



A study on Green Bonds in India: Opportunities and Challenges

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Abstract – Green Bonds have emerged as a crucial tool in mobilizing capital for environmentally sustainable projects. In India, the green bond market has witnessed consistent growth since its inception in 2015, bolstered by increasing awareness of climate change and proactive government support. While numerous studies have examined the Indian green bond market up to 2023 and a few extended their analysis to August 2024-no comprehensive research has yet incorporated full year 2024 data. As a result, recent developments- such as the municipal green bond issuances by Ahmadabad and Vadodara in early 2024, and the sectoral distribution patterns of sovereign green bonds - remain largely unexamined. This study addresses this significant gap by examining secondary data from 2015 to the end of 2024, offering one of the first comprehensive, data driven investigations into the latest patterns, opportunities and challenges in India's green bond landscape. Specifically, it reviews issuance volumes along with year- on- year growth trends, assesses policy initiatives and explores sectoral shifts. This paper concludes with policy recommendations to enhance the green bond ecosystem in India.

Keywords – Green Bonds, Sustainable Finance, SEBI, Renewable Energy & Climate Finance.

I. INTRODUCTION

As the global community accelerates its transition towards sustainable growth, green bonds have emerged as a crucial funding tool to support environmentally responsible projects. These fixed income instruments, whose proceeds are earmarked exclusively for green initiatives such as renewable energy, sustainable mobility and pollution control, have gained traction since their international launch in 2007. Governments and corporations alike are turning to green bonds to meet climate goals while mobilizing private sector investment. India entered the green bond market in 2015, making a significant landmark in its sustainable finance journey.

Over the years, the Indian green bond market has seen increasingly interest from both public and private players, further catalyzed by the issuance of the country's first-ever sovereign green bonds in 2023. These developments align with India's ambitious goal of achieving net-zero emissions by 2070, while also addressing its massive infrastructure and clean energy financing needs. Recognising the growing importance of sustainable finance, this study delves into the evolution of India's green bond landscape from 2015 to 2024. By analyzing decade long secondary data, the research highlights issuance patterns, sectoral shifts and policy changes that have shaped the market. Special focus is given to year on year growth, volume trends and sectoral wise allocation of green bond proceeds.

Research Gap:

Despite existing literature on India's green bond market, full year data for 2024-including recent municipal issuances and sovereign sectoral trends-remains underexplored. This study fills that gap by offering a detailed analysis from 2015 to 2024.

Objectives of the study:

- To analyze the growth and issuance trends of green bonds in India from 2015 to 2024, including recent developments in local and sovereign issuances.
- To examine the key challenges faced by issuers, investors and regulators in the development of India's green bond sector.
- To explore emerging opportunities and provide data driven policy suggestion to strengthen green finance and enhance market transparency.

II. REVIEW OF LITERATURES

Sahoo and Pandey (2020) examined the capability of green bonds in India to mobilize climate finance and emphasized regulatory clarity as a key driver. They identified that although the green bond market showed promise, it lacked policy alignment and uniformity.

Panda and Lal (2021) focused on investor behavior and found that awareness and ESG consciousness among institutional investors contributed to increased demand for green financial instruments. However, barriers like liquidity issues rating inconsistencies still posed significant challenges.

Sharma and Mehta (2023) examined the Indian green bond market in terms of investor perceptions and regulatory gaps. Although they acknowledge the introduction of sovereign bonds, they did not offer a comprehensive view of the issuance trends from 2015 to 2024 or detail municipal bond participation.

Iyer and Thomas (2024) investigated the economic impact of green bonds in the context of post-covid recovery. Their focus was broader in terms of sustainability finance and did not narrow down on Indian specific milestones or the chronological evolution of green bond issuances.



Panda and Sinha (2022) explored green financing instruments in India, highlighting institutional interest and policy support. However their study focused more on ESG frameworks and investment readiness, without tracking the actual growth trajectory or milestone issuance of green bonds.

Sen and Roy (2023) studied investor response to Indians first sovereign green bonds. They provided insight into yield performance and policy backing but did not evaluate how these issuances impacted long-term green financing trends.

III. RESEARCH METHODOLOGY

The present study adopts a descriptive and analytical research design to examine the trends, growth, opportunities and challenges in the issuance of green bonds in India. The study is entirely based on secondary data collected from reliable and authentic sources to ensure accuracy and relevance. The data sources include: RBI bulletins and reports, SEBI updates and sustainable finance frameworks, climate bonds initiative, Press releases and official websites of issuing entities(eg: Indore and Ahmadabad municipal corporation)and reputed financial databases and media sources such as Business standards, mint and the economic times.

IV. DATA ANALYSIS AND INTERPRETATION

To analyze the evolution of green bond issuance in India, this section presents a year wise breakdown from 2015 to 2024.

Milestone Issuances of green bonds in India:

Issuer	Milestone	Year	Amount
Yes Bank	First green bond issuance in India	2015	USD 260 million
Greenko	First high yield green bond issuance in India	2016	USD 500 million
NTPC	Issuance of a corporate green masala bond	2016	INR 2000 crores (USD 300 million)
Renew power	Major Private Sector green Bond issuance	2017	USD 475 million

State Bank of India	Green Bond Issuance	2018	USD 650 million
IREDA	Issued two green bonds	January 2019: *INR 275 crores(3 rd Jan) *INR590 crores(17 th Jan 2019)	Total INR 865 crores
IREDA	Green bond issuance for renewable energy financing	2020	Rs 19416.54 crore
Ghaziabad municipal corporation	First local civic body in India to issue a green bond(The Hindu Business line, 2021)	2021	USD 20 million
Government of India	First ever sovereign green bonds Issuance in two tranches	2023	RS. 16000 crore (8000 +8000 crore)
Ahmedabad municipal corporation	Municipal green bond issuance	Feb 2024 (Q1)	Rs. 200 crore
Vadodara municipal corporation	Municipal green bond issuance	Mar 2024(Q1)	Rs.100 crore
Government of India (sovereign)	Sovereign green bonds (10 year maturity n 30 year maturity)	Nov 2024(Q4)	*Rs.5000 crore *Rs 5000 crore
NHAI(National Highways authority)	Green bond issuance	Dec 2024(Q4)	Rs.775 crore

Year-wise Green Bond Issuances in India (in crore)

Year	Description	Amount (in Rs crore)
2015	Yes Bank-USD 260m	Rs 1,612
2016	Greenko(500m)+NTPC(300m)	Rs.5,360
2017	Renew power-USD 475 m	Rs.3,087.5
2018	SBI-USD 650m	Rs.4,420
2019	IREDA-Rs.865 crore	Rs.865 crore
2020	IREDA-Rs.19,416.54	Rs.19,416.54



2021	Ghaziabad municipal-USD 20m	Rs.148 core
2022	-	Assume Zero
2023	Govt of India-Rs 16000 crore	Rs.16,000 crore
2024	Ahmadabad (200)+Vadodara (100)+Govt(10775)	Rs.11,075

Interpretation of growth and issuance trends (2015-2024)

Green Bond issuances in India have shown a fluctuating trend from 2015 to 2024. The market saw significant growth in 2016. And peaked in 2020 due to major issuance by IREDA. However, 2021 and 2022 witnessed a sharp decline, with 2022 recording no issuances. A strong revival occurred in 2023 with India's first sovereign green bonds. In 2024, municipal bonds from Ahmadabad and Vadodara, along with continued government support, indicate a broadening issuer base, although the total value declined from the previous year. Overall, the trend reflects early volatility followed by institutional and public sectoral led growth.

Green Bonds Allocation in India (2024)

Sector of allocation	Percentage
Renewable energy	62%
• Solar energy(within Renewable)	32.47%
• Wind energy(within Renewable)	67.53%
Low carbon transport	17.5%
Low carbon Buildings	14%
Sustainable management of natural resources and land Use	1%

Green bond allocation prior to 2024(FY 2022 and 2023)

Sector of allocation	Percentage
Clean Transport	78%
Renewable Energy	21%
Sustainable management of natural resources & land use	1%

Interpretation:

This sectoral allocation of green bonds in India has undergone a significant shift between FY 2022-2023 and 2024, indicating a realignment of priorities in the country's green financing strategy. In the fiscal years 2022 and 2023, the majority of green bond funding –about 78%–was directed toward clean transport, reflecting a strong emphasis on promoting electric mobility and low emission transportation systems. However, by 2024, the allocation for clean transport drastically declined to 17.5% signaling a shift away from mobility-focused investments. In contrast, renewable energy witnessed a substantial increase in allocation, rising from 21% in the previous years to 62% in 2024. Within this category, wind energy accounted for 67.53% and solar energy for 32.47% highlighting a strategic focus on scaling up clean power infrastructure, particularly wind projects. Additionally, low carbon buildings emerged as a new and notable area in 2024 with

a 14% allocation, suggesting an increased focus on sustainable management of natural resources and land use remained constant at 1% in both periods, indicating that this area continues to receive limited attention. Overall, the data reflects a transition from a single sector dominance (transport) to a more diversified and infrastructure driven approach, aligning with India's broader goals of decarbonization and sustainable growth.

Key challenges faced by issuers, investors and regulators in the development of India's green bond market:

- Lack of clear definition and standards
- High compliance and verification costs
- Limited investor awareness and demand
- Inadequate policy support
- Green washing risk
- Currency and interest rate risk

Emerging opportunities in India's Green Bond market and policy recommendations to strengthen green finance and enhance market transparency:

- Rising Interest in sustainable finance
- Sovereign and municipal green bonds
- Integration of technology and green fintech
- Policy support needed
- Market transparency improvements

FINDINGS:

Fluctuating Trend: The green bond market in India has not shown linear growth–its fluctuated due to dependence on large issuers and lack of consistent policy push early on. Dominant role of Institutions: central government and major financial institutions like SBI, NTPC, IREDA) have dominated issuance volumes. Sovereign green bonds (2023-2024): Their introduction in 2023 marked a turning point , showing strong state –level commitment and setting benchmark for future issuers.

Municipal participation: Emerging municipal bond issuances in 2021 and 2024 suggest a bottom-up movement and deepening of the market.

Shift in currency preference: A clear shift from USD to INR denominated bonds after 2018 shows India's growing domestic capacity for green financing.

V. CONCLUSION

From 2015 to 2024, India's green bond market evolved from sporadic corporate led issuance to structured, sovereign supported growth. The entry of government and local bodies has added scale and credibility. However the market remains sensitive to policy signals, regulatory support and investor appetite. For sustainable growth India must now focus on consistent issuance, diversification of issuers and robust green project pipelines.

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