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The Green Finance Ecosystem in India: Current Landscape and Roadmap for Sustainable Development

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Abstract

India stands at a key stage in its commitment to sustainable development while pursuing ambitious economic growth. Over past few years country has reinforced commitment to sustainability and targeted of achieving net-zero emissions by 2070. To source half of its electricity from renewables by 2030, the country will need an investment of approximately $2.5 trillion (around ₹162.5 lakh crore) across the 2015–2030 period, averaging roughly $170 billion (about ₹11 lakh crore) per year. With an increasing focus on ESG initiatives and generating 50% of its electricity from renewable energy sources by 2030, the nation will require US$ 2.5 trillion (around Rs. 162.5 lakh crore) between 2015 and 2030, or US$ 170 billion (approximately Rs. 11 lakh crore) annually. Driven by convergence of policy initiatives and the imperative to meet ambitious climate targets, the role of green finance has emerged and fundamentally reshaping the investment ecosystem beyond long established wealth maximization objective. This encompasses a wide array of financial instruments, including loans, debt mechanisms, and investments, all channelled towards encouraging the development of green projects or minimizing the environmental impact of existing initiatives. This paper is an endeavor to give a comprehensive analysis of the current green finance landscape. The paper will study the various financial instruments, regulatory framework and key players that constitutes India's unique green finance ecosystem.

***Keywords**: Green Finance, Green Bonds, Green Loans, Sustainable Development Goals.*

Introduction

Global projections of macroeconomic climate-change damages is driven by consider impacts from average annual temperatures over long time horizons (Kalkuhl,2020). Projections of the macroeconomic damage caused by future climate change are crucial to informing public and policy debates about adaptation, mitigation and climate justice. The international community has agreed upon sustainable development goals (SDGs). The role of substantial investments in green and low carbon initiatives is crucial to address climate change effectively and promote sustainable economic growth (Fu et al,.2023). The emerging financial landscape for climate finance aligns with UNDP Sustainable Development Goals and The Paris Agreement in entailing sustainable global investments through cost effective, long term financing. Climate finance is needed for mitigation, because large-scale investments are required to significantly reduce emissions. Climate finance is equally important for adaptation, as significant financial resources are needed to adapt to the adverse effects and reduce the impacts of a changing climate (UNFCCC). The study shows that to achieve the target of SDGs, all sectors of society will need to invest $ 7 trillion annually. A huge investment gap persists, with trillions of dollars required to

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achieve net-zero emissions by 2070 and meet interim 2030 climate goals. Conventional sources of finance with short term profitability goals have been inadequate in financing the massive targets for green initiatives. Green finance, a key driver of sustainability, has emerged as a powerful instrument, linking financial mechanisms with environmental objectives.

Literature Review

Various de-growth projects can be seen as both attempts to change society and its economy and responses to the serious crisis of capitalism, which is demonstrated by, among other things, resource depletion, ecological degradation, social inequality, and injustice (Dorry,2018). At Climate change conferences in 2021 (UNFCCC), Green Finance was discussed to be one of the critical issue to combat the climate change disaster. The catastrophic implications of the changing climate for the globe and its inhabitants require prompt action and so it is imperative to focus both research and attention on green finance to harness its full potential (FU,2024). Green finance, an alternative means of financing green or low-carbon operations, has gained significant attention recently (Huang, 2022). Green finance primarily concerns with acquiring funds to support eco-friendly projects in a way that remain profitable and economically viable for lenders and investors. Green finance includes a number of financial asset classes and institutions, both public and private (Berensman and Lindenberg, 2019). Proponents of a green economy have suggested green finance as a realistic way of addressing the financing requirement of businesses, individuals, and governments involved in environmental preservation (Soundarrajan and Vivek, 2016). Central banks and financial supervisors play a supporting role in the transition to net-zero(Dikau and Volz, 2021). Combination of green financing policies leads to a mild cycle of emission reductions, stable financial sector and high economic growth (Lamperti et al., 2021). Countries at a different development level will require different strategies of green financing in achieving the Sustainable Development Goals in 2030(Tawiah, 2021).

Research Methodology

A descriptive research approach was adopted to provide a thorough overview of sustainable finance avenues across India. An in-depth study was carried out to evaluate the contemporary landscape of green finance mechanisms in India. Relevant insights were gathered by analyzing a wide range of secondary materials, encompassing peer-reviewed journals, published articles, digital databases, and company portals.

Objective of the Study

- To study the present ecosystem of green finance in India in achieving sustainable goals
- To categorize various instruments of green finance and their augmentation in India
- To highlight the challenges for growth and effectiveness of green finance in country

Discussion

- **India's Climate Commitment and Economic Aspiration**

The development of concerns for protection of environment from adverse human activities, accelerated in 20th century with the emergence of public consciousness about ecological issues. In 21st century, global warming and climate change have emerged as critical issue and evolved as a key driver for sustainable economic practice, requiring international cooperation and environmental laws. India, ranked world's fourth-largest economy (IMFdata (as of July, 2025)), this economic growth without a parallel shift to sustainable practices would aggravate environmental degradation. India is steering a dual imperative of achieving rapid economic growth while simultaneously fulfilling ambitious environmental commitments. India's role in international conventions on climate change and sustainable development laid the groundwork for its domestic green finance landscape. Key evets like the 1992 UNFCCC and the 2015 Paris Agreement accelerating the way for creation of policies and regulations. Therefore, green finance is not merely an optional addition but a critical enabler for India to achieve its economic aspirations *while* simultaneously addressing its environmental responsibilities and climate commitments. At the 26th Conference of Parties (COP) session in Glasgow 2021, India made a significant undertaking to achieve 'Net Zero' emissions by 2070. Complementing this long-term vision, India's current Nationally Determined Contributions (NDCs) for the year 2030 include reducing the emissions intensity of its economy by 35% compared to 2005 levels and achieving 40% of its total installed electric power capacity from non-fossil fuel sources.

- **Evolution and Growth of Green Finance in India**

The introduction of the NAPCC in 2008, alongside various policy and financial incentives, marked a major turning point for green finance in India. Today, resources are channelized from both public and private investments aimed at climate mitigation and sectoral resilience—particularly in clean energy, sustainable transit, and energy optimizationwith its reach broadening to include adaptation measures within the agricultural sector.

Green Finance Market Size in India

Over the past few years, India's sustainable debt market—encompasing both bonds and loanshas expanded rapidly. This momentum has been fueled by supportive policy moves, rising corporate spending on climate initiatives, and stronger commitments from banks and institutional investors. By late 2024, total issuance across green, social, sustainability, and sustainability-linked (GSS+) debt climbed to $55.9 billion, a 186% jump since 2021. Green debt dominate the market, commanding 83% of the overall market with most capital flowing into renewable energy and clean transport. In total, cumulative aligned green debt hit $46.6 billion by the close of 2024, more than doubling its end-2021 baseline of $21.3 billion (a 118% increase).

Table 1: Composition of Aligned Indian Green Debt Market by Instrument Type

Instrument type	USD bn
Bond	28.6
Loan	18.0
Total	46.6

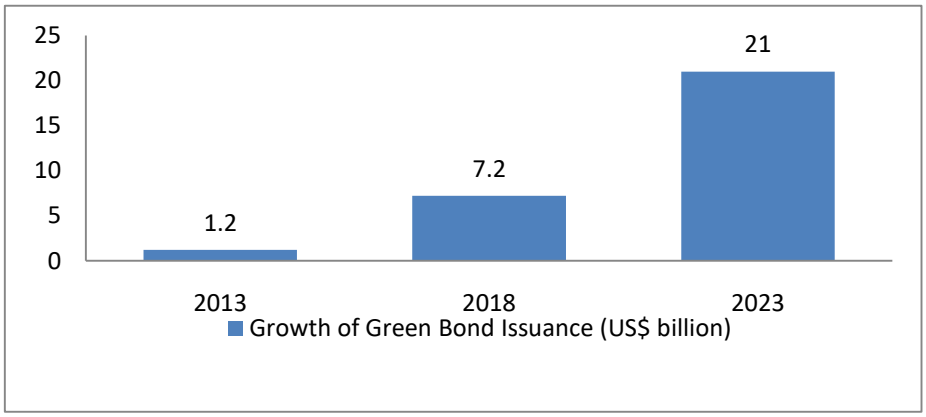
(Source: Climate Bonds Initiative 2024).

- **Mitigation Finance**: Solar energy remained the primary driver of clean energy investments, drawing roughly ₹947 billion each year. Large-scale utility projects led the charge, spurred by falling capital costs and targeted policy support such as the Production-Linked Incentive (PLI) scheme for solar manufacturing. Private domestic capital drove the green building and energy-efficient appliance markets, contributing 95% of total sector funding. In sustainable mobility, Mass Rapid Transit Systems (MRTS) got the largest share with 78% of inflows, while electric vehicle financing gained rapid momentum, tripling relative to 2019–20 levels.
- **Adaptation Finance**: Although smaller in volume, funding for adaptation grew notably to ₹1,092 billion ($15 billion) annually. However, this remains a fraction of the estimated ₹11 trillion ($170 billion) needed each year to satisfy India's 2030 climate targets. Public funds—chiefly government budgetary allocations—underpinned 98% of this capital. The bulk went toward disaster risk management, followed by investments in cyclone and flood resilience as well as climate-adaptive agriculture.

- **Key Green Finance Instruments & Current Indian Scenario**
  - **Green Bonds:** Green bonds, known for their risk mitigation characteristics and their attractiveness to institutions and socially amenable investors, are increasingly prominent in climate change and sustainable development financing approaches worldwide (Tolliver et al., 2019).Green bonds are debt securities funding environmental and climate solutions, spanning renewable energy, energy conservation, and climate adaptation initiatives.

Green bonds have expanded rapidly worldwide after been first introduced in the US and Norway in 1985. It recorded a 47% CAGR over the past 27 years and accelerating to 77% over the last decade. According to IMF data through 2021, green bond issuances have been heavily concentrated in euros and US dollars, followed by the Chinese yuan, with the Indian rupee accounting for only about 0.18% ($3.15 billion). Domestically, however, India's market has surged over the past ten years, rising from $1.2 billion (₹1,000 crore) in 2013 to $21.0 billion (approx. ₹1.7 lakh crore) in 2023. It is basically driven by broader push toward economic sustainability.

Figure 1: Growth of Green Bond Issuance in India



Source: The Journal of Indian Institute of Banking & Finance

- **Green Loans:** A more innovative development in this space is the emergence of sustainability-linked green loans. Green loans represent another vital instrument within the ecosystem, specifically designed to support environmental initiatives. Green loans are credit facilities provided by governments or financial institutions specifically to finance initiatives that deliver positive environmental outcomes. These loans are deployed for projects such as the installation of household solar panels, the purchase of electric vehicles, and various energy efficiency improvements. This initiative promotes energy efficiency ventures executed through Energy Service Companies (ESCOs). Across India, 13 banks and NBFCs including SBI, BOB, Canara Bank, HDFC Bank, and IREDA, have been enlisted as Participating Financial Institutions. Through FY 2022, the program has financed 45 energy efficiency projects with an aggregate value of ₹476.44 crore, supported by ₹231 crore in loans and ₹173.31 crore in credit guarantees.

These financial products feature predefined performance targets related to environmental sustainability, with borrowers incentivized to achieve these targets through adjusted loan terms. This rise of sustainability-linked loans signifies a shift from mere "use of proceeds" to "outcome-oriented" financing, aligning financial terms directly with measurable sustainability performance. Traditional green bonds and loans often focus on how the funds are *used*. Sustainability-linked loans, however, introduce a performance-based mechanism where interest rates or other terms are tied to the borrower's achievement of specific ESG targets.

Carbon Market (Credit Mechanism)

Development of the Carbon Credit Trading Scheme (CCTS) in July 2024, lays the foundation for a rate-based Emissions Trading System (ETS). The framework of CCTS is designed to incentivize efforts towards decarbonizing the Indian economy and comprises two significant elements. A dual framework featuring a mandatory compliance system for obligated industries alongside an offset mechanism for voluntary participants. The establishment of a legal and regulatory framework, such as the CCTS and the underlying Energy Conservation (Amendment) Act, 2022, is directly catalyzing the rapid growth and formalization of India's carbon market. The Indian carbon credit market is projected to attain US$49.4 billion mark by 2030, exhibiting a robust compound annual growth rate (CAGR) of 43.2% from 2024. India's choice of a rate-based ETS, focusing on emissions intensity rather than absolute caps, reflects a pragmatic approach to decarbonization that balances economic growth needs with climate goals.

Green Investment Instruments: Green Deposit & Mutual Funds

With the RBI introduced a "Framework for Acceptance of Green Deposits" in April 2023,the landscape of green finance further diversified. This avenue aims to channelize funds specifically towards green activities and eco-friendly projects. These green deposits are fixed interest-bearing instruments for a fixed tenure, with their proceeds earmarked for eligible green projects such as renewable energy initiatives, energy-efficient constructions, and clean transportation systems.

One of the most significant developments in green finance area is the rise of ESG Mutual Funds. The investment objective of ESG funds is to invest in companies that adhere to high standards of environmental protection, social responsibility, and corporate governance. The Nifty ESG 100 Index is used as the benchmark actively managed ESG fund. This indicates that fund will make investments in businesses that are both included in the ESG index and have a high overall ESG score. (Das, 2022). The introduction of green deposits and ESG mutual funds broadens access to green finance for retail investors and smaller entities, allowing individual depositors to directly contribute to green projects in companies with strong sustainability credentials. It also provides inclusive transition to a low-carbon society and a stable, long-term funding base for green initiatives. India's listed ESG debt market has already mobilized Rs 6,953 crore between 2017 and April 2025, indicating growing investor interest in such instruments. As of now (2025), there are 10 ESG funds in India:

Table 2. Top ESG Mutual Funds (as of early 2025)

Fund Name	AUM (₹ Cr)
ICICI Prudential ESG Exclusionary Strategy Fund	1,528.70
Quant ESG Equity Fund	312.26
Axis ESG Integration Strategy Fund	1,334.37
SBI ESG Exclusionary Strategy Fund	5,806.08
Mirae Asset ESG Sector Leaders Fund of Fund	90.00

Source: Dhan.co

Green Insurance

Insurance sector is the key component of financial system. Indian insurance industry that is seen as a means to financial risk mitigation is now stand to foster sustainable development by providing climate resilient insurance products, green initiatives and innovative solutions to address the complexities of changing climate. Green insurance serves as a key catalyst for sustainable development by directing capital toward environmentally sound projects. These policies frequently offer discounted premiums and other financial benefits for initiatives that meet concrete ecological criteria, such as cutting greenhouse gas emissions or protecting biodiversity. By aligning insurers, investors, and public authorities, green insurance helps unlock funding for sustainable initiatives, particularly in developing regions. Globally, the green insurance market was valued at USD 4.39 billion in 2024 and is projected to reach USD 17.91 billion by 2033, growing at a 15.6% CAGR over the forecast period.(businessresearchinsights.com).

The players in insurance sector are formulating ESG policies and are pursuing ESG rating to be better positioned. The General Insurance Council of India, which represents 45 non-life insurance and reinsurance businesses in India, has joined the UN Principles for Sustainable Insurance Initiative as a PSI Supporting Institution. ICICI Prudential Life Insurance has become the first company to make a commitment to ESG problems by signing the United Nations-supported Principles for Responsible Investment (UNPRI). several insurance providers in India work with renewable energy developers to create special insurance coverage for projects incorporating renewable energy investments (Rajesh & Majid, 2020).

- **Regulatory Framework driving green finance in India**

India’s green finance framework began taking formal shape in 2011, when the Ministry of Finance established the Climate Change Finance Unit (CCFU) to coordinate efforts across different government bodies. Today, the regulatory foundation is deliberately broaden in the country to provide vital policy and oversight framework. Instead of treating sustainability as an isolated department, the oversight is integrated across the financial system: the Reserve Bank of India (RBI) steers banking norms, SEBI manages capital markets, the Ministry of Finance shapes fiscal policy, and IFSCA opens channels for cross-border capital. Meanwhile, the Ministry of New and Renewable Energy (MNRE) guides core clean energy implementation through key public sector enterprises like IREDA and SECI. Also, 100% foreign direct investment (FDI) for renewable generation and distribution is allowed to bring global investors on board.

Handling climate change requires more than a single policy—it demands a total ecosystem approach. In India, sustainability is being embedded with in the financial system, with each major regulatory body playing a specific role: the RBI handles banking, SEBI looks after capital markets, the MNRE steers energy policy, and the Finance Ministry manages fiscal priorities. This comprehensive setup has created a productive ground for international climate investment. Global players are stepping

up to strengthen India's green bond market, as evident in June 2024 partnership between British International Investment (BII) and Symbiotics Investments on a $75 million Green Bond Fund. By working through MSME lenders, this fund helps ensure that financing for renewable energy, energy efficiency, and green buildings just don't remain on top but penetrates to the ground level.

Bottlenecks to Green Finance Growth in India

The most pressing challenge for India's green finance ambitions is the sheer magnitude of the investment gap. The nation requires an estimated USD 1.5 trillion by 2030 to address climate change. Looking further ahead, a staggering US10 trillion is needed by 2070 to achieve net-zero emissions.

Table 3: Investment Needs and Current Flows for India's Climate Goals

Climate Goal/Target	Estimated Investment Need	Current Annual Green Investment Flow (Average)
2030 Climate & Energy Goals	US$1.5 trillion	US$19 billion
Net Zero by 2070	US$10 trillion	US$19 billion

Source: Deloitte

The gaps that put the country's sustainable growth at serious risk are:

- **Funding Gap:** Comparing roughly $19 billion currently invested each year, the scale of India's green funding shortfall becomes obvious. That divide between what is needed and what is actually flowing puts both national climate commitments and long-term development goals in threat.
- **Structural Gap:** The challenge is not only financial constraint but a structural bottleneck. Progress is slowed by high transaction friction, inconsistent industry standards, persistent fears of greenwashing, and widespread gaps in institutional expertise.
- **Investor Gap:** The investor pool remains shallow and liquidity is thin. Capital is heavily concentrated among a handful of familiar renewable energy developers and regional pockets, silently driving up risk across the entire market.

Conclusion

With an increasing attention on ESG objectives, the government is focusing on sustainable infrastructure initiatives such as renewable energy, smart city development, and electric vehicle (EV) charging networks. These initiatives demand significant financial resources, which is driving the need for green financing sources like green bonds and sustainability-linked loans. Financial institutions are broadening their green finance options to back eco-friendly infrastructure projects across different sectors. Considering India's high susceptibility to the risks of climate change, the need for adaptation investments is likely to rise. This existing shortfall in investment needed to meet environmental goals highlights the urgent necessity for India to enhance its green finance initiatives.

The growth of sustainable bonds and loans in recent years is propelling India toward a low-carbon economy. Green finance framework is increasingly being incorporated in the lending portfolios of the entities specially Public sector banks, multilateral institutions, and private entities. Renewable energy developers are procuring funds through green bonds for initiatives in wind, solar, and hydroelectric power. Infrastructure companies are leveraging green loans to fund projects focused on climate resilience and carbon reduction. The regulatory landscape is also transforming, with SEBI implementing norms for green bonds and ESG disclosures while the RBI acknowledges climate risk in financial stability evaluations. These advancements are establishing a more organized and clear green finance framework, providing new opportunities for both institutional and retail investors. But at the same time where multifaceted regulatory framework promotes extensive coverage and integration across various financial sectors, it also raises concerns about fragmented regulations or overlapping policies.

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