ESG Reporting and Sustainable Business Transformation: A Comparative Study of Indian Public Sector Oil Companies

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ABSTRACT

This study examines ESG reporting and evidence of sustainable business transformation in six Indian public sector oil and gas companies, ONGC, Indian Oil Corporation (IOCL), Bharat Petroleum (BPCL), Hindustan Petroleum (HPCL), Oil India Limited (OIL), and GAIL (India) Limited, over FY 2022-23 to FY 2024-25. The analysis uses a ten-indicator ESG Disclosure Index alongside verified standalone operational data. Reconciled scores range from 18 to 20 out of 20, indicating a pronounced ceiling effect: BPCL, HPCL and GAIL score 20; ONGC and IOCL 19; and OIL 18. In a common FY 2023-24 to FY 2024-25 window, combined Scope 1 and 2 emissions declined at OIL and IOCL but increased at the other four companies. A revenue-based measure of emissions intensity fell at OIL (12.45%) and GAIL (4.61%) but increased elsewhere; its interpretation is restricted by revenue prices and heterogeneous business models. The Spearman correlation between disclosure scores and absolute emissions changes is positive but statistically inconclusive (rho ≈ 0.77, exact two-sided permutation $p = 0.10$; $n = 6$). A four-criterion assessment distinguishes plans, institutions, commissioned implementation and operational outcomes without claiming a validated company-wide transformation ranking. The findings highlight differences in category coverage and assurance, and show why disclosure should be considered separately from measured performance.

Keywords: ESG reporting, sustainable business transformation, public sector oil companies, BRSR, corporate sustainability, emerging economies

INTRODUCTION

Environmental, Social, and Governance (ESG) reporting has become central to how large companies show accountability to investors, regulators, and society. In India, this shift has been driven by regulation. The Securities and Exchange Board of India (SEBI) made Business Responsibility and Sustainability Reporting (BRSR) mandatory for the top 1,000 listed companies by market capitalisation, with a phased move toward assurance of BRSR Core indicators for the largest firms. The oil and gas sector is particularly relevant because it simultaneously affects energy security, industrial development, and environmental sustainability.

Public sector oil companies hold a distinctive position. They are majority government-owned commercial enterprises that compete in energy markets, and they are also expected to model responsible corporate conduct. Exploration, refining, transport, and marketing of hydrocarbons are carbon-intensive and resource-intensive, so these companies face close scrutiny of their environmental footprint and of how credible their energy transition plans are.

This paper compares six major Indian public sector oil companies, namely ONGC, IOCL, BPCL, HPCL, OIL, and GAIL, over FY 2022-23 to FY 2024-25. It asks how each company reports on ESG matters, how their disclosed environmental, social, and governance performance compares, and whether the sustainability initiatives they highlight amount to business transformation or only to reporting. The three-year window starts with the period immediately after BRSR became mandatory, which gives a fairly consistent regulatory backdrop for comparison.

The study has two motivations. First, ESG reporting in India has received growing academic attention, but little research looks at public sector oil companies as a group or compares them with one replicable scoring framework. Second, much of the literature treats ESG disclosure and ESG performance as interchangeable, although how fully a company reports on a topic is a different matter from whether it has acted on that topic or changed its business model. Accordingly, the study distinguishes among ESG disclosure, ESG-related actions, and evidence of sustainable business transformation, and evaluates the six companies on these dimensions.

The rest of the paper is organised as follows. Section 2 reviews the literature and states the research gap. Section 3 lists the objectives and Section 4 describes the methodology. Section 5 presents the ESG Disclosure Index and company scores. Section 6 reports the findings objective by objective, with tables and figures. Section 7 discusses the results, Section 8 sets out the limitations, and Section 9 concludes.

REVIEW OF LITERATURE

2.1 ESG reporting practices

Reviews of ESG and CSR research in corporate finance show that a firm's ESG profile depends on market conditions, leadership, and ownership, and that ESG activity is linked to risk, performance, and value, although the empirical results are mixed (Gillan et al., 2021). Work on mandatory reporting finds that compulsory sustainability disclosure improves the supply of non-financial information, with effects that depend on standards, implementation, and enforcement (Christensen et al., 2021). Reviews of ESG disclosure add that rating agencies and information intermediaries now shape how disclosure is used, which supports comparing firms with systematic disclosure frameworks (Velte, 2023). For India's oil and gas industry in particular, Sana and Basak (2022) found growing alignment with Global Reporting Initiative guidelines. However, comparative evidence based on a common ESG disclosure framework remains limited for Indian public sector oil companies.

2.2 Environmental, social, and governance disclosures

Studies of Indian energy companies show that disclosure varies widely between firms and between ESG dimensions. Motwani and Gupta (2023) examined environmental disclosures on energy, water, emissions, and waste among large energy companies and found considerable variation. Karlapudi and Reddy (2022) compared public and private power companies and found differences across ESG dimensions. Mehra (2024) and Laskar and Maji (2016) show how narrative sustainability reports can be turned into disclosure scores for comparison, which is the approach taken here. No study found by the authors compares all three ESG dimensions across Indian public sector oil companies with one scoring framework.

2.3 Sustainable business transformation

The energy transition literature stresses that oil and gas companies have capabilities that could support diversification, but that the depth and pace of change differ between firms and often lag stated ambitions (Halttunen et al., 2023; Hartmann et al., 2022). Systematic reviews point to technological, economic, and institutional barriers to moving away from fossil fuels (Dongo & Relvas, 2025), and conceptual work identifies the organisational, technological, and policy factors that support a transition (Abraham-Dukuma, 2021). These studies argue for judging transformation by what companies do and achieve rather than by what they announce, and little of this work covers Indian public sector oil companies.

2.4 ESG disclosure scores and performance indicators

Indian evidence links ESG disclosure scores with firm performance, valuation, and financing conditions. Disclosure has been associated with better firm performance among NSE 500 companies (Veeravel et al., 2024), with better financial outcomes and lower borrowing costs among 272 listed firms (Malik & Kashiramka, 2024), and with higher firm value, although the effect is weaker for carbon-sensitive firms (Desai, 2024). Effects differ across ESG dimensions and performance measures (Shobhwani & Lodha, 2024), so a total score should be read next to individual indicators. These studies use broad samples and financial outcomes, and few relate disclosure scores to operating indicators such as emissions, renewable capacity, or CSR spending in the oil and gas sector.

2.5 Research gap

The literature review identifies four important research gaps. Few studies focus on Indian public sector oil companies despite their economic weight and environmental impact. Disclosure and performance are often studied separately, so the amount reported is confused with the outcomes achieved. Comparative work rarely links ESG reporting to the transformation initiatives of these companies. Evidence is also limited on whether higher disclosure scores go together with better scores on specific ESG indicators in this sector. This paper addresses each of these gaps.

3. Research Objectives

- To examine the ESG reporting practices of selected Indian public sector oil companies.
- To compare the Environmental, Social, and Governance performance and disclosures of the selected companies.
- To assess the extent of sustainable business transformation reflected through ESG-related initiatives.
- To examine the relationship between the ESG disclosure score and selected ESG indicators of the selected companies.

RESEARCH METHODOLOGY

4.1 Research design and sample

The study uses a descriptive and comparative design based on secondary data. Content analysis identifies what each company discloses, and comparative analysis examines differences across companies and over time. The sample is six Indian public sector oil and gas companies: ONGC, IOCL, BPCL, HPCL, OIL, and GAIL. The period covers FY 2022-23, FY 2023-24, and FY 2024-25.

4.2 Data sources and basis of figures

The study uses each company's FY 2022-23, FY 2023-24 and FY 2024-25 Annual Reports, Integrated Reports, Sustainability/ESG Reports, and BRSR filings. Original report-year disclosures were checked against later comparative tables, with corrections logged when a restatement or a change of category scope was reported. ESG indicators are compared principally on a standalone-company basis, excluding subsidiaries and joint ventures unless a source explicitly specifies another boundary. ONGC and HPCL are treated as separate observations; consolidated reporting by ONGC could otherwise duplicate HPCL's operations. Where a source uses another organizational perimeter, the difference is identified and the figure is not silently combined with standalone values. A source register documenting all 60 indicator assessments is provided in the companion six-company verification workbook.

4.3 ESG Disclosure Index

The ten indicators are: (1) the Scope 1 and 2 net-zero milestone, (2) Scope 1 and 2 emissions, (3) Scope 3 disclosures, (4) renewable energy footprint, (5) water stewardship, (6) workforce gender diversity, (7) employee training, (8) occupational safety/LTIFR, (9) business ethics and anti-corruption, and (10) independent ESG assurance. Each receives 0 for no qualifying disclosure, 1 for partially available, missing-year or materially non-comparable evidence, and 2 for recurring substantive evidence in all three years. For numerical indicators, annual quantitative information and its units and boundary are required; for policy-based indicators, the criterion is a time-specific policy or target and supporting implementation evidence. Scope 3 is not assigned full continuity merely because a nominal total appears each year when its category perimeter changes fundamentally. An independently assured report or explicitly identified ESG metrics qualify for assurance disclosure; the level and assurance perimeter are recorded separately. The maximum score is 20. The index is a study-specific measure of disclosure availability and continuity, not an externally validated rating of ESG quality, impact or achieved transformation.

4.4 Analysis

Changes are computed as (later / earlier - 1) × 100, using a fixed FY 2023-24 to FY 2024-25 window in Table 3. A review of the original reports identified FY 2022-23 Scope 1 and Scope 2 disclosures for ONGC, IOCL and OIL, correcting the initial incomplete collection. Absolute combined Scope 1 and 2 emissions are normalized to tonnes CO2e. To address production-scale confounding, we add a transparent revenue-based intensity proxy: (standalone Scope 1 + Scope 2 emissions, tCO2e) / (standalone revenue from operations, ₹ crore). Both inputs refer to the same fiscal year and company boundary; ONGC annual revenues in ₹ million are converted to ₹ crore. This metric is not equivalent to tonnes per physical production unit and can change with fuel prices, sales mix and price inflation. Within-company intensity trends are therefore discussed cautiously, not compared as universal process-efficiency benchmarks across exploration, refining and gas transmission. Scope 3 is only interpreted where annual category boundaries can be reconciled. Spearman correlations, with exact two-sided label-permutation p-values because of small samples and score ties, are descriptive. Transformation evidence is separately classified under four explicitly anchored criteria (strategy, institutional action, implementation and observable outcomes); neither these codes nor the disclosure index are an independently validated sustainability-performance rating. No second blinded coder was available, which remains a disclosed limitation.

5. ESG Disclosure Index and Company Scores

Because external ESG assessments use different scales and reporting boundaries, the study uses a common documentary disclosure index (Section 4.3) rather than pooling agency ratings. Table 1 reports the harmonized scores verified against all three years of company sources; Figure 1 plots the resulting percentages. A score of 20 means ten indicators meet the established disclosure-continuity criteria. It does not mean all indicators were reasonably assured or that the company's overall performance is superior.

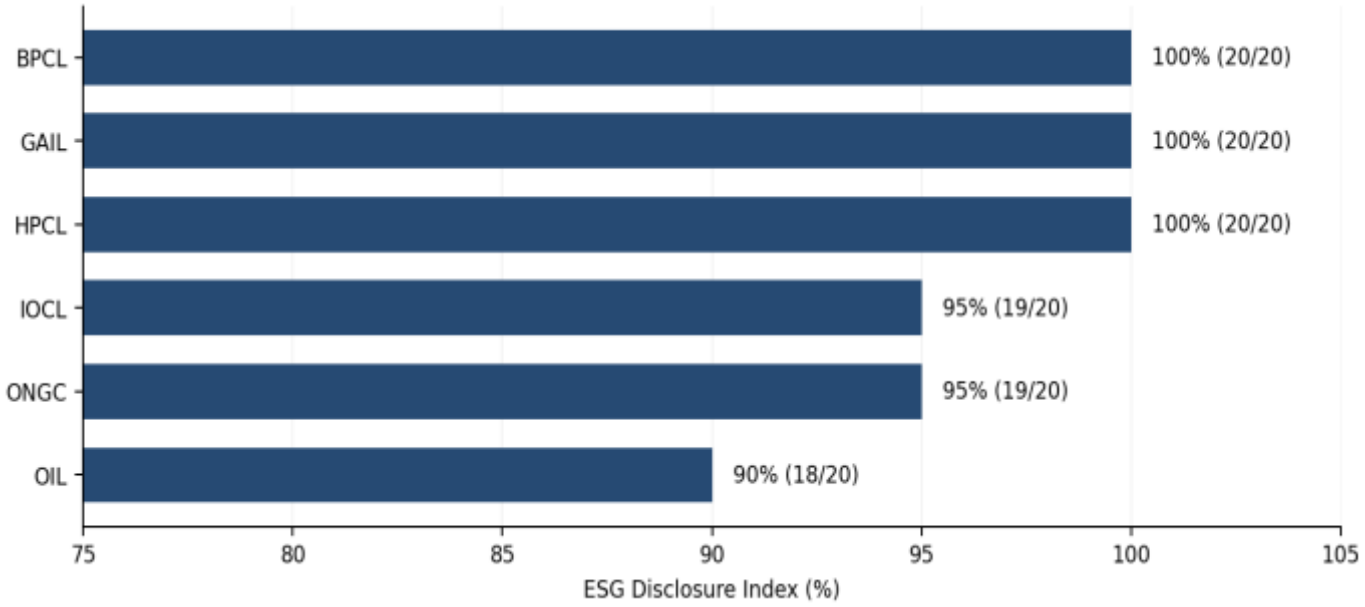
Table 1 ESG Disclosure Index Scoring Matrix

Indicator	ONGC	IOCL	BPCL	HPCL	OIL	GAIL
1. Net-zero milestone (Scope 1 and 2)	2	2	2	2	2	2
2. Scope 1 and 2 emissions data	2	2	2	2	2	2
3. Scope 3 (value chain) data	1	1	2	2	1	2
4. Renewable energy footprint	2	2	2	2	2	2
5. Water stewardship metrics	2	2	2	2	2	2
6. Gender diversity (%)	2	2	2	2	2	2
7. Human capital (training)	2	2	2	2	2	2
8. Health and safety (LTIFR)	2	2	2	2	2	2

9. Business ethics and anti-corruption	2	2	2	2	2	2
10. External ESG assurance	2	2	2	2	1	2
Raw score (out of 20)	19	19	20	20	18	20
ESG Disclosure Score	95%	95%	100%	100%	90%	100%

Note. Scores: 0 = no qualifying disclosure, 1 = partial or materially non-comparable disclosure, 2 = substantive three-year disclosure under the common rubric. Scope 3 categories, assurance levels, workforce classifications and restatements are recorded separately. Source: authors' reconciliation of FY 2022-23 to FY 2024-25 company reports; companion six-company evidence audit updated 26 October 2026.

Figure 1 ESG Disclosure Scores by Company



Note. Scores are percentages of the 20-point disclosure index. BPCL, HPCL and GAIL jointly score 100%; ONGC and IOCL score 95%; OIL scores 90%. The index has limited rank discrimination because of ceiling effects.

BPCL, HPCL and GAIL each score 20/20, while ONGC and IOCL each score 19/20 and OIL scores 18/20. ONGC's FY 2022-23 current-year Scope 3 figure is not established in the reviewed original records. IOCL's Scope 3 category inventory changed and cannot be treated as a seamlessly comparable three-year trend. OIL's FY 2022-23 Scope 3 reporting is narrower than its later inventory, and its FY 2022-23 DARPAN report explicitly states that the information was not independently assured. In contrast, independent assurance is documented for HPCL throughout the study period. BPCL's FY 2022-23 Sustainability Report reports sold-product-related Scope 3 emissions absent from the narrower BRSR scope; the same-year values should not be conflated. Since five of six firms obtain at least 19 points, the index chiefly indicates high disclosure saturation; small score differences do not warrant a ranking of sustainability success.

6. Findings and Analysis

6.1 Objective 1: ESG reporting practices

For each of the six companies, the study examined the available Annual/Integrated Reports, Sustainability/ESG disclosures and BRSR filings for FY 2022-23 to FY 2024-25 (Table 2). These disclosures are sometimes integrated into a single report rather than issued as separate documents. ONGC discloses GRI/SDG alignment, 2038 operational net-zero targets and independent assurance, although the FY 2022-23 Scope 3 series is

incomplete. IndianOil discloses a 2046 operational net-zero commitment, renewable developments and externally verified sustainability information, but has changing Scope 3 category coverage. BPCL provides three-year Scope 3 category evidence in its Sustainability Reports, including use of sold products; its same-year BRSR uses a narrower presentation. HPCL shows continued independent assurance and reports renewables and safety outcomes, but its emissions rose over the study window. OIL's assurance improved after a non-assured FY 2022-23 ESG report; its later report gives a much broader Scope 3 inventory. GAIL's assured Sustainability Reports document a net-zero target brought forward from 2040 to 2035 and quantify two Scope 3 categories. The presence of reporting frameworks should not be mistaken for independently verified operational improvement.

Table 2 Comparative ESG Reporting Practices

Company	Primary reporting documents examined	BRSR	Frameworks and benchmarks	External assurance	Net-zero year (Scope 1 and 2)
ONGC	Annual/Integrated Reports; Sustainability/ESG disclosures	Yes	GRI Standards, UN SDGs; CDP Climate Change rating B	Bureau Veritas; scope varies by year	2038
IOCL	Annual/Integrated Reports; Sustainability Reports	Yes (BRSR Core)	BRSR, GRI, TCFD, UN SDGs	Independent assurance (see annual statements)	2046 (operational)
BPCL	Annual Reports; Sustainability Reports	Yes	DJSI rank 8, MSCI BB, CDP B	Independent assurance; provider varies by year	2040
HPCL	Annual/Integrated Reports; Sustainability Reports	Yes	S&P Global score 51	Independent in all three years (BV / SR Asia)	2040
OIL	Annual Reports; DARPAN Sustainability/ESG Reports	Yes (BRSR Core assured)	NGRBC, UN SDGs; S&P Global score 44	Not independently assured in FY23; BV in FY24-25	2040
GAIL	Annual/Integrated Reports; Sustainability Reports	Yes	Strategy 2030; stakeholder and materiality reporting	Independent in all three years (including SR Asia FY25)	2035

Note. “Primary reporting documents examined” describes the Annual/Integrated and Sustainability/ESG materials reviewed for FY 2022-23 to FY 2024-25; BRSR is recorded in its own column and may be incorporated within another report rather than published separately. Report titles and formats vary between companies and years. The target year is the latest stated Scope 1 and 2 target. For assurance, refer to annual report-level evidence and the differentiated independent-assurance scope rather than a uniform assurance grade. Source: individual company Sustainability/ESG and BRSR filings.

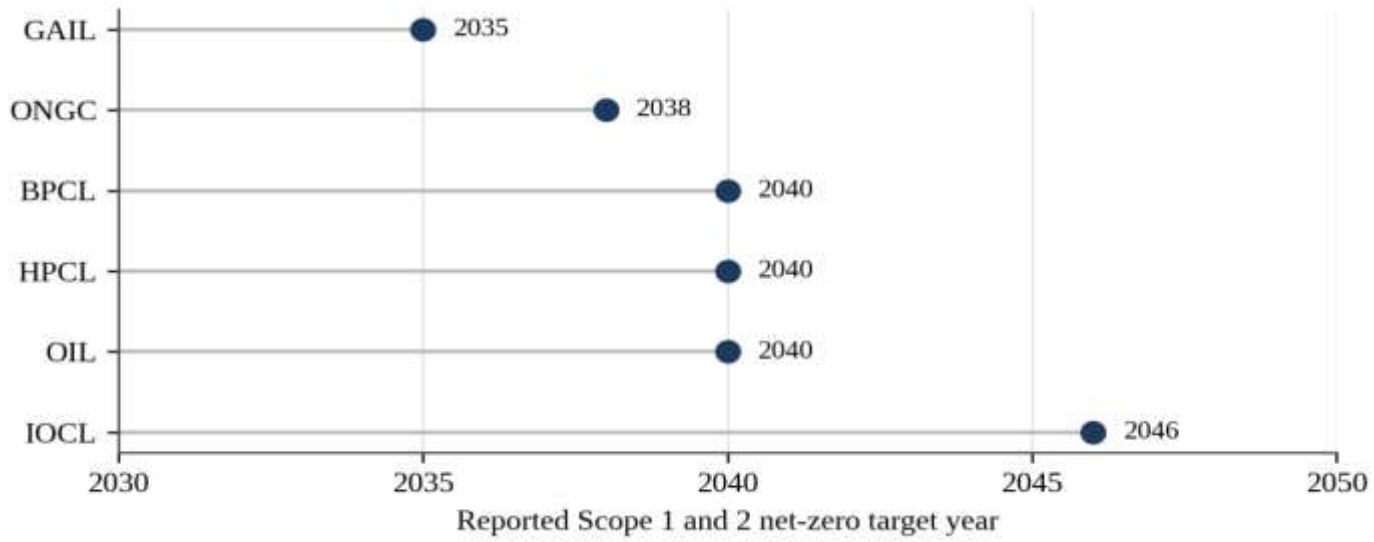
Supplementary Table S1

Principal ESG reporting boundaries and external assurance, FY 2022-23 to FY 2024-25

Company	Reporting boundary and comparability	Independent assurance and qualification
ONGC	Parent-company operational emissions; selected assurance wording can reference a wider ONGC Group perimeter. ONGC Green projects are not automatically counted in the parent's standalone operating figures.	Bureau Veritas evidence for all three years. FY23 limited assurance; FY24 BRSR Core reasonably assured while other disclosures have limited/specified coverage. FY25 scope remains metric-specific.
IndianOil	Company-specific operating series. Renewable MW is based on attributable installed capacity; Scope 3 categories and retrospective comparators have changed, limiting direct trend comparability.	Independent ESG/BRSR assurance documented in the reporting period. Type, individual metrics and coverage vary by reporting instrument; no uniform company-wide assurance level is implied.
BPCL	Standalone operations covering three refineries (Mumbai, Kochi and Bina) and specified controlled business units. Subsidiaries/JVs and certain retail/distribution operations excluded. Sustainability Scope 3 includes use of sold products; FY23 BRSR is narrower.	FY23 Sustainability Report independently assured by EY (ISAE 3000 Revised; AA1000AS Type 2 Moderate, limited). FY24-FY25 Sustainability Reports use Intertek with specified assurance boundaries and exclusions.
HPCL	Standalone Indian operations exclude subsidiaries/JVs. Scope 3 inventory covers six selected categories; employee and contractor health-and-safety figures have different reporting populations.	External Sustainability Report assurance documented in FY23-FY25: Bureau Veritas in FY23-FY24 and SR Asia in FY25. Standards, levels and covered indicators vary.
Oil India	Company-level disclosures. Later operational-water comparatives exclude township/community water; FY23 Scope 3 has substantially narrower category coverage than the later two years.	FY23 DARPAN Sustainability/ESG Report expressly not independently assured. FY24 and FY25 independent external assurance is documented; assurance should not be extrapolated to FY23.
GAIL	Standalone operations exclude subsidiaries, joint ventures and associates. Scope 3 comprises selected categories, notably business travel and use of sold products, rather than a complete universal inventory.	Independent Sustainability Report assurance is documented for all three years; FY25 provider SR Asia. Assurance type and subject-matter perimeter vary. Retrospective training-hour labels differ from the original-year series.

Note. This table describes the main reporting perimeters and assurance disclosures, not a uniform assured-data boundary. A 2/2 assurance-disclosure score indicates qualifying independent ESG assurance evidence under the study rubric, not reasonable assurance of every metric. Original year-specific company Annual/Integrated, Sustainability and BRSR reports are the sources; individual report and page references are retained in the companion 60-indicator audit register. BV = Bureau Veritas; EY = Ernst & Young; JV = joint venture.

Figure 2 Reported Scope 1 and 2 Net-Zero Target Years



Note. GAIL reports the earliest target (2035, advanced from 2040). BPCL, HPCL, and OIL share 2040. IOCL's 2046 target refers to operational emissions.

Net-zero targets span eleven years (Figure 2). GAIL reports 2035, advanced from 2040, ONGC reports 2038, BPCL, HPCL, and OIL report 2040, and IOCL reports 2046 for operational emissions. GAIL also reports a Scope 3 target of a 35 percent reduction by 2040.

External ESG scores are not directly comparable because the agencies use different scales, coverage and methodologies. The selected CDP, MSCI, DJSI and S&P indicators cited by the companies should therefore be treated as background disclosures and not combined into an inter-company rank or a longitudinal series. Our 0-2 index supplies a common disclosure coding approach, while its ceiling effect is acknowledged.

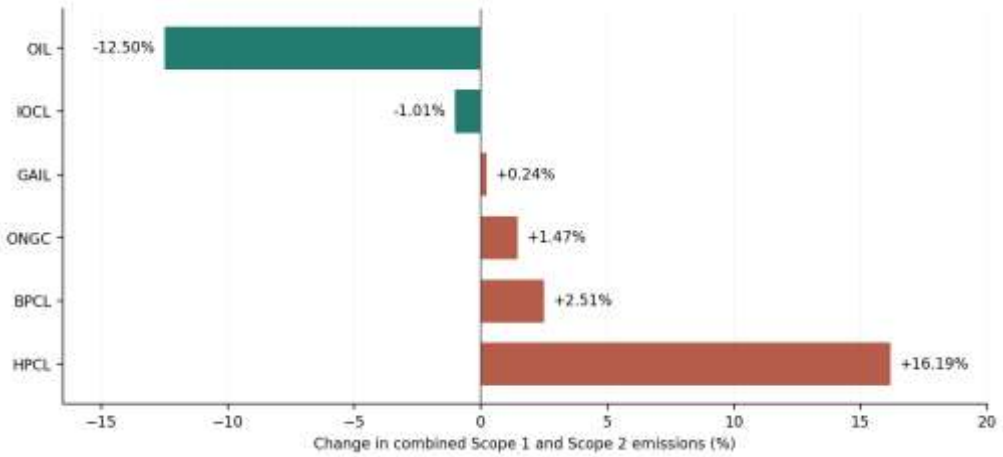
The reports show that ESG reporting is becoming more structured, including BRSR, targets, assurance and recognized frameworks. Supplementary Table S1 makes the main differences in company reporting boundaries and assurance coverage explicit; reporting an assured ESG document does not mean every operational metric was assured to the same level. This conclusion refers to documentary practices in the post-BRSR window. Without a pre-BRSR control period and a comparable outside group, the study cannot attribute these practices causally to the BRSR requirement.

6.2 Objective 2: Comparison of environmental, social, and governance disclosures

6.2.1 Environmental disclosures

Environmental comparison requires uniform reporting years and organizational boundaries, even when operating models differ. Table 3 uses FY 2023-24 and FY 2024-25 for every company. The standalone revenue-normalized proxy supplements, rather than replaces, absolute combined Scope 1 and 2 emissions. Scope 3 comparability remains limited: BPCL's FY 2022-23 Sustainability Report included sold-products emissions absent from its narrower same-year BRSR; OIL expanded categories after FY 2022-23; and ONGC's FY 2023-24 Scope 3 figure differs between contemporary and later retrospective presentations. These figures are not treated as identical whole-value-chain inventories. The accompanying audit workbook records data sources, units and reporting boundaries.

Figure 3 Change in Reported Scope 1 and 2 Emissions, FY 2023-24 to FY 2024-25



Note. Change in combined Scope 1 and 2 emissions between FY 2023-24 and FY 2024-25, calculated from each company's reported standalone figures in tonnes of CO2-equivalent. Negative values denote decreases. Values rounded to two decimals. Source: three-year company ESG/BRSR audits.

From FY 2023-24 to FY 2024-25, absolute combined Scope 1 and 2 emissions fell at OIL (-12.50%) and IOCL (-1.01%), while rising at GAIL (+0.24%), ONGC (+1.47%), BPCL (+2.51%) and HPCL (+16.19%). Revenue-based intensity gives a different picture in two cases: IOCL's intensity rose (+1.43%) despite falling absolute emissions, and GAIL's intensity fell (-4.61%) despite rising absolute emissions. OIL improved on both measures (-12.45% revenue intensity), while HPCL worsened on both (+15.02% revenue intensity). Revenue intensity does not establish process efficiency because price, throughput, sales mix and boundary may change.

BPCL historical-emissions reconciliation. Its original FY 2022-23 Sustainability Report (pp. 106-107) reported Scope 1 at 10.24249 million tCO_2e, Scope 2 at 0.71531 million tCO_2e, and Scope 3 at 141.17524 million tCO_2e. Later comparative tables report FY 2022-23 Scope 1 at 9.68345 million tCO_2e and Scope 2 at 0.72098 million tCO_2e. BPCL's FY 2023-24 Sustainability Report (Annexure 6, printed p. 250; PDF p. 252) explains that Scope 1 was corrected for double-counted gas-consumption emissions and Scope 2 revised with improved data availability. Using the corrected historical series, BPCL's Scope 1, Scope 2 and combined Scope 1+2 emissions changed by +2.62%, +18.91% and +3.75%, respectively, from FY 2022-23 to FY 2024-25. Scope 3 increased approximately 12.49%, including Category 11 (use of sold products). These three-year changes are contextual and are not mixed into the common FY 2023-24 to FY 2024-25 comparison in Table 3.

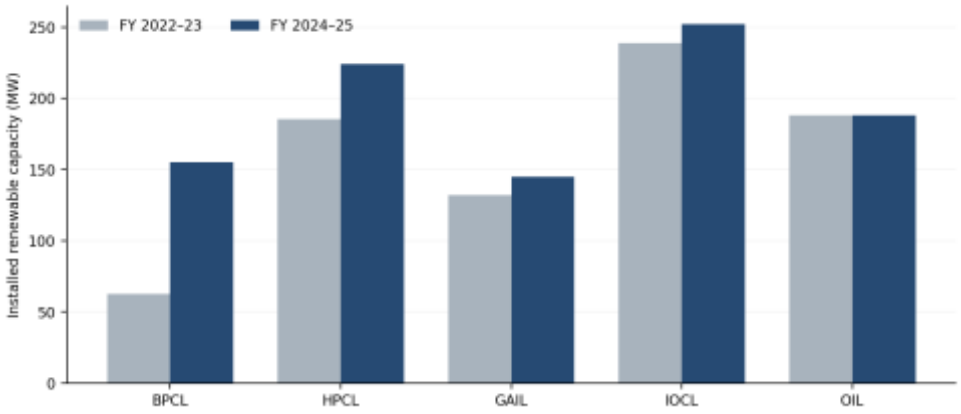
Table 3 Matched FY 2023-24 to FY 2024-25 Scope 1 and 2 Emissions and Revenue-Based Intensity

Company	FY24 S1+S2 ($MtCO_2e$)	FY25 S1+S2 ($MtCO_2e$)	Absolute change	Intensity FY24 → FY25 (tCO_2e/₹ crore)
ONGC	9.363	9.501	+1.47%	67.65 → 68.92 (+1.88%)
IOCL	22.760	22.530	-1.01%	26.27 → 26.65 (+1.43%)
BPCL	10.531	10.795	+2.51%	20.78 → 21.57 (+3.83%)
HPCL	5.777	6.712	+16.19%	12.51 → 14.39 (+15.02%)
OIL	1.450	1.268	-12.50%	65.50 → 57.35 (-12.45%)
GAIL	3.854	3.863	+0.24%	29.50 → 28.14 (-4.61%)

Note. All six rows use FY 2023-24 to FY 2024-25, not a mixture of two-year and three-year changes. Intensity = Scope 1 + Scope 2 emissions (tCO2e) divided by standalone revenue from operations (₹ crore); figures are rounded. IOCL emissions are drawn from source disclosures rounded to 0.01 million tCO2e. BPCL FY 2023-24 revenue uses the adjusted comparative amount in its FY 2024-25 standalone statement. The source ledger identifies the original report, printed page and PDF page for each annual revenue figure. Intensity is revenue-

normalized, not physical-production-normalized, and should not be interpreted as comparable technology efficiency across companies.

Figure 4 Installed Renewable Capacity, FY 2022-23 and FY 2024-25



Note. Installed renewable capacity in MW, distinguishing commissioned operating assets from announced or planned projects. ONGC is omitted from this graph because a matched FY 2022-23 MW denominator was not established in the reconciled audit. HPCL's total 185.26 MW FY 2022-23 capacity is now used instead of a solar-only 84.35 MW figure.

The revised within-company renewable-capacity comparison indicates growth at BPCL from 62.30 to 154.86 MW (148.6%), GAIL from approximately 132 to 145 MW (9.8%), IOCL from 238.70 to 252.10 MW (5.6%), and HPCL from 185.26 to about 224 MW (20.9%). OIL's reported 188.1 MW is unchanged over this comparison. Proposed projects and renewable electricity generation are excluded from installed capacity. Capacity expansion did not uniformly coincide with short-run reductions in combined Scope 1 and 2 emissions, particularly at BPCL and HPCL.

Water, waste and circular-economy performance also differ by company. ONGC provides extensive water-withdrawal and consumption records. OIL's later ESG Data Book revises FY 2023-24 water-withdrawal comparators because its operational boundary excludes townships/community supplies; its revised historical series must not be combined with unrevised values. Year-on-year interpretations in other firms likewise require checking unit and category definitions. These environmental indicators are useful contextual outcomes, not components of the index weighted by magnitude.

6.2.2 Social disclosures

Social disclosures span gender diversity, employee training, occupational safety and community programmes. IOCL, GAIL and BPCL report rising CSR expenditure over the period, but expenditure partly reflects statutory obligations in India and does not by itself demonstrate positive social outcomes. BPCL's reported CSR amount spent was ₹128.67 crore in FY 2022-23, ₹158.19 crore in FY 2023-24 and ₹179.37 crore in FY 2024-25, equivalent to a 39.40% increase. The FY 2022-23 Annual Report, Note 58, distinguishes ₹128.67 crore actually spent during the year from ₹191.63 crore labelled CSR expenditure elsewhere in the financial statements. This difference is a measure-definition issue, not evidence that the Sustainability Report omitted CSR data. Employee and contractor safety outcomes remain separate; GAIL reported contractor fatalities despite other employee-safety initiatives.

Additional workforce and training comparability checks: ONGC's FY 2022-23 permanent workforce totals combine employees and workers, whereas later reports separate the categories; counts were reconciled before interpreting female representation. BPCL's female permanent-workforce figures and training averages are documented annually, while two corruption/bribery breaches disclosed for FY 2024-25 demonstrate why disclosure completeness is not a governance-outcome score. GAIL's original Sustainability Reports disclose average training hours of 40.01 in FY 2022-23 (printed p. 137; PDF p. 139) and 37.40 in FY 2023-24 (printed

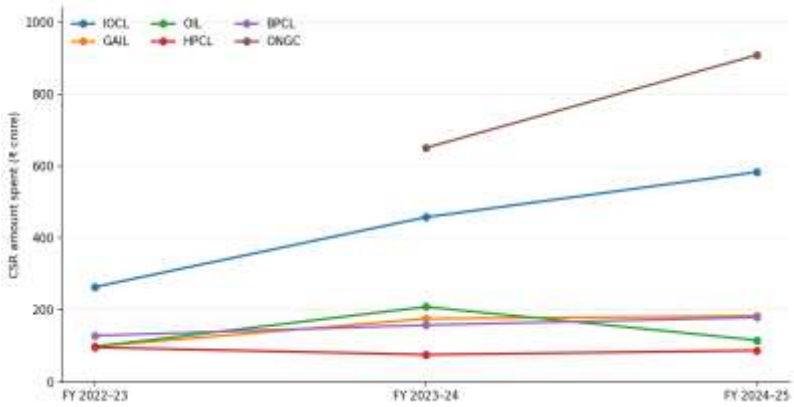
p. 147; PDF p. 149). Its FY 2024-25 report shows 42.60 for the current year (printed p. 32; PDF p. 34) but reverses the two historical chart labels. Without an explained restatement, the original report-year figures are retained and no directly comparable three-year trend is claimed. The training indicator nevertheless retains 2/2 because each year contains qualifying quantitative disclosure.

Table 4 CSR Expenditure by Company (Rs crore)

Company	FY 2022-23	FY 2023-24	FY 2024-25	Change
IOCL	264.03	457.71	583.04	+120.8%
GAIL	99.10	175.71	183.77	+85.4%
OIL	98.21	208.77	115.98	+18.1%
HPCL	96.11	75.91	87.35	-9.1%
ONGC	n.d.	650.34	908.28	+39.7% (FY 2023-24 to FY 2024-25)
BPCL	128.67	158.19	179.37	+39.40%

Note. Amounts in ₹ crore; changes use FY 2022-23 to FY 2024-25 unless otherwise indicated. BPCL figures represent CSR amount spent: ₹128.67 crore in FY 2022-23 (FY 2022-23 Annual Report, Note 58, printed p. 320, PDF p. 322; and Sustainability Report, p. 16), ₹158.19 crore in FY 2023-24 and ₹179.37 crore in FY 2024-25. The FY 2022-23 ₹191.63 crore financial-statement CSR expense figure is distinct from the amount spent. ONGC's FY 2022-23 amount was not established in the reviewed dataset. CSR expenditure is partly statutory and is not an impact measure.

Figure 5 CSR Expenditure Trends, FY 2022-23 to FY 2024-25



Note. Three-year CSR spending is shown for IOCL, GAIL, OIL, HPCL and BPCL. ONGC is shown from FY 2023-24 because its FY 2022-23 value is not established. BPCL's FY 2022-23 amount is ₹128.67 crore actually spent, not the separate ₹191.63 crore accounting expense. Values in ₹ crore.

6.2.3 Governance disclosures

Governance disclosures document policies, oversight bodies, whistleblower arrangements and anti-corruption procedures, but the availability of policies does not demonstrate their effectiveness. The source audit distinguishes the FY 2022-23 non-assured OIL Sustainability Report from assurance in FY 2023-24 and FY 2024-25; HPCL reports external assurance in all three years. Assurance levels and selected subject-matter scope differ between providers, so even a fully scored assurance indicator cannot be interpreted as uniform reasonable assurance across companies or metrics.

6.2.4 Summary of the comparison

Company performance varies even though the disclosure scores are close to their maximum. GAIL's absolute combined Scope 1 and 2 emissions increased slightly while its revenue-based intensity declined; IOCL shows

the opposite pattern. BPCL and HPCL raised both absolute emissions and revenue-normalized intensities as installed renewable capacity rose. OIL's combined emissions and intensity declined despite constant installed renewable capacity. These results caution against assuming a simple relationship between ESG reporting, renewable additions and enterprise-wide decarbonisation. Scope 3 series require separate category-boundary interpretation; neither statutory CSR expenditure nor zero employee fatalities can stand in for broad social-performance impacts.

6.3 Objective 3: Sustainable business transformation through ESG-related initiatives

The assessment considers four pre-specified facets of transformation evidence: (1) formal strategy and emissions targets, (2) identifiable capital or organizational arrangements, (3) implemented/commissioned initiatives, and (4) observed operating results. The first three are rated 0 if absent, 1 if merely planned or incomplete, and 2 if evidenced as active in the reporting period. For the fourth, 2 indicates a matched FY 2023-24 to FY 2024-25 decline in company-wide combined Scope 1 and 2 emissions, 1 indicates reported implemented initiatives but no such company-wide decline, and 0 no quantifiable operating result. This deliberately narrow outcome rule is transparent but not an independent index of overall sustainability success. The evidence map (Table 7) supports interpretation of the company initiatives in Table 5 without presenting the ordinal codes as a validated cross-firm performance ranking.

Table 5 Major Sustainability Initiatives, Targets, and Quantified Outcomes

Company	Key initiatives	Renewable capacity target	Quantified outcomes
ONGC	Flare-gas recovery, LED retrofits, CCUS, green hydrogen, water recycling, circular economy, ONGC Green Ltd., BARC collaboration	10 GW by 2030; Rs 48,808.70 crore earmarked by 2038	146,505 MTCO2e avoided by flare-gas recovery; 63,796 MTCO2e avoided by LED retrofits
IOCL	Project SPRINT, green hydrogen, Terra Clean Ltd.	31 GW by 2030	CSR beneficiaries up 138.6%; renewable capacity up 5.6%
BPCL	5 MW electrolyser at Bina Refinery, zero-waste-to-landfill certification, biofuel blending	10 GW by 2035	45 energy-conservation schemes in FY 2024-25; renewable capacity up 148.6%
HPCL	HPCL Renewable and Green Energy Ltd. (HPRGE), dedicated Energy Transition Cell	10 GW by 2030	~224 MW renewable capacity by FY25; combined Scope 1+2 emissions rose ~16.19% in FY24-25
OIL	Project Santulan, APGCL OIL Green Power Ltd. (AOGPL), Climate Academy	5 to 5.5 GW by 2040	Renewable footprint 188.1 MW; FY24-25 combined Scope 1+2 emissions fell ~12.50%
GAIL	10 MW green hydrogen electrolyser at Vijaipur, CCUS study, Strategy 2030	3.5 GW by 2035 (reported ambition)	10 MW green-hydrogen electrolyser; ~145 MW commissioned renewable capacity in FY25

Note. Source: company reports as compiled for this study.

Initiatives across the six firms show plausible transition pathways but differ in demonstrated operating outcomes. ONGC reports flare-gas recovery and other quantified interventions; IOCL and BPCL report renewable and hydrogen initiatives; HPCL documents its transition cell and approximately 224 MW of installed renewable capacity in FY 2024-25; OIL reports flaring-reduction work and a zero-change 188.1 MW renewable portfolio; and GAIL reports its commissioned 10 MW green-hydrogen electrolyser and 145 MW of renewable capacity. These examples show different forms of implementation, but they do not justify a single, unvalidated 'most transformed' rank.

Measures such as avoided emissions, electricity generated, commissioned capacity and reported injuries provide more direct evidence of implementation than targets or spending alone. Projects at planning, construction and operation stages are therefore distinguished. No single firm's reported projects establish comprehensive enterprise-wide transformation in the three-year period.

6.4 Objective 4: ESG disclosure score and selected ESG indicators

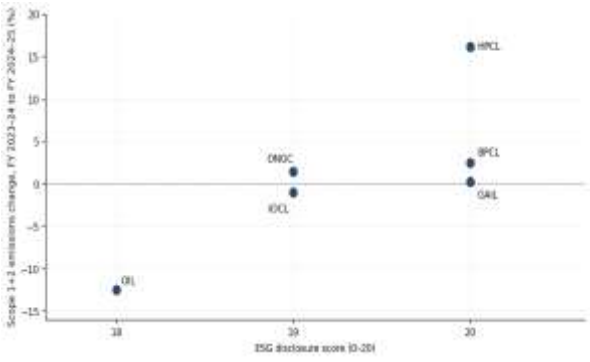
Disclosure, implemented action and longer-run transformation are analytically separate. The index records the breadth and continuity of reported information. Implementation is evidenced by installed assets, operational policies and documented activities. Transformation would require evidence of durable changes in business models, capital deployment and normalized environmental and social outcomes over a longer period. Given the three-year window and diverse company operations, this paper compares disclosed evidence of transformation rather than claiming to estimate a validated transformation index. Spearman's rho was recalculated using the reconciled six-company ESG disclosure scores (ONGC 19, IOCL 19, BPCL 20, HPCL 20, OIL 18 and GAIL 20). With matched FY 2023-24 to FY 2024-25 combined Scope 1 and 2 emissions changes, rho = 0.772 (n = 6; exact two-sided permutation p = 0.100). Renewable-capacity growth across five companies with comparable FY 2022-23 and FY 2024-25 MW figures (BPCL, HPCL, GAIL, IOCL and OIL) yields rho = 0.894 (n = 5; exact p = 0.100). Incorporating BPCL's reconciled CSR-spending series also increases the CSR sample to five firms, for which rho = -0.112 (exact p = 1.000; 120 label permutations). These tests remain exploratory owing to the very small samples, the ties and ceiling effect in disclosure scores, and the use of two-point capacity changes; none provides statistically significant or causal evidence.

Table 6 Spearman Rank Correlations Between ESG Disclosure Score and Selected Indicators

Indicator	n	rho	p	Reading
Scope 1 and 2 emissions change, FY 2023-24 to FY 2024-25 (%)	6	0.772	0.100	Positive; exact test not significant
Renewable capacity growth, FY 2022-23 to FY 2024-25 (%)	5	0.894	0.100	Exploratory; exact test not significant
CSR expenditure growth, FY 2022-23 to FY 2024-25 (%)	5	-0.112	1.000	Exploratory; exact test not significant

Note. Spearman's rho uses raw ESG disclosure scores (0-20); all p-values are exact two-sided label-permutation probabilities (720 permutations for n = 6 and 120 for n = 5). Higher emissions change indicates larger emissions growth. Renewable capacity growth includes five companies plotted in Figure 4 (BPCL, HPCL, GAIL, IOCL and OIL) and excludes ONGC because a matched FY 2022-23 MW denominator was not established. BPCL is included in CSR spending growth using CSR amount spent rather than accounting expense. ONGC's FY 2022-23 CSR value is unavailable. Correlations are descriptive only.

Figure 6 ESG Disclosure Score and Change in Scope 1 and 2 Emissions



Note. Six companies plotted with corrected index values (18, 19, 20) and matched FY 2023-24 to FY 2024-25 Scope 1 and 2 changes. Labels are offset to separate companies with identical index scores. Dashed reference line denotes no emissions change.

Table 7 applies the stated four-criterion evidence anchors to all six companies. The first three codes primarily establish the presence of documented action, while the fourth separately captures the direction of matched absolute combined Scope 1 and 2 emissions. Codes are shown for auditability, not summed or ranked as a validated transformation-performance index.

Table 7 Four-Criterion Transformation Evidence Matrix (0-2 Codes; Not an Overall Rank)

Company	Strategy / Institution / Implementation / Outcome	Documented basis and limits
ONGC	2 / 2 / 2 / 1	2038 target; ONGC Green and flare recovery; combined S1+2 increased 1.47%.
IOCL	2 / 2 / 2 / 2	2046 target; Terra Clean and renewable measures; combined S1+2 decreased 1.01%.
BPCL	2 / 2 / 2 / 1	2040 target; renewable assets and energy measures; combined S1+2 rose 2.51%.
HPCL	2 / 2 / 2 / 1	2040 target; HPRGE and energy transition cell; combined S1+2 rose 16.19%.
OIL	2 / 2 / 2 / 2	2040 target; AOGPL and emissions/flaring measures; combined S1+2 fell 12.50%.
GAIL	2 / 2 / 2 / 1	2035 target; operating green hydrogen and renewable assets; combined S1+2 rose 0.24%.

Note. Anchors: 0 = not evidenced; 1 = planning/partial evidence (criteria 1-3) or implemented initiatives with no enterprise-wide combined S1+2 reduction (criterion 4); 2 = currently evidenced strategic/institutional/operational action (criteria 1-3) or reduced matched absolute Scope 1+2 emissions (criterion 4). The four codes are illustrative and assessed by the authors; no independent second-rater validation was conducted, and their sum is not interpreted as a sustainability ranking. Subsidiary and JV actions are evidence of institutional direction, not automatically included in the company's standalone emissions boundary.

Under the narrow and explicit operating-outcome criterion, OIL and IOCL score 2 because their combined Scope 1 and 2 emissions declined from FY 2023-24 to FY 2024-25. ONGC, BPCL, HPCL and GAIL score 1 despite tangible initiatives, because their combined emissions increased in that window. This approach avoids placing ONGC ahead of OIL solely on the basis of qualitative initiatives when OIL reported reductions in emissions and flaring. It does not imply that the reduction was necessarily due to strategic transformation, nor that one year of emissions change summarizes financial, social or lifecycle performance. Green subsidiaries and joint ventures are discussed separately from parent standalone environmental figures.

DISCUSSION

The six-company audit indicates very high disclosure saturation: scores range from 18 to 20, and five firms receive at least 19. Differences are confined mainly to missing or mismatched Scope 3 reporting and the lack of independent assurance for OIL in FY 2022-23. In particular, HPCL's assurance is documented across all years, and BPCL's original FY 2022-23 Sustainability Report records a broader Scope 3 boundary than its BRSR. This supports the interpretation of disclosure maturity while highlighting the limited ability of a ten-item index to differentiate mature reporters. No pre-BRSR baseline was examined, so the regulatory effect should not be inferred.

Sustainability outcomes are less aligned. The corrected emissions-change correlation is positive but statistically inconclusive (rho = 0.772; exact p = 0.100; n = 6), and the other two small-sample tests also fail to establish a robust association. Data availability and tied index values limit inference; neither the absence nor the presence of a causal relationship is established. Actual outcomes must be evaluated separately from the disclosure index.

Absolute emissions, revenue intensity, physical output intensity, installed renewable MW and commissioned project outcomes measure distinct concepts. BPCL increased renewable capacity from 62.30 to 154.86 MW

between FY 2022-23 and FY 2024-25; yet its matched last-year combined emissions increased 2.51% and revenue-based emissions intensity rose 3.83%. HPCL's revised FY 2022-23 installed base of 185.26 MW reached about 224 MW in FY 2024-25, while its last-year combined emissions rose 16.19% and revenue intensity 15.02%. IOCL illustrates the need for both denominators: absolute Scope 1+2 decreased 1.01%, but revenue-based intensity increased 1.43%. GAIL's absolute Scope 1+2 rose 0.24% while revenue intensity fell 4.61%. The results are not physical output-adjusted efficiency benchmarks and cannot establish a causal effect of transition investments.

The findings suggest clearer industry reporting of annual Scope 1 and 2 emissions, Scope 3 categories, restatements, commissioned renewable MW, employee versus contractor incidents and assurance scope. Corporate reporting should distinguish announced commitments from commissioned projects and observed outcomes. Researchers and investors should not use a near-ceiling disclosure index as a standalone sustainability-performance ranking; supplementary emissions-intensity, investment and outcome measures are required.

8. Limitations

The study covers six heterogeneous companies and three post-BRSR years, without a pre-BRSR baseline or control group. The index developed for this study measures disclosure availability and continuity, is near its upper bound and was not independently dual-coded; no inter-rater agreement statistic is claimed. All 60 indicator decisions have supporting documentary entries, but this does not imply independently confirmed reliability or that definitions, reporting boundaries and historical comparators are universally consistent. Scope 3 categories differ between firms. BPCL’s original FY 2022-23 Sustainability Report, standalone Annual Report Note 58 and FY 2023-24 Sustainability Report Annexure 6 were used to reconcile source restatements and distinguish CSR amount spent from accounting expense. GAIL’s later training chart reverses two historical averages relative to the original-year reports, without a documented restatement explanation; its original-year values are retained and a seamless training trend is not inferred. OIL’s water boundary was revised, while ONGC’s earlier workforce classifications require reconciliation. Revenue intensity is sensitive to prices and business mix, and is not a substitute for physical-output intensity. The four transformation codes are descriptive, not validated performance ratings; CSR spending is partly statutory. All small-sample correlation results remain exploratory.

CONCLUSION

The six-company comparison documents widespread, highly saturated ESG reporting over FY 2022-23 to FY 2024-25. Reconciled index scores are BPCL, HPCL and GAIL 20/20, ONGC and IOCL 19/20, and OIL 18/20. The common FY 2023-24 to FY 2024-25 emissions analysis and standalone revenue-based intensity show divergent operating outcomes; OIL reduced both absolute emissions and revenue intensity, IOCL lowered absolute emissions but not revenue intensity, and GAIL lowered revenue intensity but not absolute emissions. BPCL's corrected historical Scope 1/2 series and its three-year CSR amounts spent demonstrate why reporting versions and financial-statement classifications must be reconciled. The four explicit transformation criteria distinguish initiatives from outcomes and avoid an unsupported overall sustainability ranking. None of the descriptive tests establishes causal effects. Future studies should harmonize production intensity, Scope 3 categories and assurance scope, include a pre-regulation baseline and conduct genuine independent second-coder verification.

The findings address the four research objectives: reporting practices are widespread; the extent and comparability of E, S and G indicators differ; all six firms document material sustainability initiatives but no validated overall transformation ranking is supportable; and disclosure scores cannot substitute for evidence of operating improvement. Future studies should incorporate a longer pre- and post-regulation window, independent coding, common Scope 3 category boundaries and normalized emissions and social outcomes. The original company reports and the harmonized evidence register should be retained as the basis for any future replication.

Data availability and reproducibility: A supplementary six-company source ledger documents all 60 indicator-level decisions, with report-year evidence, page locations, definition and boundary qualifications, and disclosed source-version differences. Completion of the documentary evidence register is not an independent external audit or second-coder reliability assessment. The index was coded by the authors and has not undergone independent dual-coder validation.

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