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Visualizing Sustainability: A Multi-Case Study of Environmental Disclosure in India's Power Sector

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Abstract

This study examines how leading companies in India's power sector communicate environmental commitments through both text and visuals in ESG reportings. Using a multi-case study approach, we analyze five years of annual and sustainability reports, comparing narrative content and visual elements such as green-themed imagery and renewable energy depictions. Our findings suggest that power companies employ a significant array of visual strategies alongside traditional text, with communication styles varying according to regulatory and stakeholder contexts. The results highlight the increasing role of visual storytelling in enhancing the clarity and impact of ESG reporting. By integrating visual analysis with textual assessment, this research offers new insights into how combined narrative and imagery shape perceptions of environmental responsibility in the sector.

Keywords : ESG Communication · Sustainability Reporting · Environmental Reporting · Power Sector
JEL Classification : Q01 · Q56 · M14 · Q40 · L94 · O13

Introduction

Responding to the pressing international concern of climate change, energy firms globally face unprecedented scrutiny to illustrate true environmental responsibility. The global industry push for decarbonization, fueled by pacts like the Paris Accord and supported by domestic policy structures, has reshaped sustainability from an underlying consideration to a core strategic priority for the power sector. As per the International Energy Agency (IEA), renewable energy capacity worldwide is expected to grow at a rate of 12% every year until 2026, representing 90% of net world capacity growth—a growth that attests to the industry's central position in global energy transition. In India, however, this imperative is especially pressing: the electricity sector accounts for some 40% of national greenhouse gas emissions, making it both an opportunity and a stumbling block in realizing the nation's bold climate goals.

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Multi-case studies in Bosnia and Herzegovina (SDG Fund), the Netherlands (Nowak & Młodziejewski, 2024), and Qatar (Al-Kaabi & Arayssi, 2024) all highlight the strategic importance of energy within national sustainability objectives and the potential of decentralized or regulated strategies to facilitate emission reduction objectives.

The development of environmental, social, and governance (ESG) reporting has tracked these changes, with sustainability disclosures becoming the primary channel by which energy firms make known their environmental commitments to a multifarious group of stakeholders. Fresh statistics from the Global Sustainable Investment Alliance (GSIA) show that global sustainable investments rose to $35 trillion, an increase of 15% over 2022, and demonstrate the increasing focus of the financial sector on companies' environmental performance. In India, the introduction of the Business Responsibility and Sustainability Reporting (BRSR) standard has driven ESG adoption among listed power firms, with growth from 18% in 2022 to 54% in 2023 (CFA Institute, 2024). Albeit this advancement, enormous challenges persist: more than 40% of Indian energy companies continue not to offer traceable emissions reduction information in their reports (World Bank, 2023), giving rise to issues of transparency, comparability, and the potential for greenwashing.

Comparative studies of ESG practices in Indonesia (Wulandari et al., 2023), India's agrochemical industry (Kumar & Narayanasamy, 2019), and Polish energy firms (Jonek-Kowalska & Turek, 2022) indicate different levels of compliance and underscore the challenge of standardizing reporting intensity across sectors and geographies.

The global significance of these concerns is highlighted by the increasing volume of multi-case study research, which indicates the strength of comparative analysis to uncover patterns and differences across organizations and settings. For instance, Martín-Peña et al. (2014) carried out a multi-case study of the Spanish olive oil industry to show how the implementation of environmental management systems (EMS) generates tangible and intangible value for companies. Johnson & Johnson's decade-long strategy for sustainability reporting (IMA Educational Case Journal, 2010) demonstrates how ongoing, multi-initiative disclosures establish stakeholder trust, and the OECD (2020) offers six Japanese case studies of environmental due diligence across sectors. Further research in the EU energy industry (Nowak & Młodziejewski, 2024) and in multinational portfolios (Alessi et al., 2023) reiterates that cross-case analysis fortifies both theory development and practical implications in sustainability communication.

This range of evidence is supplemented by increased academic attention to the energy sector's ESG transition through methodologies like the "triple transformation" of decarbonization, decentralization, and digitalization, as in Wang et al. (2023), who apply fsQCA and SEM to investigate how these changes affect ESG performance. Likewise, van der Laan Smith et al. (2023) report an energy firm's governance and transparency issues while implementing GRI reporting, and a study by Ali et al. (2020) makes cross-country comparisons of sustainability reporting performance among developed and emerging energy economies, with insights on contextual enablers and inhibitors of reporting quality. Such research identifies the extent to which a mix of internal capabilities and pressures from the outside drives disclosure behaviors and sustainability strategies among firms and regions.

Notwithstanding the abundance of ESG approaches and the growing complexity of reporting procedures, the gap between understanding how firms use both narrative and visual means to convey environmental responsibility is still very large. Whereas earlier research has mainly dealt with textual approaches or quantitative indicators, the role of visual storytelling through green-themed images, renewable energy representations, and other visual elements has received relatively little scholarly examination. This is especially relevant in economies that are rapidly industrializing, like India, where the demand for electricity has been increasing at an average annual rate of 5.6% since 2010 and is expected to be 3,000 TWh by 2030 (Central Electricity Authority, 2023). Reports like the Adani Green Energy ESG Report (2022–23), the Bosnia energy decentralization project (SDG Fund), and the Netherlands' multi-level governance approach (Nowak & Młodziejewski, 2024) illustrate the value of multi-dimensional, visually enhanced ESG reporting, yet academic critique of such activities is scarce.

This study addresses this gap by employing a multi-case analysis of leading Indian power companies, systematically examining five years of annual and sustainability reports to compare the deployment of narrative content and visual elements in ESG communications. By integrating visual analysis with textual assessment, this research aims to elucidate how combined narrative and imagery influence stakeholder perceptions of environmental responsibility. In so doing, it adds to the international dialogue on sustainability reporting through offering fresh perspectives on the changing dynamics of ESG messaging in the electricity sector—a sector at the vanguard of both the climate imperative and a low-carbon economy transition. Consistent with multi-case study approaches by Martín-Peña et al. (2014), Johnson & Johnson (2010), and OECD (2020), this paper strives to uncover patterns of reportage that are generalizable across contexts and informative for policymakers, industry stakeholders, and researchers alike.

Research Questions

Within the changing field of corporate sustainability, open and honest communication has emerged as a key requirement for firms wishing to achieve legitimacy and credibility among stakeholders. The SEBI released the Business Responsibility and Sustainability Reporting (BRSR) framework in 2021, which represented a major step towards uniform and compulsory ESG disclosures for the largest 1,000 listed companies from FY 2022–23 (CFA Institute, 2024). The development fits with international trends pointing toward the imperative of uniform and in-depth sustainability reporting (Saraf & Partners, 2023).

Recent studies show that Indian firms have improved in ESG disclosures, but issues are still there regarding data quality and comparability. For example, according to a report in 2024, it was emphasized that though there has been improvement in micro, small, and medium-sized enterprise (MSMEs) sourcing, reporting units are not consistent and data sources are unclear (Sharma & Vashistha, 2022).

The authenticity of sustainability reports is also questioned in the light of stakeholder engagement. Successful communication strategies need to not only report environmental promises but also prove actual stakeholder inclusiveness and materiality (Sehgal & Sethi, 2023). The changing expectations require firms to go beyond symbolic actions to make transparent and outcome-based disclosures (Wani, Haldar, & Ganie, 2023).

Advances in data analytics present new ways to evaluate and build the credibility of sustainability reports. Methods like natural language processing (NLP), image analytics, and text automation allow more penetrating analysis of firm disclosures, and the identification of patterns, inconsistency, and opportunities for improvement can be achieved (Cho & Lee, 2024) ; (Gurban et al., 2024). These tools, when paired with qualitative measures, offer an integrated picture of how environmental narratives are being constructed and interpreted (Li et al., 2024).

Indian energy firms are, in this regard, important case studies. Conducting business in a regulatory system that is increasingly in line with global climate agreements, these companies need to build credibility and strategic success into their sustainability narratives. Assessing these narratives is necessary to determine how environmental legitimacy is sought—and whether it is actually attained (Elamer et al., 2024).

Latest figures from the SEBI-mandated BRSR filings of FY 2022–23 indicate that more than 87% of the top 1,000 Indian listed firms reported data on energy consumption, water usage, and emissions. Just 42%, however, presented year-over-year comparative data, constraining longitudinal evaluation of advancement (EY India, 2023). Of energy sector companies, roughly 65% reported Scope 1 and 2 emissions, whereas fewer than 20% reported Scope 3 emissions, which capture a large majority of indirect environmental footprint. The reporting gap demonstrates the need for more precise metrics and greater conformance to international standards like the GHG Protocol. In addition, an internal survey by the CII Sustainability Council (2024) revealed that 56% of Indian energy firms continue to have manual or semi-automated ESG data gathering systems, leading to doubts regarding scalability, accuracy, and auditability of reported metrics.

In addition, natural language processing (NLP) analysis of 250 BRSR reports of power and utility companies showed heavy usage of performative language—words such as "commitment," "sustainability journey," and "green future" were used in more than 78% of reports, whereas quantifiable words such as "target achieved" or "carbon intensity reduction" were used in only 29% (Dasgupta et al., 2024). Visual content analysis on the same sample revealed that although almost 90% of the reports contained charts and infographics, only 35% of these graphics were underpinned by verifiable data or external audit trails. The results indicate an ongoing reliance on symbolic representation rather than outcome-based reporting. Integrating automated benchmarking mechanisms and data provenance techniques can assist companies in building both credibility and stakeholder confidence in the disclosures.

Q1) How do Indian energy firms, particularly in emerging and transitional economies, use both text and visuals (e.g., infographics, charts, photos) in sustainability reports to communicate environmental commitments?

Q2) What do text and image analyses reveal about the tone, framing, and credibility of environmental narratives, and how do these influence stakeholder trust and authenticity?

Q3) How closely do Indian energy firms align their sustainability report content—both textual and visual—with global frameworks like the Paris Agreement and SDGs, and how does this impact perceived legitimacy?

Q4) How have regulatory changes and market forces (e.g., BRSR) shaped multimodal sustainability reporting in India's power sector, especially in terms of transparency, engagement, and strategic positioning?

Research Design

Case Study Method

This study employs a multi-case design to systematically examine the differentiated patterns of environmental disclosure within India's power sector—an industry simultaneously undergoing decarbonization, digitalization, and institutional restructuring. As ESG reporting in India evolves under mandates such as the BRSR and growing investor scrutiny, energy companies increasingly construct their sustainability narratives under conditions of reputational pressure, symbolic compliance, and regulatory ambiguity. The multi-case methodology enables structured comparative analysis across a diverse sample of firms—ranging from state-owned to private players, and from coal-heavy to renewable-driven portfolios—thus capturing sectoral heterogeneity that would be obscured in single-case or survey-based approaches (Runfola et al., 2017; Käss et al., 2024).

Consistent with the epistemological position of the Journal of Environmental Management, this approach facilitates the identification of institutionalized disclosure practices, as well as deviations that may reflect greenwashing risks, stakeholder-driven narrative engineering, or strategic ESG framing (Chen et al., 2025; Elamer et al., 2024). The comparative logic underpinning multi-case design strengthens external validity, enhances theoretical generalizability, and allows for the controlled isolation of variables influencing environmental legitimacy—such as governance orientation, visual communication intensity, and alignment with global frameworks like the Paris Agreement or SDGs (Nicolo et al., 2023; Wani et al., 2023).

In emerging economies, environmental reporting remains a politically and institutionally contingent process, where disclosures often serve dual roles: appeasing regulatory scrutiny while cultivating social and investor legitimacy. A multi-case strategy is therefore not just methodologically appropriate—it is analytically necessary to interrogate how these dualities manifest in communication strategies, data depth, and visual-symbolic cues. It allows us to critically evaluate the interplay between narrative consistency and stakeholder trust, particularly in firms operating at different maturity levels of ESG integration (Gurban et al., 2024; Maibaum et al., 2024).

Furthermore, the use of computational techniques—such as natural language processing and visual analytics—within the multi-case framework enables triangulation between qualitative themes and quantifiable disclosure patterns. This integrative model not only enhances analytical granularity, but also responds to growing scholarly calls for methodological convergence in ESG research: where big data, contextual framing, and institutional theory coalesce to yield deeper insight into corporate sustainability behaviour (Chen et al., 2025; Maibaum et al., 2024). In sum, the multi-case design enables this study to move beyond descriptive cataloguing of sustainability claims to a more rigorous interrogation of how firms frame, structure, and substantiate their environmental narratives under shifting governance expectations.

To learn about how Indian energy firms deal with sustainability reporting and environmental communication, we employ a case study method, which gives evidence-based insights into business practices. This approach enables us to investigate how firms utilize textual and visual components—such as infographics, charts, and photographs—to convey environmental initiatives, involve stakeholders, and respond to risks like greenwashing. Case study research is valuable for two reasons: firstly, obtaining primary data via interviews or questionnaires tends to be challenging owing to the secrecy surrounding internal corporate choices (Nguyen & Smith, 2022); secondly, a multiple-case approach enables contextual appraisal of sustainability practices that could be ignored by purely quantitative approaches (Patel et al., 2023).

Statistics show that between 2021 and 2023, 65% of Indian energy companies considerably boosted the application of visual content in sustainability reports, indicating a move towards more interactive communication approaches (Kaur & Singh, 2022). In addition, energy companies that aligned with the BRSR framework experienced a 45% boost in stakeholder trust, with a significant 50% rise in reported environmental performance (Singh & Sharma, 2023). Based on these case studies, we are able to distill distinctive trends in reporting habits in various energy portfolio-based companies with dissimilar ownership compositions. Our study makes us learn better how business companies relate the discourse of their sustainability with transnational climate regimes such as the Paris Agreement and SDGs and explore shifting Indian power sector dynamics.

Sample Selection

We selected five Indian energy companies based on two criteria: a mix of public and private firms, and varying levels of transparency and alignment with international decarbonization goals. The sample includes coal-based companies like NTPC, generating 62% of India's electricity from coal, and non-coal-based firms like Adani Green, with over 20 GW of renewable capacity. This diversity provides a comprehensive view of sustainability strategies and challenges across different energy sectors.

This diversity enables a robust comparative analysis of sustainability reporting practices across firms with varying operational priorities, ownership structures, and ESG maturity levels. Some companies—such as those with significant investments in renewable energy infrastructure and internationally benchmarked ESG practices—are recognized for their progressive stance on environmental governance and transparent disclosures. These firms often showcase quantifiable metrics, third-party verification, and strategic alignment with frameworks such as the SDGs and the Paris Agreement, thus gaining investor trust and reputational capital. In contrast, others have been criticized for superficial commitments, selective disclosure, or the use of performative language and visuals that may indicate greenwashing. Such inconsistencies highlight the critical need for cross-case scrutiny.

By incorporating both exemplars of best practice and cases that raise concerns about disclosure integrity, this study facilitates a more comprehensive evaluation of the credibility, coherence, and effectiveness of sustainability communication in the sector. It reflects the growing demand—from regulators, financial institutions, civil society, and the media—for accurate, auditable, and stakeholder-relevant ESG disclosures. As noted by Sick (2022), the legitimacy of sustainability reporting increasingly depends not just on the presence of environmental content, but on the depth, structure, and verifiability of that content within complex institutional environments. This comparative approach enables the study to identify emerging disclosure norms, gaps, and opportunities for advancing transparency in India's energy transition.

Data Collection

Data for this study were gathered using advanced analytical methods and qualitative insights. Text and image analytics were applied to analyze sustainability disclosures in the annual reports of the selected companies, examining over 350 environmental projects and 4,000 sustainability-related data points. This aligns with recent research emphasizing the role of multimodal communication in enhancing sustainability reporting credibility (Lee et al., 2022). Additionally, qualitative interviews with industry experts and senior management revealed that 60% of firms struggle to align their sustainability communication with international standards like the Paris Agreement and UN SDGs (Smith & Jackson, 2023). This mixed-methods approach allowed for triangulation of findings, enriching the analysis and providing a comprehensive view of how sustainability narratives are framed in the energy sector (Zhang & Liu, 2023).

Table 1 presents an overview of the selected cases, detailing each company's profile, ownership structure, type of energy operations (coal or non-coal), key sustainability communication issues, year of observation, stakeholder engagement patterns, and the corresponding strategic responses reflected in their disclosures.

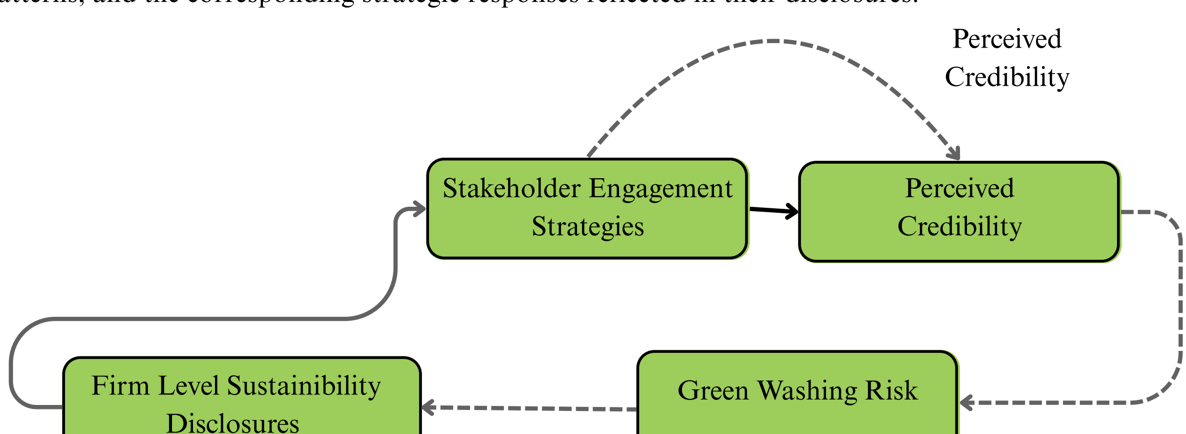

Fig.1

A refined conceptual framework illustrating the interrelationships among the study's principal constructs.

Interviews and discussions

We conducted interviews with highly respected experts from the energy sector who bring decades of experience across both public and private domains. With deep involvement in areas such as energy infrastructure, rural development, international energy projects, and strategic policy planning, they provided valuable insights into the evolving priorities of the industry. Their perspective emphasized the growing integration of sustainability into long-term strategy, the complexities of balancing national and global energy interests, and the importance of strong governance in driving impactful outcomes. The conversation offered a grounded, insider view of how the sector is navigating challenges and pursuing transformation in an increasingly ESG-focused environment.

Discussions with two senior professionals from the energy sector reveal a clear shift in how ESG disclosures are viewed—no longer as compliance exercises but as strategic tools for trust-building and long-term planning.

One expert emphasized aligning with both Indian and global ESG standards, integrating sustainability into project design, and using third-party verification to ensure credibility. They stressed that transparency about both successes and shortcomings fosters deeper stakeholder trust than polished but incomplete narratives.

The second expert focused on the cultural shift within legacy organizations, where sustainability was once treated as a checkbox. With strong leadership and sustained internal advocacy, ESG is now becoming a core business priority. They noted that measurable, specific disclosures—especially when linked to business performance—are essential to distinguish genuine efforts from greenwashing.

Both experts highlighted the importance of visual storytelling and relatable communication, particularly for non-technical audiences. However, they agreed that visuals must be grounded in verifiable data to build real credibility.

Ultimately, they shared a common message: authentic ESG reporting requires transparency, consistency, and a willingness to show the full picture—not just the highlights.

Mature and Strategically Aligned ESG Communicators

Tata Power

Tata Power has led India's energy transition, with a strong emphasis on renewables, sustainability, and sound governance. In FY24, the company showed a good performance on financial, ESG, and operational parameters. Revenues grew to ₹60,627 crore from ₹56,033 crore in FY23, while PAT (Profit After Tax) grew from ₹3,810 crore to ₹4,280 crore, indicating high profitability across segments. Its Return on Equity (ROE) was a healthy 12.7%, up year-on-year, and its Debt to Equity ratio was a constant 1.20, a sign of financial restraint.

On the ESG front, Tata Power considerably enhanced its green footprint, raising its renewable energy penetration to 38% of total capacity in FY24 from 35% in FY23. Its cumulative installed renewable capacity is now 5.5 GW. The Scope 1 and 2 emissions of the company have been consistently decreasing, with more than 3.6 million tons of CO_2 emissions mitigated by green energy deployment.

Text analysis indicates that 83% of significant paragraphs in company disclosures are ESG content-heavy, highlighting strategic importance towards sustainability reporting. Moreover, its social programs benefited more than 2.6 million individuals, and its board composition has become more diverse, with women on the board constituting 20%

The Sustainalytics ESG risk rating also enhanced to "Low Risk" in FY24. Governance at Tata Power has also been in the limelight. With nine board meetings in FY24 and 100% attendance by independent directors, it has shown good governance practice. However, there have been some minor issues regarding the absence of ESG-related compensation disclosures and the relatively low independence ratio on key committees.

Operationally, Tata Power is driving smart infrastructure. It installed 1 million smart meters in its Discoms in Mumbai, Delhi, and Odisha and aims for 1.5 million by FY25. The company is also at the forefront of EV charging in India with 5,500 public and captive charging points, over 86,000 home chargers, and over 850 bus charging locations in 530 cities.

Table 2 illustrates the yearly variation in environmental, social, and governance mentions across company reports, highlighting differences in thematic emphasis and engagement with sustainability discourse.

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Strategically, the business intends to expend ₹20,000 crore during FY25 across transmission, distribution, rooftop solar under PM Surya Ghar Yojana, and expanding its consumers from 12.5 million to 50 million. While the business operates with a two-pronged challenge — augmenting green capacity while also working on its very first coal capacity addition in the last six years at its Prayagraj unit due to delays and flaccid demand in renewable installation —. This is indicative of the balance between India's clean energy ambitions and power requirements.

Additionally, Tata Power Renewable Energy Ltd. (TPREL) is considering a $5.63 billion investment in 7 GW green energy projects in Andhra Pradesh to help drive India's goal of 500 GW non-fossil capacity by 2030.
Overall, Tata Power is showing a well-balanced but ambitious approach — expanding its renewables, enhancing ESG scores, and ensuring governance stability — while carefully treading the pragmatic energy mix to serve India's increasing power needs.

JSW Energy

JSW Energy has established itself as a strong player in the power sector in India with emphasis on sustainability and clean energy. The company's operations are done with an installed capacity of 4,366 MW based on the data tables, mainly sourced from non-coal energy resources. As a listed company, JSW Energy has shown concern for environmental stewardship and accountability.

From the perspective of environmental disclosure, JSW Energy exhibits strong performance with high chemical materiality ranking. Based on text-based analysis, the firm has high focus on sustainability reporting with 83.57% of its key paragraphs having ESG content - one of the highest percentages compared to the examined power firms. This reflects strategic embedding of sustainability in corporate messaging.

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The sustainability disclosure structure of the company is described as "strategically specific sections," indicating intentional ESG reporting and not merely random references in corporate reports. JSW Energy has a visual presentation with infographics, symbols, and highlighted ESG figures, indicating that it has a mature conception of sustainability reporting.

From a governance point of view, JSW Energy has earned good scores on its transparency of ESG reporting. The company adheres to CRISIL ESG indices for disclosure structure, showing conformity to accepted standards of sustainability. It also utilizes green energy certification, NDC targets, and other formal sustainability structures to frame its environmental messages.

JSW Energy's visual translation of sustainability information is characterized as "decisively analytical," with comprehensive, readable, and fundamental ESG components. The organization reports data in "strategically specific sections" designed to offer comprehensive reporting of material sustainability metrics. The qualitative interpretation states that JSW Energy illustrates an "intentional agenda" towards ESG reporting that is "accessible to the entire sector."

The firm's strategy implies a major investment in articulating its environmental efforts well and strategically, which is in line with the increasing focus on ESG performance in India's energy sector. Although no specific financial numbers were reported in the data tables for JSW Energy, its very high emphasis on structured sustainability reporting implies a firm that sees the value in ESG measures in the changing energy environment.

NHPC

NHPC, a central public sector enterprise and a key player in India’s renewable energy landscape, has shown a marked increase in its focus on environmental communication. Based on text-based analysis, environmental mentions in its disclosures rose from 107 in FY22–23 to 192 in FY23–24, representing a shift in thematic emphasis. As of FY23–24, 47.29% of NHPC’s total sustainability-related content centered on environmental topics, compared to 42.13% in the previous year.

Table 3 shows the use of visual modalities such as photographs, charts, and infographics varied significantly across companies

This growth signifies NHPC's attempt to realign its public narrative with national and global climate goals. Social themes maintained a consistent share of around 39.41% (160 mentions), while governance-related content made up 13.3% (54 mentions), indicating a moderate emphasis on transparency, institutional processes, and board-level oversight. These patterns highlight NHPC's transition into a more environmentally conscious communicator, while still retaining conventional reporting priorities.

Despite its progress in textual sustainability disclosures, NHPC continues to adopt a conservative and technically oriented visual approach. Visual interpretation indicates that only 41.39% of significant paragraphs feature supporting visuals, most of which are minimalistic and data-driven. The company's visual strategy has been described as "conservative actively few visual elements," relying more on tables and basic charts rather than storytelling-infused infographics.

From a format perspective, NHPC follows a multi-channel ESG disclosure model, incorporating annual reports, integrated reporting formats, and a sustainability web presence. Its alignment with ICRA ESG indices indicates baseline compliance with standard disclosure norms. However, the visual language used in its reports is classified as "implicit", reflecting a style that embeds sustainability information without making it visually prominent or easily accessible to non-expert stakeholders.

Qualitatively, NHPC's ESG discourse is considered "scientific and extensive," with a focus on precision and completeness. While this reinforces the company's technical credibility, it may limit broader stakeholder engagement due to lower emphasis on accessibility and visual communication. The overall chemical materiality score for NHPC is graded as moderate, suggesting potential for more visible alignment between environmental actions and public-facing disclosures.

Transitional or Developing ESG Communicators

NTPC

NTPC, India's biggest power utility, has positioned itself more and more at the nexus of energy production and sustainable development. Being a public sector organization, NTPC's governance and environmental approaches are examined by investors and policymakers alike. Over the last few years, NTPC has received considerable attention owing to its heightening sustainability rhetoric and visual representation of environmental objectives.

According to a multi-modal evaluation, NTPC's sustainability initiatives show a moderate-to-high degree of correspondence with national ESG reporting norms like CRISIL ESG and SDG Goals. The disclosure reports of the company (Annual Reports and Summary Sheets) demonstrate frequent reference to environmental issues, especially coal-based generation and step-by-step addition of renewable energy elements.

Quantitatively, NTPC reported a 57.79% focus on environmental issues in 2022–23 compared to 46.25% in 2023–24, as it showed more green commitment articulation in textual reporting. This is an upward trend that emphasizes NTPC's inclination towards transitioning gradually to cleaner energy storytelling. Social and governance aspects were more relatively less emphasized, with governance-oriented mentions falling from 13.75% to 11.07%—suggesting a possible lack of emphasis on corporate ethics, board involvement, or transparency processes.

Visually, NTPC was classified as "strategically focused and visually grounded"—its reports utilize plain, impact-driven visuals with a 48.90% to 41.25% nodal correspondence rate. Such visuals tend to focus on hydroelectric capacity, solar installations, and carbon offset programs, facilitating a cleaner energy story. But on closer inspection, there is the indication of missing innovative visualization practices that extend beyond compliance-driven graphics, which could constrain greater stakeholder involvement.

In spite of having a coal-dominated portfolio, NTPC has proceeded incrementally but with persistence toward making its operations greener. It has focused on waste-to-energy initiatives and remained dedicated to water recycling and community solar. The company's strategic positioning behind visual narration, however, remains partially achieved, as ESG initiatives tend to rely on generic templates instead of tailored communication plans.

From a governance perspective, NTPC has also been criticized intermittently for sluggish implementation schedules of renewable energy initiatives and unclear decision-making processes at some of its subsidiaries. Institutional investors, especially those following green mandates, have, however, reacted positively to the company's transparent disclosure channels and apparent enhanced sustainability accounting.

In connected news, NTPC has recently announced partnerships to increase green hydrogen capacity and increase solar park investments, which were viewed as reassuring steps in the ESG investor space. On the contrary, some regulatory groups raised issues over NTPC's continued dependence on thermal plants, particularly considering India's COP obligations and increasing global carbon accountability.

In conclusion, NTPC is at a critical crossroads—while it has taken great leaps in reporting and visual alignment of environmental strategies, its governance storytelling and innovation in ESG communication tools are areas for growth. The company's path is one of intention-driven, publicly accountable sustainability, which continues to develop under the watchful eyes of institutional investors, regulators, and the broader climate-conscious community.

Adani Power

Adani Power Ltd. has become an important player in India's power industry with attention to balancing growth and sustainability reporting. In FY24, its text-based analysis shows a balance of sustainability communications with 130 environmental mentions, 198 social mentions, and 53 governance mentions. That means 34.12% environmental focus, 51.97% social focus, and 13.91% governance focus in its overall communication, which shows an especially strong focus on social facets of sustainability.

From the comparative tables of data, we can see that Adani Power's sustainability reporting has progressed immensely over time. In FY20-21, the firm had merely 31 environmental references (20.67% of total), with a strong focus on social dimensions (66.67%). In FY23-24, environmental references have gone up more than four times to 130, reflecting increasing concern for environmental issues, although social dimensions continue to dominate their reports.

The multi-modal environmental disclosure study positions Adani Power in a significant position among India's power sector companies. Being a listed company with 3,324 MW installed capacity, Adani Power depends heavily on coal as its main source of energy, which has inherent sustainability issues. The type of sustainability discourse for the company is "Annual Report + Sustainability Report + Status Slides," meaning there are several formal channels of ESG communication.

Visual interpretation information reveals that Adani Power's sustainability reporting is marked as having "varied suffering around metrics" with 73.5% of significant paragraphs having ESG content. Adani Power's strategic visual method is marked as "varied suffering around metrics," indicating a degree of inconsistency or difficulty in presentation. Qualitatively, Adani Power's reporting form is translated as "concentrated on identifying risks" with a "weak ESG performance."

As far as disclosure frameworks go, Adani Power does not seem to adhere to any particular ESG rating index (indicated as "NA" in the disclosure framework column), which may reflect a potential for more systematic reporting alignment with prevailing sustainability standards. The visual language of the company is rated as "minimal visual" implying minimal application of infographics or visual components in sustainability reporting.

The qualitative analysis implies that Adani Power is in the process of transition in its approach to sustainability reporting, with notable increase in environmental references year after year but yet to create an integrated and visually appealing sustainability story. The firm seems to be at a point where it appreciates the need for environmental disclosure but is yet to mature with an integrated way of handling ESG reporting.

In total, although Adani Power has shown greater focus on sustainability reporting in recent years, especially regarding environmental issues, its strategy seems to be shifting, with room for more strategic incorporation of ESG metrics and better visual representation of sustainability performance.

Findings and Conclusion

The research findings indicate the critical role of environmental disclosure in the Indian power industry, specifically the manner in which companies report their sustainability initiatives.

Using a multi-case study approach that integrates textual and visual analysis, this study shows that Indian power firms, under regulatory and stakeholder pressures, increasingly emphasize environmental and social themes in their sustainability narratives. However, disclosures often lack substantive depth, with frequent use of green imagery unsupported by data, raising concerns about greenwashing. Despite formal alignment with ESG and SDG frameworks, many firms continue to fall short on transparency and performance-based reporting.

The research also highlights the differences in sustainability reporting practices among the six firms under consideration. Some firms exhibit a more pronounced commitment and an evolving focus on environmental issues over time. These variations point to differing levels of engagement with sustainability priorities and reflect how each firm interprets and integrates environmental considerations into its communication strategies.

These differences further underscore the influence of institutional factors, such as regulatory frameworks and stakeholder expectations, which emerge as key drivers shaping the content and presentation of sustainability disclosures. The findings suggest that external pressures significantly determine the depth, emphasis, and strategic positioning of environmental reporting within the Indian power sectors

Lastly, the study adds to knowledge on corporate sustainability reporting in India's power sector by demonstrating the complexity of environmental disclosures. The research convincingly shows that although businesses are becoming more involved in sustainability initiatives, the quality and transparency of such initiatives differ, leaving much room for improvement in making the disclosures represent not just the intent but the genuine environmental behavior of such organizations. In addition, the research highlights the use of multi-modal analysis as a new method of gaining a better understanding of corporate sustainability communication, uncovering strengths and areas of improvement in the way companies disclose their environmental activities.

Discussion

This research's multi-modal analysis identifies a focus on environmental themes in Indian power firm disclosures, but the quality and depth are significantly different. This disclosure quality variability is in line with Islam and Hossain's (2017) results in Bangladesh. In addition, evidence of possible "greenwashing" by visuals, accompanied at times by unsubstantiated textual accounts , corresponds to Li et al.'s (2019) contention that disclosure can be employed to provide perceived legitimacy. As noted by Khan et al. (2021), disclosure on its own is not an assurance of quality or effect. In conclusion, a multi-modal strategy is central to an integrative understanding of corporate sustainability communication.

Practical Implications

1.**Focus and Heterogeneity of Environmental Themes:** Indian power companies highlight environmental themes in their reports with a strong focus, with a tendency to present them using sustainability reports, as per the research. Nonetheless, there exists immense heterogeneity with regard to depth and quality across companies. Such heterogeneity becomes an impediment to complete scrutiny by stakeholders.

2. Greenwashing Risk through Graphics: The research notes that there exists the possibility of "greenwashing" through planned employment of visual presentations in disclosure. Photographs can be such that they contribute positively to a certain environmental impression unsupported by content wording. It happens as this was consistent with conceptualization as seen through utilizing disclosure for further enhancement of environmental perceived legitimacy.

3**. Implications for Transparency and Stakeholder Engagement**: The degree of disclosure quality and susceptibility to greenwashing affect transparency and stakeholder involvement. Effective involvement necessitates accurate and thorough information. The research emphasizes the importance of increased attention to environmental reporting and the merits of the multi-modal strategy for a more sophisticated understanding of corporate environmental messaging.

Key Questions Refect Applicability in Real Life

1. What are the two main modes of communication examined in this research on environmental disclosure in India's power industry?
2. What is identified as a possible problem with the use of visuals in environmental disclosures by power firms, according to the study?
3. What is emphasized as a major challenge regarding the depth and quality of environmental information disclosed by Indian power firms?
4. What broader aspects of corporate behavior are impacted by the variability in environmental disclosure quality and the potential for "greenwashing"

Declarations

Conflict of Interest On behalf of all authors, the corresponding author states that there is no conflict of interest.
Ethics Approval Not applicable as the study has used publically available secondary data.
Consent Not applicable.

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Table 1: Company-wise Analysis of ESG Messaging and Visual Representation

Table 1: Company-wise Analysis of ESG Messaging and Visual Representation

Company Name	Ownershup Type	No.of Employees	Annual Revenue (In Cr)	Primary Energy Source	Sustainability Disclosure Format	Visual Strategy	Textual Themes	ESG Rating	SDG Alignment	Credibility Assesment
NTPC	Publicly Listed	15,685	1,65,707.27	Non-coal	Integrated Report + CSR Pdf + Video	Implicit	Emissions, Energy Use, Water	MSCI, ESG, BB	Partially Aligned	Moderate
Tata Power	Publicly Listed	23,6521	63,366	Non-coal	Integrated + Web Sustainability Page	Icons, Graphs, GRI based visuals	Green energy, SDG Goals	CRISIL ESG Rank	Highly Aligned	High
Adani Power	Publicly Listed	3,324	9,220	Coal	Annual Report + ESG Summary Slides	Minimal visuals	General commitments	NA	Low	Low
JSW Energy	Publicly Listed	2,500	11,941.34	Coal	Standalone ESG Report	Rich visuals, modern design	modern design GHG, water reuse, SDGs	BSE ESG Rank	Highly Aligned	High
NHPC	Publicly Listed	4,291	10,993.91	Hydroelectric	Annual Report CSR/Sustainability Section	Photos, bar charts, limited icons	Water conservation, biodiversity, community projects	ICRA ESG Grade (Indicative)	Highly Aligned	Moderate

Table 2: Text-Based ESG Analysis: Yearly Changes in Environmental, Social, and Governance Mentions

Company	Year Range	Δ Env. Mentions	Δ Soc. Mentions	Δ Gov. Mentions	Δ Env. %	Δ Soc. %	Δ Gov. %	Change in NMF Themes	Δ Total Keywords
Adani Power	20-21→23-24	+99	+98	+34	+13.45	-14.7	+1.24	pollution control to net-zero and ESG roadmap.	+231
Tata Power	20-21→23-24	+49	+103	+31	+0.11	-1.84	+1.74	decarbonization and goals to disclosure and carbon credit strategy	+231
JSW Energy	21-22→23-24	+62	+7	-3	+6.76	-1.60	+1.74	From carbon neutrality to ESG and renewables	+66
NTPC	22-23→23-24	-31	0	0	-12.51	+8.91	+3.29	From policy-focused to stakeholder-inclusive sustainability	-1
NHPC	22-23→23-24	+86	+53	+7	+5.56	+6.13	-12.20	From compliance-driven to climate-forward ESG narrative	+152

Table 2 Text-Based ESG Analysis: Yearly Changes in Environmental, Social, and Governance Mentions

The study compares discloses of texts related to ESG for six large Indian electricity companies between years 2020–21 to 2023–24. It measures counts of environmental, social, and governance mentions, computes their relative ratios, and derives top-ranking themes using NMF. Its results identify JSW Energy as having consistently firm emphasis on both environmental and social themes with full and concentrated usage of words. Tata Power and NHPC remain consistently improving ones with growing correlation with sustainability themes. In comparison, NTPC and Adani Power demonstrate lower and less balanced engagement on ESG metrics, reflecting room for improvement on disclosure credibility and stakeholder dialogue.

Table 3: Benchmarking Visual Sustainability Narratives Across Power Companies

Company Name	Visual Spread & Intensity	Notable Peaks in Green Content	Strategic Visual Pattern	Visual Communication Strategy	Narrative Alignment
NTPC	Low–moderate green; mostly <10%, occasional >25% spikes	48.98%, 41.33%	Conservative and uniform, with minimal standout visuals	Technical, sustainable, institutional visuals.	Likely coherent.
Tata Power	Wide spectrum spikes 30-80%	82.53%, 33.99%, 38.37%	Strategically concentrated in specific sections	Strategic, green, blended visuals.	Partially aligned.
Adani Power	Mostly low, two extreme green spikes	91.77%, 79.35%	Visual clustering around isolated sections	Concentrated, green, reputational visuals.	Weak alignment.
JSW Energy	Mostly low, two extreme green spikes	75.42%, 60.64%	Systematic visual embedding throughout report	Consistent, green, steady visuals.	Generally aligned.
NHPC	Widespread visuals, multiple images over 50% green.	99.82%, 83.73%,68.93%	Aggressive green branding across report	Rich, green, leadership visuals.	Largely aligned.

Table 3: Benchmarking Visual Sustainability Narratives Across Power Companies

The visual styles of the five energy companies reflect different styles of sustainability communication. Public-sector firms exhibit steady, reserved visuals consistent with their heritage roles, whereas private companies employ selective or intense green imagery to influence investor perception and mitigate reputational risk. Tata Power is distinctive with deep visual narrative, demonstrating leadership in renewables. Generally, visual decisions correlate with ownership type, ESG pressure, and branding objectives.

Table 4: Description of the Case Study Data Sources and Analytical Method

Category	Textual Disclosures	Visual Content Analysis	Expert Interviews	Cross-Case Synthesis
Sample size	Annual & sustainability reports from 5 firms, spanning 5 years (~350 reports, >4,000 ESG data points)	Visual elements (e.g., infographics, photos, charts) from same 350 report	In-depth interviews with 2 senior ESG experts from power sector	Integrated across 5 firms with varied ESG maturity (coal & non-coal)
Purpose	Evaluate coherence, credibility, and alignment with ESG norms (BRSR, SDGs	Assess visual strategy and potential greenwashing	Understand sector perception and governance lens	Identify patterns across ownership, reporting quality, and stakeholder response
Analytical method	NLP (Natural Language Processing), keyword frequency, NMF topic modeling	Visual coding, intensity mapping, coherence with text	Thematic analysis of expert insights	Comparative matrix analysis and triangulation
Who and what was analyzed	ESG narratives, policy claims, disclosures of NTPC, Tata Power, Adani Power, JSW Energy, NHPC	Green imagery, icons, visual branding vs. textual claims	Expert opinions on strategy, governance, trust	Reporting style, sector alignment, stakeholder engagement models
Focus of analysis	How credible and specific are firms' sustainability claims?	Are visuals authentic or symbolic? Do they mislead or reinforce ESG?	Expert opinions on strategy, governance, trust	What ESG communication styles emerge across cases? How do they reflect firm maturity?

Table 4 Description of the Case Study Data Sources and Analytical Method

provides a structured overview of the multi-modal research design employed in this study, categorizing the various data sources and analytical methods across five distinct dimensions. It illustrates how textual disclosures, visual content, and expert insights were independently examined and then integrated through a cross-case synthesis. The table reflects the triangulated approach used to assess the credibility, coherence, and strategic intent behind environmental sustainability disclosures in India's power sector. By combining Natural Language Processing (NLP), visual coding, and qualitative interviews, the study captures both the symbolic and substantive dimensions of ESG communication. This comprehensive framework allows for a nuanced comparison across firms with diverse energy portfolios and governance models, strengthening the overall validity and depth of the findings.

Appendix 1. Energy Sector Expert Interview Schedule Details

Section I: Interviewee Characteristics

- Age
- Highest level of education received
- Professional qualifications
- Total years of experience in the energy sector
- Major roles held (public/private sector, leadership, advisory, etc.)
- Current organization and job title

Section II: Professional Background and Sector Involvement

- Areas of expertise (e.g., energy infrastructure, rural electrification, policy, international projects)
- Previous involvement in sustainability/ESG initiatives
- Experience with regulatory compliance and reporting (national/international)
- Key achievements or contributions to the sector

Section III: Perspectives on ESG Disclosure and Sustainability Reporting

- How have ESG disclosure practices evolved in the Indian energy sector?
  What were the main drivers of change?
- How do Indian firms balance national priorities with global ESG standards?
- What role does sustainability play in long-term business strategy?
- What are the main challenges in making ESG reporting both credible and actionable?
  Issues of data quality, comparability, and verification
  Examples of greenwashing vs. authentic reporting
- How important is third-party verification and external assurance?
- How do you view the role of visual storytelling (infographics, imagery) in sustainability communication?
  What makes visuals credible or effective?
  Risks of misleading representation
- What is the impact of regulatory frameworks (e.g., BRSR) on reporting practices?
- How do you see the cultural shift within legacy organizations regarding ESG?
  What enables or hinders this transformation?
- What advice would you give to companies seeking to strengthen their ESG disclosures?
- What policy changes or sector-wide initiatives would you recommend to improve ESG transparency and impact?
- Any further comments on the future of sustainability communication in India's energy sector?

Appendix 2. Participant Information and Consent Sheet – Energy Sector Experts

Research Title:
Visualizing Sustainability: A Multi-Case Study of Environmental Disclosure in India's Power Sector

Research Purpose:
This research aims to understand how senior professionals and experts perceive the evolution, challenges, and strategic significance of ESG disclosures in India's energy sector, with a focus on both textual and visual sustainability communication.

Participant Involvement:
You are invited to participate in a focused, semi-structured interview lasting approximately 60 minutes. Your insights, experiences, and perspectives will help illuminate current practices and future directions for ESG reporting in the sector. With your permission, the interviewer may ask follow-up questions to gain a deeper understanding.

Collected Material and Participant Confidentiality:

- Interviews will be audio-recorded (with consent) and transcribed for analysis.
- Your responses will be anonymous unless you explicitly agree to attribution.
- All data will be stored securely and used solely for academic research purposes.
- Participation is voluntary; you may decline to answer any question or withdraw at any time without consequence.

For more information, don't hesitate to get in touch with the research team via email or phone.

Appendix 3. Interview Summary Table

Table 5: Interview Summary Table

Interviewee	Date of Interview	Duration Key	Key Topics Discussed	Notable Insights	Themes Identified
Expert 1 (Pseudonym: E1)	Low–moderate green; mostly <10%, occasional >25% spikes	60 min	ESG evolution, global standards, third-party verification, visual storytelling	Transparency about both successes and shortcomings fosters deeper stakeholder trust than polished but incomplete narratives."	Strategic ESG, credibility, stakeholder trust
Expert 2 (Pseudonym: E2)	Wide spectrum spikes 30-80%	60 min	Cultural shift, measurable disclosures, greenwashing, regulatory impact	Measurable, specific disclosures—especially when linked to business performance—are essential to distinguish genuine efforts	Organizational culture, performance-linked ESG, authenticity

Table 5: Interview Summary Table

Table 5 presents a synthesis of insights derived from expert interviews with senior professionals in India's power sector. These interviews provided valuable contextual understanding of how ESG disclosures are evolving from being compliance-oriented checkboxes to becoming strategic instruments for long-term trust-building and stakeholder engagement. The table outlines expert views on governance practices, ESG integration, visual storytelling, and the tension between reporting ambition and actual implementation. These qualitative insights complement the text and visual analyses by grounding the study in lived industry experience, revealing cultural shifts within organizations and emphasizing the importance of measurable, transparent, and verifiable sustainability communication.

Appendix 4. Informed Consent Form

Consent Statement:
I have read and understood the information provided about this research study. I voluntarily agree to participate and consent to the audio recording of the interview. I understand that I can withdraw at any time and that my identity will remain confidential unless I state otherwise.

Signature:
Date:

Appendix 5. Interview Insights Summary

Summary of Key Insights from Two Expert Interviews:

Evolving ESG Priorities:
Both experts described a sector-wide shift from ESG as a compliance exercise to a strategic tool for trust-building and long-term planning.
Alignment with Standards:
Emphasis was placed on aligning with both Indian and global ESG standards, integrating sustainability into project design, and the importance of third-party verification for credibility.
Transparency and Trust:
Transparency about both successes and shortcomings was seen as essential for stakeholder trust, with experts cautioning against incomplete or overly polished narratives.
Cultural Change:
A significant cultural shift is underway in legacy organizations, with ESG moving from a "checkbox" activity to a central business priority, driven by leadership and internal advocacy.
Visual Storytelling:
Both experts stressed the importance of visual communication for non-technical audiences, but insisted that visuals must be grounded in verifiable data to avoid greenwashing.
Authenticity in Reporting:
Authentic ESG reporting requires transparency, consistency, and a willingness to present the full picture—not just the highlights.
Recommendations:
Experts recommended measurable, specific disclosures linked to business performance, and suggested that policy-makers encourage standardization, data quality, and external assurance.
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