initiative, the study finds that clean energy projects secured the largest share (45–65%) of funds, followed by sustainable transportation and green buildings. However, limited financing in water and waste management sectors remain underfunded. The findings reveal a strong alignment with Sustainable Development Goals (SDG 7: Affordable and Clean Energy and SDG 11: Sustainable Cities and Communities), though broader contributions to other SDGs remain underdeveloped. Overall, India; s green bond market has evolved into a vital component of sustainable finance, though challenges such as policy gaps, greenwashing risks and limited sectoral diversification still hinder its full potential.

KEY WORDS

Green Bonds, Climate Finance, Sustainable Development, Renewable Energy.

INTRODUCTION

With the rising economic activity, accelerating industrialization, and fossil fuel dependency led to severe ecological imbalances, global warming, and unsustainable growth patterns. In response to these challenges, the concept of green finance began to gain prominence in the early 2000s, as economies sought mechanisms to address growing environmental concerns and promote sustainable economic growth. Within this emerging framework, green bonds emerged as key

financial innovation to fund climate-friendly and sustainable initiatives. The European Investment Bank (EIB) pioneered this concept in 2007 by issuing world's green bond aimed at funding projects with measurable ecological benefits (Climate Bonds Initiative, 2018).

Green bond debt instruments which are earmarked for funding projects with environmental benefits—have emerged as a key tool in this mobilization effort. A green bond is a climate finance debt instrument, which addresses environmental and climate-related challenges through adaptation and mitigation financing. Unlike conventional bonds, green bonds commit issuer and investor alike to specific environmental goals, such as renewable energy deployment, energy efficiency improvement, clean transportation, biodiversity conservation, and pollution control (Climate Bonds Initiative, 2018; Demski, 2025).

The growth of the green bond market has been remarkable. For example, by early 2023, green bonds had raised about USD 2.5 trillion globally in support of sustainable projects, with a growing number of emerging market countries issuing sovereign or quasi-sovereign green bonds to finance climate action and SDG relevant infrastructure (World Bank, 2023). Province level and municipal green bonds are also being used in many places to fund sustainable mobility projects and other local infrastructure.

The rapid economic growth in India has led to significant environmental challenges, necessitating urgent and substantial investments in sustainable projects. Green bonds have emerged globally as a pivotal financial instrument to fund environmentally friendly projects. Among emerging markets, India is the second largest green bond issuing country, only behind China. India needs more power and energy utilization to expand its economy (Abhishek Kumar, 2021). Green bond is demonstrated as a better financing mechanism to achieve sustainable development goals in the country (Abhilash et al., 2023).

The aim of this study therefore is to examine and evaluate the role of green bonds in promoting sustainable development in India. It aims to provide insights into how these financial instruments not only facilitate capital mobilization but also foster measurable environmental and socio- economic outcomes consistent with India's sustainability commitments.

Objectives of the Study

- To analyze the growth of the green bond market in India.
- To evaluate the role of green bonds in promoting sustainable development.

Literature Review

Agarwal; et al.. (2020) further showed that the Asian green bond market is expanding at an exponential rate and that international investors are increasingly willing to finance such instruments, suggesting strong growth potential in the region.

Kumar, A. (2021) The paper ''An Evaluative Study of Green Bond Scenario in India'' by Abhishek Kumar examines the regulatory framework, commercial bank involvement, and international comparisons of green bond issuance in India. It emphasizes the significance of green finance for sustainable development, outlines SEBI regulations, discusses the role of banks, and recommends a national strategy for India's green bond market development.

Bansal, Mani, Gupta & Maurya (2022) explored the evolution of India's green bond market and highlighted barriers such as limited investor awareness, policy gaps, and weak verification mechanisms. Their study emphasized the importance of transparency and investor confidence in building a credible ecosystem and recommended stronger regulatory frameworks to strengthen the market.

An empirical study published in the Journal of Banking & Finance (2024) examined whether green bonds deliver measurable environmental benefits. The findings revealed that certified green bonds significantly reduce firms' carbon footprints compared to conventional bonds. However, the study also warned of potential "greenwashing" in cases of weak disclosure standards, underscoring the need for stringent monitoring and certification.

Goshu, D. & Tangl, A. (2022) The paper explores the increasing scholarly attention on green finance post-2015 Paris Agreement, with a significant rise in publications. It emphasizes the need for more research

articles to delve into methodological and theoretical aspects. The study includes 146 selected papers, highlighting the global interest in green finance, particularly from China, England, Pakistan, and Vietnam, while urging more contributions from developing countries for a balanced green economy.

Md. Kashif A. and Yukta Anand (2022) The study emphasizes the importance of green finance for India's sustainable development, particularly in achieving renewable energy targets. It discusses Government measures, challenges like high costs and lack of regulatory framework, and the need for transparent policies to attract investment. It suggests a balanced approach involving investors, issuers, and projects for India's green economy to flourish.

Reitsema, L., & Scholtens, B. (2022) investigated the global relationship between green finance and renewable energy investments. The study concluded that green bonds accelerate the deployment of solar, wind, and other clean technologies, thereby directly contributing to the global energy transition. This reinforces the role of green finance as a crucial instrument for achieving sustainability targets.

Abhilash; et al. (2023) The paper explores the growth, challenges, and future development of green bonds in the Indian financial market through a systematic literature review. It highlights factors limiting market expansion, such as transaction costs and green washing, and suggests policy measures for improvement. The study emphasizes the importance of active involvement from various stakeholders to drive the success of green bonds in India.

Research Gap

Although Existing literature examines the growth, challenges, and environmental outcomes of green bonds at global and regional scales. However, most studies focus on either market mechanisms or corporate emissions strategies. Only a few attempt to establish a comprehensive connection between green bond financing and the broader Sustainable Development Goals (SDGs). Research on developing economies, particularly India, is limited and fragmented. Moreover, there is little academic research on their measurable contribution to India's Sustainable Development Goals.

Therefore, the present study identifies a clear research gap concerning the extent to which green bonds contribute to India's sustainable development objectives and aims to assess this relationship within the national context.

Methodology

This study adopts a descriptive and analytical research design, relying exclusively on secondary data to examine the growth of the green bond market in India and its contribution to sustainable development. Data have been compiled from authentic institutional sources such as Climate Policy Initiative (CPI), Securities and Exchange Board of India (SEBI), World Bank, Climate Bonds Initiative (CBI), and Research Articles, covering the period 2015–2024. The research is analytical in nature and focuses on India's sovereign, corporate, and financial institution green bonds. Analytical tools include trend analysis to assess issuance growth, sectoral analysis to study fund allocation, and content analysis of policy and disclosure documents. The scope is limited to India's context, with emphasis on contributions to the SDGs and Paris

Agreement targets. Limitations include reliance on secondary data and restricted long-term impact assessment due to the evolving nature of India's green bond market.

Analytical Study on Green Bond in India

Table.1: Growth of Green Bond Issuance in India (2015–2024)

Year	Green Bonds Issuance USD (Billions)	% Growth YoY	Remarks
2015	1.1	-	First green bonds issued
2016	1.6	45.45%	Increase due to govt incentives
2017	3.1	137.5%	Renewable energy projects grew
2018	0.70	-81.58%	New green bond guidelines
2019	3.1	342.86%	More corporate issuances
2020	0.916	-70.45%	Pandemic impact
2021	3.9	325.11%	Rising SG awareness
2022	2.8	-28.21%	Policy support from SEBI
2023	7.2	157.14%	Sovereign green bonds debut (USD 1900 Millions)
2024	24.3	237.5%	Rapid acceleration, corporate and public sector surge

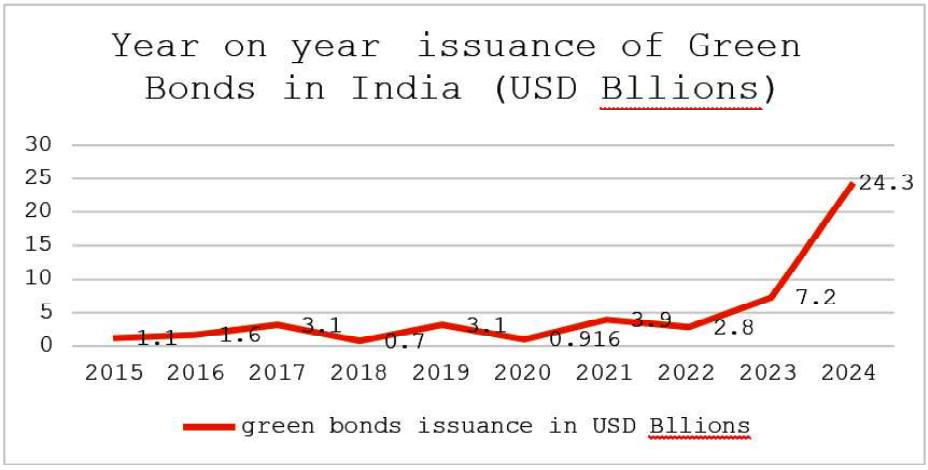
*[**Source:** Compiled from Climate Bonds Initiative Reports (2016, 2017, 2018, and May 2025)]*

India's green bond issuance has undergone significant structural shift over the past decades. As presented in Table 1, the value of issuances expanded from USD 1.1 billion in 2015, issuance rose to USD 3.1 billion in 2017 but declined sharply in 2018 (–81.6%). This decline coincided with the introduction of revised regulatory guidelines, which temporarily slowed issuance activity. A similar contraction occurred in 2020 (–70.5 percent) as the COVID-19 pandemic disrupted capital flows and investment sentiment.

A strong rebound became visible post-2021, driven by rising Environmental, Social and Governance awareness, the mainstreaming of sustainability reporting, and enhanced policy support. The debut of sovereign green bonds in 2023 proved to be a turning point, signaling Government commitment and boosting investor confidence. By 2024, green bond issuance in India reached a record USD 24.3 billion, underscoring the rapid institutionalization of sustainable finance.

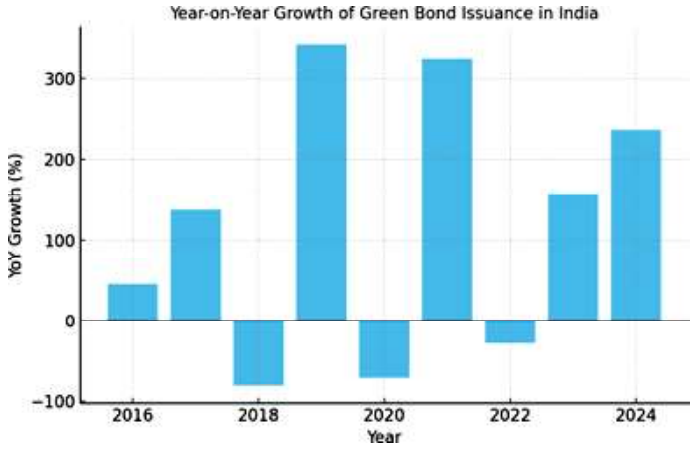
Overall, the data indicate a volatile yet upward growth trajectory, where market consolidation has been shaped by both domestic policy frameworks and global sustainable finance trends.

Figure 1: Year on year issuance of Green Bonds in India (USD Billions)



*[**Source:** Compiled from Climate Bonds Initiative Reports (2016, 2017, 2018, and May 2025)]*

Figure 2: Year on year Growth of Green Bond Issuance in Year



*[**Source**: Compiled from Climate Bonds Initiative Reports (2016, 2017, 2018, and May 2025)]*

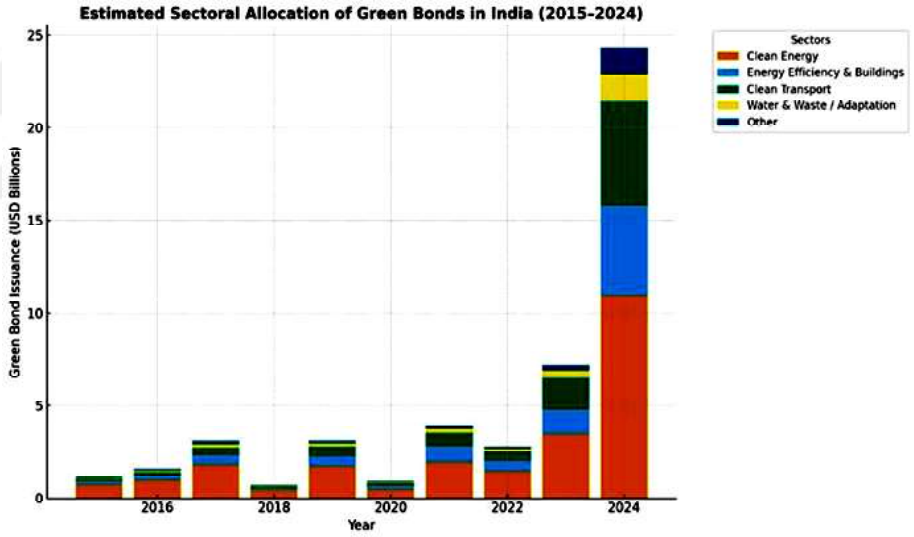
The charts clearly show both the volatility in earlier years and the rapid acceleration after 2021, suggesting that regulatory clarity and sovereign participation boosted investor confidence significantly.

Table 2: Estimated Sectoral Allocation of Green Bonds in India (2015-2024)

Year	Clean Energy		Energy Efficiency & Green Buildings		Clean Transportation		Water & Waste Mgmt.		Others		Total
	(%)	USD Bn	(%)	USD Bn	(%)	USD Bn	(%)	USD Bn	(%)	USD Bn	USD Bn
2015	65%	0.72	15%	0.17	10%	0.11	5%	0.06	5%	0.06	1.1
2016	60%	0.96	15%	0.24	12%	0.19	7%	0.11	6%	0.10	1.6
2017	58%	1.80	16%	0.50	14%	0.43	6%	0.19	6%	0.19	3.1
2018	62%	0.43	14%	0.10	12%	0.08	7%	0.05	5%	0.04	0.70
2019	55%	1.71	17%	0.53	18%	0.56	6%	0.19	4%	0.12	3.1
2020	50%	0.46	20%	0.18	18%	0.17	7%	0.06	5%	0.05	0.916
2021	50%	1.95	22%	0.86	18%	0.70	6%	0.23	4%	0.16	3.9
2022	52%	1.46	20%	0.56	18%	0.50	6%	0.17	4%	0.11	2.8
2023	48%	3.48	18%	1.30	24%	1.73	6%	0.43	4%	0.28	7.2
2024	45%	10.94	20%	4.86	23%	5.59	6%	1.46	6%	1.46	24.3

*[**Source:** Author's own estimation based on Climate Bonds Initiative (2024), Climate Policy Initiative (2024)]*

Figure 3



*[**Source:** Author's own estimation based on Climate Bonds Initiative (2024), Climate Policy Initiative (2024)]*

The sectoral distribution of green bond proceeds, summarized in Table 2, reveals distinct patterns in India's investment priorities. The clean energy sector consistently commanded the largest allocation ranging from 45 to 65 percent of total issuance throughout the study period. This reflects the Government's continued focus on renewable energy generation under programs such as the *National Solar Mission* and other climate-oriented initiatives.

- **Clean Energy:** Largest share throughout, though declining slightly from 65% in 2015 to 45% in 2024.
- **Energy Efficiency & Green Buildings:** Gradual increase from 15% in 2015 to 20% by 2024.
- **Clean Transportation:** Significant growth, especially in 2023–24, reaching 23–24%, driven by metro rail and EV infrastructure financing.
- **Water & Waste Management:** Received only 4–7% of funds, showing underutilization despite critical sustainability needs.

This sectoral concentration highlights both strengths (energy transition) and weaknesses (neglect of water, waste, and biodiversity).

The analytical results collectively demonstrate that the green bond market in India, though marked by early fluctuations, has gained stability in 2021. The launch of sovereign issues and regulatory standardization by SEBI has substantially enhanced market credibility. At the same time, the persistence of sectoral concentration in clean energy reflects policy alignment and limited diversification.

Discussion

The analytical outcomes of this study offer new insights into how green bonds have evolved as a financial instrument shaping India's path toward sustainable development. When compared with prior literature, several major patterns become evident.

1. Growth Trajectory and Market Evolution

The analytical outcomes confirm that India's green bond market has grown substantially, particularly since 2021, with issuance reaching USD 24.3 billion in 2024. This trend is consistent with earlier research by Bansal, Mani, Gupta, and Maurya (2022), which identified India's climate commitments and regulatory initiatives as vital drivers for the green finance ecosystem. The fluctuations in issuance during 2018 and 2020 demonstrate the sensitivity of the market to regulatory changes and global shocks. Similar observations are made in the Journal of Sustainable Finance & Investment, which highlights high transaction costs and policy uncertainties as barriers in emerging economies.

A crucial turning point came with the introduction of sovereign green bonds in 2023, which enhanced credibility and reassured investors of Government commitment. This observation aligns with the World Bank (2023), which emphasized that sovereign issuances serve as benchmarks for private participation and signal institutional reliability. Thus, India's experience validates the literature that sovereign interventions can significantly accelerate market development.

2. Sectoral Allocation Patterns

The sectoral allocation analysis reveals that clean energy has consistently dominated, absorbing nearly half or more of annual green bond issuances. This pattern corroborates the findings of Energy Economics (2022), which highlighted the crucial role of green finance in advancing renewable energy infrastructure globally. India's reliance on solar and wind projects reflects both its comparative advantage and its policy focus under the National Solar Mission and other renewable programs.

At the same time, the increasing proportion clean transportation (up to 23–24% in 2023–2024) indicates a strategic shift toward low-carbon urban mobility, such as metro expansion and electric vehicle infrastructure. These observations resonate with Reitsema and Scholtens (2025), who noted that corporate issuers of green bonds tend to adopt more sustainable technologies and practices. India's case shows that transportation is becoming the second-largest beneficiary sector, which broadens the scope of green bonds beyond power generation.

In contrast, water and waste management projects have received relatively limited financing (4– 7%).

This limited participation reflects challenges faced by developing economies, including weak project pipelines and low investor awareness outside the energy sector. To broaden the impact, policymakers need to strengthen institutional support mechanisms that encourage green financing in underfunded sustainability areas.

3. Linkage to Sustainable Development Goals (SDGs)

One of the central objectives of this study is to assess the extent to which green bonds contribute to achieving the Sustainable Development Goals (SDGs). The analytical outcomes that India's green bond initiatives are most strongly aligned with SDG 7 (Affordable and Clean Energy) and SDG 11 (Sustainable Cities and Communities), given the emphasis on renewable energy and sustainable transportation projects. This confirms earlier claims by Energy Economics (2022) and Reitsema, L., & Scholtens, B. (2025) that green bonds act as governance tools for accelerating energy transition and low-carbon development.

However, limited engagement with sectors tied to SDG 6 (Clean Water and Sanitation) and SDG 12 (Responsible Consumption and Production) highlights the need for greater project diversity and innovative financing models. To maximize sustainability outcomes, India must adopt a more integrated approach that connects green bond investments with a wider range of SDG indicators.

In summary, the discussion highlights that India's green bond market has evolved from a niche instrument in 2015 to a rapidly expanding component of sustainable finance by 2024. Its growth trajectory, sectoral concentration, and regulatory interventions largely align with global and regional findings in the literature. At the same time, concerns around diversification, disclosure, and long-term impact assessment remain unresolved. These insights underline the dual nature of India's green bond market rapidly growing yet still facing structural challenges that must be addressed for it to achieve its full potential in promoting sustainable development.

Findings

1. **Overall Growth**
   - Despite volatility, issuance surged from USD 1.1 billion (2015) to USD 24.3 billion (2024).
   - Key turning points: SEBI guidelines (2018), pandemic (2020), sovereign green bonds (2023).
   - Rapid post-2021 growth reflects rising ESG awareness and stronger policy frameworks.
2. **Sectoral Allocation**
   - Clean energy remains the backbone of India's green bond market.
   - Clean transportation emerged as a new growth area post-2021.
   - Water and waste sectors remain marginally financed, indicating a need for diversification.
3. **Challenges Reflected in Data**
   - Sharp declines in 2018 and 2020 reveal vulnerability to policy shifts and external shocks.
   - Heavy concentration in energy projects risks overlooking equally important sustainability areas.
4. **Implication**
   - India's green bond market is maturing but requires balanced sectoral investment and robust governance to maximize contributions toward the SDGs.

Overall, the findings suggest that India's green bond market has matured significantly within a decade, with strong momentum toward clean energy and sustainable transportation. However, diversification and consistent policy support are essential to sustain this growth and to maximize contributions toward the broader Sustainable Development Goals (SDGs).

CONCLUSION

This study examined the growth and sectoral allocation of green bonds in India from 2015 to 2024, with a focus on their role in promoting sustainable development. The findings highlight a dynamic but uneven growth trajectory, with significant acceleration after 2021 driven by ESG awareness, supportive SEBI regulations, and the introduction of sovereign green bonds in 2023. By 2024, green bond issuance reached an unprecedented USD 24.3 billion, underscoring their rising importance in India's sustainable finance landscape.

Sectoral analysis confirms that green bonds in India have primarily supported clean energy projects, reflecting the nation's policy priorities in renewable energy. The increasing share of sustainable transportation projects since 2021 demonstrates diversification, though limited allocation to water management and waste recycling points to underutilization of green bonds in broader sustainability sectors.

These findings align with international literature that recognizes green bonds as critical instruments for financing renewable energy and low-carbon infrastructure. At the same time, challenges such as regulatory adjustments, greenwashing risks, and sectoral concentration reveal gaps in ensuring that green bonds fully deliver on their sustainability promises.

Overall, the study concludes that green bonds have emerged as a powerful financing tool in India's transition toward sustainable development, but their long-term success will depend on strengthening governance, diversifying project pipelines, and aligning issuances more comprehensively with the Sustainable Development Goals (SDGs).

Limitations

Like any academic study, this research is subject to certain limitations. It relies primarily on secondary data from sources such as RBI, SEBI, World Bank, and the Climate Bonds Initiative, without incorporating primary insights from issuers or investors. The study period of 2015–2024, though useful in capturing India's early growth trajectory, is relatively short for assessing long- term sustainability outcomes. Moreover, the exclusive focus on India, centered on sovereign, corporate, and financial institution issuances, restricts the scope for cross-country comparisons that could have enriched the analysis.

Despite these limitations, the study contributes meaningfully to the literature by filling the gap on India's green bond experience and its linkage with sustainable development goals.

BIBLIOGRAPHY

1. Abhilash; Shenoy, S. S.; Shetty, D. K.; Lobo, L. S. & Subrahmanya Kumar, N. (2023) Green bond as an innovative financial instrument in the Indian financial market: Insights from systematic literature review approach. *SAGE Open,* 13(2), 1-15, DOI:10.1177/21582440231 178783
2. Agarwal, Versha; et al. (2020) Sustainable financing: a study of an effect and development of green bonds in Asia. *International Journal of Creative Research Thought,* 18(10), 3299-3414, Oct 2020 ISSN:2320- 2882.
3. Alharbi, S. S.; Al Mamun, M.; Boubaker, S. & Rizvi, S. K. A. (2023) Green finance and renewable energy: A worldwide evidence. *Energy Economics*, 118, Article 106499. https://doi.org/10.1016/j.eneco.2022.106499
4. Ansari, M. K. & Anand, Y. (2022) Green finance in India: Trend and challenges. (Report / article) Retrieved from https://www.hansshodhsudha.com/volume2-issue4/Manuscript%205.pdf, Accessed on 12/10/2025.
5. Bansal, S.; Mani, S. P.; Gupta, H. & Maurya, S. (2023) Sustainable development of the green bond markets in India: Challenges and strategies. *Sustainable Development*, 31(1), 237–252. https://doi.org/10.1002/sd.2386
6. CBI. (2018) Explaining green bond, www.climate bonds.net/market/explaining green bonds Climate Bonds Initiative. (2016) Green bonds highlights 2015. https://www.climatebonds.net, Accessed on 15/10/2025.
7. Climate Bonds Initiative. (2018) Green bonds highlights 2017. https://www.climatebonds.net Climate Bonds Initiative. (2020) Green bonds highlights 2019. https://www.climatebonds.net, Accessed on 16/10/2025.
8. Climate Bonds Initiative. (2023) Sustainable debt global state of the market 2022. https://www.climatebonds.net, Accessed on 16/10/2025.

9. Climate Bonds Initiative. (2025, May 31) Global State of the Market *2024*. *Climate Bonds Initiative*. https://www.climatebonds.net/data-insights/publications/global-state-of-the- market-2024, Accessed on 16/10/2025.

10. Climate Policy Initiative. (2024, November) Landscape of green finance in India 2024. Climate Policy Initiative. https://www.climatepolicyinitiative.org, Accessed on 18/10/2025.

11. Demski, J.; Dong, Y.; McGuire, P. & Mojon, B. (2025) Growth of the green bond market and greenhouse gas emissions. *BIS Quarterly Review*, March. https://www.bis.org/publ/qtrpdf/r_qt2503d.htm, Accessed on 18/10/2025.

12. Desalegn, G. & Tangl, A. (2022) Developing countries in the lead: A bibliometric approach to green finance. *Energies*, 15(12), Article 4436. https://doi.org/10.3390/en15124436

13. ElBannan, M. A. & Löffler, G. (2024) How effectively do green bonds help the environment*? Journal of Banking & Finance,* 158, Article 107051. https://doi.org/10.1016/j.jbankfin.2023.107051, Accessed on 10/11/2025.

14. Gomez-Echeverri, L. (2018) Climate and development: Enhancing impact through stronger linkages in the implementation of the Paris Agreement and the Sustainable Development Goals (SDGs) *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences,* 376(2121), 20160444. https://doi.org/10.1098/rsta.2016.0444

15. Goshu, D. and Anita, T. (2022) Enhancing green finance for inclusive green growth: a systematic approach. *Sustainability*, 14, 7416. https://doi.org/10.3390/su14127416

16. Kumar. Abhishek. (2021) An evaluative green bond scenario in India. *IRE Journal*, 5(5), 67-73, ISSN: 2456-8880.

17. Reitsema, L. & Scholtens, B. (2025) *The role of corporate green bonds in managing greenhouse gas emissions. Climatic Change,* 178, Article 158. https://doi.org/10.1007/s10584-025-04005-3.

18. World Bank (2023) Emerging market green bonds. https://documents1.worldbank.org/curated/en/099724509062343381/pdf/IDU0bf38e89407e1 b044f0086d4037c85a201ca7.pdf, Accessed 20/10/2025.

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