



A STUDY ON FINANCIAL IMPACT OF GREEN BONDS ON CORPORATE SUSTAINABILITY AT NTPC LTD

Kandadi Sravya Reddy¹, N V N S Aashrith², G Nageshwari³, Sattu Ajay Kumar⁴, K.V. Chiranjeevi⁵

¹⁻⁴MBA (Finance), Aurora's PG College Hyderabad, Telangana

⁵Assistant Professor, Department of Business Administration, Aurora's PG College
Hyderabad, Telangana

Email: venkata.chiru4@gmail.com

ABSTRACT

Abstract—Green bonds have emerged as a pivotal instrument in sustainable finance, enabling corporations and public sector enterprises to raise capital specifically earmarked for environmentally beneficial projects including renewable energy, energy efficiency, clean transportation, and climate adaptation infrastructure. NTPC Limited, India's largest power generation company and a Maharatna central public sector enterprise, has been a pioneer in green bond issuance among Indian power sector companies, raising ₹10,000 crore through multiple green bond tranches to finance its ambitious renewable energy capacity expansion from 7 GW to 60 GW by 2032. This study examines the financial impact of green bond issuance on NTPC's corporate sustainability outcomes, analysing cost of capital effects, investor base diversification, ESG rating improvements, renewable energy capacity addition, carbon emission intensity reduction, and balance sheet implications of green financing. Primary data was collected through structured questionnaires administered to 100 respondents comprising financial analysts, institutional investors, and sustainability professionals. Secondary data was sourced from NTPC Annual Reports (2021–2024), SEBI green bond framework circulars, Climate Bonds Initiative certification records, RBI sustainable finance guidelines, and academic literature on green bond market development. Findings indicate that NTPC's green bond programme has reduced financing costs by 25–40 basis points compared to conventional bonds, attracted 38% new

international ESG-focused investors, improved Sustainalytics ESG risk rating from 38.4 to 29.7, and directly financed 4,200 MW of renewable energy capacity addition. Recommendations address green bond framework enhancement, use-of-proceeds reporting improvement, and green bond market deepening strategies.

Keywords: *Green bonds, NTPC, corporate sustainability, renewable energy, ESG, cost of capital, Climate Bonds Initiative, sustainable finance, energy transition, green premium.*

1. INTRODUCTION

Green bonds represent a specialised fixed-income instrument where proceeds are exclusively allocated to projects with demonstrable environmental benefits, subject to independent verification and periodic use-of-proceeds reporting. First issued by the European Investment Bank in 2007, the global green bond market has grown exponentially to reach USD 575 billion in annual issuance in 2023, with cumulative global green bond issuance exceeding USD 2.5 trillion. This growth reflects accelerating institutional investor demand for climate-aligned fixed income assets, regulatory mandates for sustainable finance disclosure, and corporate recognition that green financing can simultaneously lower capital costs and enhance sustainability credentials.

India's green bond market has developed rapidly since SEBI introduced its Green Bond Framework in 2017 and the Union Budget 2022–23 announced sovereign green bond issuance. Indian green bond issuance



reached USD 18.7 billion in 2023, representing a 47% growth over 2022, with power sector entities accounting for the largest share of issuance volume. The government's National Action Plan on Climate Change and the 2070 net-zero commitment have created strong policy tailwinds for renewable energy financing through green bonds.

NTPC Limited, established in 1975 and headquartered in New Delhi, operates India's largest integrated power generation portfolio with installed capacity of 73.8 GW across coal, gas, hydro, solar, and wind sources as of March 2024. NTPC's strategic goal of achieving 60 GW renewable energy capacity by 2032—requiring estimated investment of ₹ 2.5 lakh crore—has driven an aggressive green bond financing strategy. NTPC issued its first green bond in 2016 and has since established itself as India's most prolific power sector green bond issuer, accessing both domestic and international capital markets with Climate Bonds Initiative certified instruments.

This study examines the financial and sustainability impact of NTPC's green bond programme, providing empirical evidence on cost of capital effects, investor base evolution, ESG performance improvement, renewable capacity financing, and balance sheet implications. The research aims to contribute to academic understanding of green bond impact in the Indian public sector enterprise context and provide insights for practitioners and policymakers advancing India's sustainable finance ecosystem.

2. OBJECTIVES OF THE STUDY

The objectives of this study are to examine NTPC's green bond issuance history, framework structure, and use-of-proceeds allocation across renewable energy and sustainability projects; to evaluate the financial impact of green bond issuance on NTPC's cost of capital, comparing green bond pricing against conventional bond benchmarks and estimating the green premium (greenium) achieved; to assess the

investor base diversification impact of green bonds, analysing the proportion of new ESG-focused domestic and international institutional investors attracted through green issuances; to examine the corporate sustainability outcomes linked to green bond financed projects, including renewable energy capacity addition, carbon emission intensity reduction, and ESG rating improvement; and to recommend enhancements to NTPC's green bond framework, reporting standards, and market development strategies for maximising sustainable finance programme effectiveness.

3. LITERATURE REVIEW

[1] Flammer (2021) conducted the first large-scale empirical study of corporate green bond issuance impact, analysing 1,000+ green bond announcements and finding that green bond issuers experience positive abnormal stock returns of 0.5% at announcement, improved environmental performance measured by lower CO₂ emissions, and higher institutional investor ownership in the two years post-issuance, establishing that green bonds generate both financial and sustainability benefits for issuers.

[2] Zerbib (2019) quantified the green bond premium (greenium) by matching green bonds with comparable conventional bonds, finding a statistically significant negative yield spread of 2–8 basis points attributable solely to green labelling, with the premium largest for investment-grade issuers in the utilities sector—directly relevant to NTPC's credit profile and sector positioning.

[3] Climate Bonds Initiative (2023) published the Global Green Bond Market Summary, reporting USD 575 billion in 2023 green bond issuance and cumulative global issuance of USD 2.5 trillion. The report highlighted India as the fastest-growing emerging market green bond issuer, with power sector entities including NTPC, Power Finance Corporation, and IREDA



among the largest domestic issuers by volume.

[4] SEBI (2023) issued revised guidelines on Green Debt Securities, mandating enhanced use-of-proceeds disclosure, independent third-party verification, and annual impact reporting for all listed green bonds. These regulations govern NTPC's green bond disclosure obligations and provide the regulatory framework within which the company's sustainable finance programme operates.

[5] Tang and Zhang (2020) studied the stock market response to green bond announcements, finding that firms announcing green bond issuance experienced significantly higher abnormal returns (+1.3%) compared to conventional bond announcements, with the premium strongest for firms with previously weak ESG credentials, suggesting green bonds serve as credible commitment devices for corporate sustainability transformation.

[6] Ministry of Power India (2023) published the National Electricity Plan 2023–2032, projecting renewable energy capacity requirement of 500 GW by 2030 with associated capital investment of ₹25 lakh crore. Green bonds are identified as a critical financing instrument for achieving this target, with public sector power companies including NTPC expected to be primary issuers in the domestic market.

[7] Ehlers and Packer (2017) studied green bond pricing across primary and secondary markets, finding that green bonds were priced 18 basis points lower in yield at issuance compared to comparable conventional bonds from the same issuers, translating to significant interest cost savings for large-volume issuers like NTPC over multi-year financing programmes.

[8] Shishlov et al. (2022) evaluated the additionality and impact of green bond financed projects, finding that 73% of surveyed green bond issuers reported that green bond availability enabled projects that would not have been financed through conventional instruments, particularly in

emerging market renewable energy contexts where green bonds open access to international ESG investor capital unavailable through domestic conventional bond markets.

4. RESEARCH METHODOLOGY

A mixed-methods research design was employed to comprehensively examine the financial impact of green bonds on NTPC's corporate sustainability. Quantitative analysis of green bond issuance data, financial performance metrics, and ESG rating trends was combined with structured survey insights from financial analysts and sustainability professionals, enabling both statistical measurement of green bond financial outcomes and contextual understanding of investor and market perception dynamics.

4.1 Research Design

Descriptive and analytical research design was adopted. Descriptive design documents NTPC's green bond issuance programme, framework structure, use-of-proceeds allocation, and impact reporting practices. Analytical design examines the relationship between green bond issuance and financial outcomes (cost of capital, investor base, credit rating trajectory) and sustainability outcomes (renewable capacity, emission intensity, ESG ratings) over the FY 2021–22 to FY 2023–24 study period, benchmarked against NTPC's pre-green bond baseline and comparable peer issuers.

4.2 Data Sources

Primary data was collected through structured questionnaires administered to 100 respondents across three categories: financial analysts covering NTPC and power sector (n=40), institutional investors holding NTPC green bonds (n=35), and corporate sustainability and ESG professionals (n=25). The questionnaire covered green bond awareness, perceived financial benefits, sustainability impact assessment, reporting quality evaluation, and green bond market development recommendations across a 5-point Likert scale. Secondary data sources



included NTPC Annual Reports FY 2022–2024, NTPC Green Bond Framework and allocation reports, Climate Bonds Initiative certification records, Sustainalytics and MSCI ESG rating reports, SEBI green bond circulars, RBI Report on Currency and Finance 2023, Bloomberg green bond pricing data, and academic literature on green bond market development and impact measurement.

4.3 Sample Size

Purposive sampling was used to select respondents with direct knowledge of NTPC's green bond programme or Indian power sector sustainable finance markets. Financial analyst respondents covered sell-side and buy-side analysts with minimum two years of NTPC or power sector coverage. Institutional investor respondents included fund managers from domestic mutual funds, insurance companies, and foreign portfolio investors holding NTPC green bonds. Sustainability professional respondents comprised ESG analysts, CBI verifiers, and corporate sustainability officers. Sample adequacy was validated at 95% confidence level with 10% margin of error using Cochran's formula.

4.4 Tools for Analysis

Descriptive statistical analysis including mean scores, frequency distributions, and percentage analysis was applied to Likert scale survey responses measuring green bond impact perceptions and market development assessments. Financial impact analysis computed cost of capital differential between NTPC green bonds and comparable conventional bonds using Bloomberg secondary market yield data. ESG rating trend analysis tracked Sustainalytics and MSCI ESG score evolution across the study period. Renewable energy capacity addition tracking linked green bond use-of-proceeds to commissioned renewable projects. Comparative analysis benchmarked NTPC's green bond outcomes against peer issuers including Power Finance Corporation, IREDA, and REC Limited.

5. DATA ANALYSIS AND INTERPRETATION

5.1 NTPC Green Bond Issuance Programme

Year	Amount	Tenor	Coupon
2016	USD 300 Mn	10 yr	4.75%
2020	₹1,500 Cr	10 yr	6.48%
2021	USD 750 Mn	10 yr	4.25%
2022	₹2,000 Cr	7 yr	7.15%
2023	USD 500 Mn	5 yr	5.50%
2024	₹3,000 Cr	10 yr	7.40%

Table I: NTPC Green Bond Issuance History 2016–2024

NTPC has issued green bonds across six tranches between 2016 and 2024, accessing both international (USD-denominated) and domestic (INR-denominated) capital markets. Total green bond financing raised amounts to approximately ₹10,000 crore equivalent, representing approximately 12% of NTPC's total outstanding debt as of March 2024. International green bond tranches have been Climate Bonds Initiative certified and listed on the London Stock Exchange Green Bond Segment, enabling access to global ESG-focused institutional capital at below-market coupon rates reflecting the greenium benefit.

5.2 Cost of Capital Impact (Greenium Analysis)

Bond Tranche	Green Yield	Conventional Yield	Greenium (bps)
2021 USD 750 Mn	4.25%	4.60%	–35 bps
2022 INR	7.15%	7.45%	–30 bps



2,000 Cr			
2023 USD 500 Mn	5.50%	5.85%	–35 bps
2024 INR 3,000 Cr	7.40%	7.65%	–25 bps
Average Greenium	—	—	–31 bps

Table II: Green Bond Greenium Analysis – NTPC

NTPC's green bonds have consistently priced at 25–35 basis points below comparable conventional bonds across both USD and INR-denominated tranches, generating an average greenium of 31 basis points. On the USD 750 million 2021 tranche alone, this 35 basis point greenium translates to annual interest savings of approximately USD 2.6 million, or USD 26 million over the 10-year bond tenure. Across all green bond tranches cumulatively, the greenium benefit represents estimated savings of ₹380–420 crore over bond tenures, demonstrating substantial financial value from green labelling beyond sustainability credentials.

5.3 ESG Rating and Sustainability Impact

Sustainability Metric	FY 2021–22	FY 2023–24	Change
Sustainalytics ESG Risk	38.4	29.7	–8.7 pts ✓
MSCI ESG Rating	BB	BBB	Upgraded ✓
RE Installed Capacity (GW)	3.2 GW	7.4 GW	+4.2 GW ✓
Emission Intensity (kg/kWh)	0.82	0.76	–7.3% ✓
Green Bond Financed RE (MW)	1,800	4,200	+133% ✓
Int'l ESG	22%	38%	+16 pts

Investors %		✓
-------------	--	---

Table III: NTPC Sustainability Performance FY 2022 vs FY 2024

Green bond financing has demonstrably accelerated NTPC's sustainability transformation across all tracked metrics. Sustainalytics ESG Risk Score improvement from 38.4 (high risk) to 29.7 (medium risk) and MSCI ESG rating upgrade from BB to BBB reflect broader investor community recognition of NTPC's sustainability progress. Green bond financed renewable capacity grew from 1,800 MW to 4,200 MW, representing 57% of NTPC's total renewable capacity addition over the study period. International ESG-focused investor ownership increased from 22% to 38% of green bond holdings, confirming that green issuances have successfully diversified NTPC's investor base beyond conventional domestic fixed income buyers.

5.4 Respondent Green Bond Impact Perception

Impact Dimension	Mean (/5)	% Agree
Cost of capital reduction	4.28	83%
Investor base diversification	4.21	80%
ESG credibility enhancement	4.34	86%
RE project financing access	4.19	77%
Reporting transparency quality	3.72	58%
Green bond framework robustness	3.81	62%
Additionality of green projects	3.64	54%

Table IV: Respondent Perception of Green Bond Impact (n=100)

ESG credibility enhancement (mean 4.34; 86%) and cost of capital reduction (mean 4.28; 83%) are rated as the two highest-



impact green bond benefits, consistent with both quantitative greenium analysis and academic literature findings. Reporting transparency quality (mean 3.72; 58% agreement) and project additionality (mean 3.64; 54%) record the lowest satisfaction scores, indicating that while NTPC's green bond financial outcomes are strong, use-of-proceeds reporting depth and demonstration of project additionality require improvement to meet evolving institutional investor ESG reporting expectations.

5.5 Green Bond vs. Conventional Bond Comparison

Parameter	Green Bond	Conv. Bond
Avg. Coupon Rate	6.25%	6.56%
Investor Type	ESG + Conv.	Conv. only
Reporting Requirement	Annual Impact	Standard
Third-party Verification	Required	Not required
Market Access	Global ESG	Domestic
Use of Proceeds	Restricted	General purpose
Certification Required	Yes (CBI)	No

Table V: Green Bond vs. Conventional Bond – NTPC Comparison

6. FINDINGS AND SUGGESTIONS

6.1 Key Findings

NTPC's green bond programme has generated measurable and significant financial benefits, with a consistent greenium of 25–35 basis points across four recent tranches translating to cumulative interest savings of ₹380–420 crore over bond tenures. Cost of capital reduction (83% respondent agreement) emerges as the most immediately quantifiable financial benefit, establishing a clear economic rationale for green bond issuance beyond sustainability

intent and positioning green bonds as financially superior financing instruments for eligible renewable energy projects.

Investor base diversification from 22% to 38% international ESG-focused investor ownership demonstrates that green bonds have successfully opened access to global sustainable finance capital pools previously unavailable through NTPC's conventional bond programme. This diversification reduces refinancing concentration risk, improves liquidity in NTPC's green bond secondary market, and creates reputational relationships with globally influential ESG-focused institutional investors whose sustainability engagement can support NTPC's broader energy transition strategy.

Sustainalytics ESG Risk Score improvement from 38.4 to 29.7 and MSCI rating upgrade from BB to BBB confirm that green bond-financed renewable capacity addition and associated sustainability reporting have materially improved NTPC's ESG investment credentials. These rating improvements reduce the risk premium applied by ESG-screened investors, expand NTPC's eligible investor universe, and strengthen NTPC's positioning in ESG indices that increasingly influence institutional asset allocation decisions globally.

Reporting transparency quality (58% satisfaction) and project additionality demonstration (54%) are identified as the primary green bond programme improvement areas. As institutional investors and regulators raise green bond reporting standards globally and SEBI mandates enhanced impact disclosure for listed green bonds, addressing these reporting gaps is both a compliance necessity and a differentiation opportunity for NTPC in the competitive Indian green bond issuer landscape.

6.2 Suggestions

NTPC should enhance its green bond impact reporting framework by adopting the Climate Bonds Initiative Impact Reporting Recommendations and ICMA Green Bond



Principles Harmonised Framework for Impact Reporting, providing quantified environmental impact metrics per bond tranche including MWh of renewable energy generated, tonnes of CO₂ avoided, households served with clean energy, and renewable capacity commissioned. Quantified, independently verified impact reporting directly addresses the 58% reporting satisfaction deficit and strengthens NTPC's positioning with ESG-screened institutional investors applying rigorous impact evidence requirements.

NTPC should establish a dedicated Green Finance Office with cross-functional responsibility spanning treasury, sustainability, investor relations, and project finance, responsible for green bond programme coordination, use-of-proceeds tracking, impact measurement, and investor engagement. Institutionalising green finance governance within a dedicated organisational function signals strategic commitment to sustainable finance, ensures consistent reporting quality across issuances, and builds specialist capability for navigating increasingly complex global green bond market standards and investor expectations.

Expanding the green bond programme to include blue bonds (water-related projects), social bonds (rural electrification, energy access), and sustainability-linked bonds (SLBs) with coupon step-ups linked to renewable capacity and emission intensity targets would diversify NTPC's sustainable finance instrument portfolio and access additional investor segments with specific thematic mandates. SLBs in particular align financing cost directly with sustainability performance achievement, creating powerful financial incentive alignment between NTPC's energy transition goals and its capital structure management objectives.

7. CONCLUSION

This study has comprehensively examined the financial impact of green bonds on NTPC's corporate sustainability, providing empirical evidence on cost of capital effects,

investor base diversification, ESG rating improvement, and renewable energy financing outcomes across the FY 2021–22 to FY 2023–24 study period. NTPC's green bond programme has delivered quantifiable financial benefits through a consistent greenium of 25–35 basis points generating cumulative savings of ₹380–420 crore, alongside strategic sustainability benefits including ESG rating improvement, international investor base expansion, and 4,200 MW of renewable energy capacity financing.

The positive green bond financial outcomes—lower cost of capital, broader investor access, and ESG rating improvement—are mutually reinforcing, establishing a virtuous cycle where improved sustainability credentials reduce future financing costs, which in turn fund additional renewable capacity that further strengthens ESG ratings and investor confidence. This dynamic confirms that green bonds represent not merely a financing instrument but a strategic mechanism for accelerating NTPC's energy transition while simultaneously optimising its capital structure.

Reporting transparency and additionality demonstration gaps, identified by respondents as the primary green bond programme weaknesses, represent both near-term improvement priorities and longer-term differentiation opportunities as Indian green bond market standards continue evolving toward global best practices. Addressing these gaps through enhanced impact reporting, dedicated green finance governance, and expanded sustainable finance instrument portfolio will position NTPC as India's benchmark green bond issuer in the power sector.

As India advances toward its 500 GW renewable energy target by 2030 and 2070 net-zero commitment, green bonds will play an increasingly central role in financing the estimated ₹25 lakh crore required energy infrastructure investment. NTPC's demonstrated ability to access international green capital at below-market rates, attract



ESG-focused institutional investors, and deliver verified sustainability impact establishes a replicable model for Indian public sector enterprises seeking to align capital structure with national climate commitments while optimising financing efficiency.

8. REFERENCE

- [1] C. Flammer, "Corporate Green Bonds," *Journal of Financial Economics*, vol. 142, no. 2, pp. 499–516, 2021.
- [2] O. D. Zerbib, "The Effect of Pro-Environmental Preferences on Bond Prices: Evidence from Green Bonds in the Secondary Market," *Journal of Banking and Finance*, vol. 98, pp. 39–60, 2019.
- [3] Climate Bonds Initiative, "Global Green Bond Market Summary 2023," CBI, London, 2023.
- [4] Securities and Exchange Board of India, "Circular on Green Debt Securities," SEBI, Mumbai, 2023.
- [5] X. Tang and Y. Zhang, "Do Shareholders Benefit from Green Bonds?" *Journal of Corporate Finance*, vol. 61, pp. 1–18, 2020.
- [6] Ministry of Power, Government of India, "National Electricity Plan 2023–2032," Central Electricity Authority, New Delhi, 2023.
- [7] T. Ehlers and F. Packer, "Green Bond Finance and Certification," *BIS Quarterly Review*, pp. 89–104, September 2017.
- [8] I. Shishlov, R. Morel, and I. Cochran, "Beyond Transparency: Unlocking the Full Potential of Green Bonds," *Institute for Climate Economics*, Paris, 2022.
- [9] NTPC Limited, "Annual Report 2023–24," NTPC, New Delhi, 2024.
- [10] NTPC Limited, "Green Bond Framework and Allocation Report 2023," NTPC, New Delhi, 2023.
- [11] Reserve Bank of India, "Report on Currency and Finance 2022–23: Towards a Greener Cleaner India," RBI, Mumbai, 2023.
- [12] Sustainalytics, "NTPC Limited ESG Risk Rating Report 2023–24," Morningstar Sustainalytics, Amsterdam, 2024.
- [13] International Capital Market Association, "Green Bond Principles 2021," ICMA, Paris, 2021.
- [14] Bloomberg New Energy Finance, "India Green Finance Market Outlook 2024," BloombergNEF, London, 2024.
- [15] IREDA, "Renewable Energy Financing Trends in India FY 2023–24," Indian Renewable Energy Development Agency, New Delhi, 2024.