

Appendix A – Benchmarking Sustainability: A Comparative Case Studies Analysis of ESG Practices in the HVAC Industry

Table 1 – Mapping ESG dimensions to theoretical lenses and core constructs

ESG Dimension	Theoretical Lens	Purpose in the model	Core Constructs (examples)
E	LCA	Defines the E-KPI domain and lifecycle coverage	Lifecycle stages; global warming potential; water consumption
S	IEQ	Define the S-KPI domain at building/occupant level	Thermal comfort; indoor air quality; acoustics; lighting
G	CSR	Define the G-KPI domain and governance alignment	Code of ethics, diversity metrics, litigation risks

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Table 2 – Corpus composition (n = 168) and inclusion notes

Source type	Count (n)	Inclusion notes
Annual reports	18	Full-year consolidated reports within 2019-2023
Financial disclosures / earnings releases	18	Official filings, earnings releases, IFRS highlights
Sustainability / ESG / integrated reports	24	Standalone ESG/sustainability reports or report-like ESG sites
Press releases (ESG/IEQ/LCA-related)	36	Releases with measurable content on policies, targets, or metrics
Corporate webpages (policies, targets, IEQ pages)	48	Corporate policy/Code of Ethics/QHSE/Human Rights/IEQ pages
Third-party materials (assurance/certifications/investor/regulator)	24	ISO/EMAS/EcoVadis/assurance statements; regulator/standard-setter docs; AIDA Bureau van Dijk
Total	168	De-duplicated at firm-year level

Notes – Hierarchy (from preferred to fallback): annual reports, financial disclosures and earnings releases, sustainability, ESG, or integrated reports, press releases containing ESG, IEQ, or LCA content, corporate policy and IEQ webpages, and third-party sources (for triangulation only). Exclusions: marketing pages without verifiable metrics, press unrelated to ESG, and duplicates. Deduplication rule: retain the latest version for each firm-year.

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Table 3 – Core KPI families: operational definitions, measurement units, inclusion rules, mapping, and associated scoring rules

ESG Dimension	Conceptual Lens	KPI Family	Operational Definition	Measurement Unit	ESRS Mapping	Scoring rule Presence (P), Completeness (C), Evolution (E)
E	LCA	GHG emissions	Total Scope 1-3 greenhouse gas emissions	tCO _{2e}	ESRS E1-6	P: quantitative S1-S3 disclosed (0/1) C: coverage & methods (S1, S2, S3 boundaries/methods) (0-2) E: multi-year trend $\geq 2y$ & time-bound target (0-2)
		Energy intensity	Energy consumption per unit of revenue or output	kWh/€ or kWh/unit	ESRS E1-5	P: indicator disclosed (0/1) C: boundary + normalization unit specified (0-2) E: trend $\geq 2y$ & intensity target (0-2)
		Renewable energy share	Share of energy from renewable sources	%	ESRS E1-5	P: % RE disclosed (0/1) C: source definition/Guarantees of Origin + scope (own vs purchased) (0-2) E: trend $\geq 2y$ & RE target (0-2)

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ESG Dimension	Conceptual Lens	KPI Family	Operational Definition	Measurement Unit	ESRS Mapping	Scoring rule Presence (P), Completeness (C), Evolution (E)
		Water intensity	Water consumption per unit of revenue or output	m ³ /€ or m ³ /unit	ESRS E3-5	P: indicator disclosed (0/1) C: boundary + type (withdrawal/discharge) (0-2) E: trend ≥2y & reduction target (0-2)
		Waste/recycling rate	Share of waste recycled or diverted from landfill	%	ESRS E5-4	P: % disclosed (0/1) C: breakdown (hazardous/non-hazardous or diversion) (0-2) E: trend ≥2y & target (0-2)
		Product LCA hotspots	Disclosure of quantified environmental impacts across life cycle stages	various (e.g., kg CO ₂ e/stage)	ESRS E1/E2	P: quantified LCA per stage (0/1) C: coverage of key stages/indicators (0-2) E: repeat assessments or eco-design target (0-2)

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ESG Dimension	Conceptual Lens	KPI Family	Operational Definition	Measurement Unit	ESRS Mapping	Scoring rule Presence (P), Completeness (C), Evolution (E)
S	IEQ	Indoor air quality	Average or peak levels of CO ₂ , PM _{2.5} , TVOC	ppm / µg/m ³ / µg/m ³	ESRS S1-13	P: ≥1 pollutant quantitative (0/1) C: ≥2 pollutants + threshold/frame (0-2) E: trend ≥2y & corrective-action target (0-2)
		Thermal comfort	Non-conformity rate or complaint frequency	% / count	ESRS S1-13	P: metric disclosed (0/1) C: method + building coverage (0-2) E: trend ≥2y & target (0-2)
		OHS performance	Total Recordable Incident Rate (TRIR) or Lost Time Injury Rate (LTIR)	rate per 200k hours	ESRS S1-14	P: TRIR/LTIR disclosed (0/1) C: coverage (employees + contractors) & definitions (0-2) E: trend ≥2y & target (0-2)

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ESG Dimension	Conceptual Lens	KPI Family	Operational Definition	Measurement Unit	ESRS Mapping	Scoring rule Presence (P), Completeness (C), Evolution (E)
	CSR	Training intensity	Average training hours per full-time equivalent (FTE)	hours/FTE	ESRS S1-16	P: hours/FTE disclosed (0/1) C: segmentation (role/site) or content areas (0-2) E: trend $\geq 2y$ & target (0-2)
		Workforce turnover	Annual voluntary turnover rate	%	ESRS S1-9	P: % disclosed (0/1) C: segmentation (gender/level/region) or method clarity (0-2) E: trend $\geq 2y$ & target (0-2)
		Gender diversity	Share of women in total workforce or management	%	ESRS S1-6	P: % disclosed (0/1) C: disaggregation by level + policy link (0-2) E: trend $\geq 2y$ & target (0-2)
G	CSR	Board independence	Proportion of independent members on the board	%	ESRS G1-1	P: % disclosed (0/1) C: criteria + committee roles (0-2) E: trend $\geq 2y$ or policy target (0-2)

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ESG Dimension	Conceptual Lens	KPI Family	Operational Definition	Measurement Unit	ESRS Mapping	Scoring rule Presence (P), Completeness (C), Evolution (E)
		ESG-linked remuneration	Share of executive remuneration linked to ESG targets	%	ESRS G1-3	P: linkage disclosed (0/1) C: metrics & weights (0-2) E: persistent use ≥ 2 y or escalation plan (0-2)
		Code of Ethics & whistleblowing	Disclosure of formal code and whistleblowing system coverage	binary (yes/no)	ESRS G1-5	P: code + channel in place (0/1) C: scope/coverage & protections (0-2) E: updates or effectiveness indicators (0-2)
		Assurance coverage	Scope and level of external assurance on ESG disclosures	% / level	ESRS G1-6	P: assurance disclosed (0/1) C: level (limited/reasonable) & scope (E/S/G) (0-2) E: continuity ≥ 2 y & plan to extend scope/level (0-2)

Scoring notes: Row-level subscores are assigned as follows: Presence 0/1, Completeness 0-2, and Evolution 0-2. Within each pillar, these row-level subscores are aggregated and normalized to a scale of 0-10 per criterion (refer to Section 4.4). The total scores in Section 6 range from 0 to 30.

Table 4 – Summary of key financial and CSRD compliance metrics for HVAC companies, updated with Omnibus Package 2025

Company	Data Year	Total Assets (M EUR)	Revenue (M EUR)	Employees	NFRD Compliance	Wave Category	First CSRD-Compliant Report Publication Year*
Aermec	2022	286	325	808	No	Wave 2	2028
Ariston	2023	3,870	3,090	10,769	Yes	Wave 1	2025
Baxi	2022	264	424	966	No	Wave 2	2028
Daikin	2023	316	794	293	No	Wave 2	2028
Ferrol	2022	406	296	641	No	Wave 2	2028
Italtherm	2022	79	83	139	No	Wave 2	2028
Midea (CN)	2022	423	346	149	No	Wave 4	2029
Mitsubishi (JP)	2023	39,471	33,651	149,655	No	Wave 4	2029
Riello	2022	464	412	791	No	Wave 2	2028
Samsung (KR)	2023	386,409	224,235	267	No	Wave 4	2029
Vaillant	2022	N/A	3,700	17,132	Yes	Wave 1	2025
Viessmann	2022	N/A	4,000	14,653	Yes	Wave 1	2025

Table 5 – KPIs and measurement methods used by the 12 HVAC firms

Company	Key KPIs	Measurement Methods
Aermec	• GHG emissions • Energy efficiency • Use of sustainable materials	• Emissions monitoring • Energy performance tests • Material evaluation
Ariston	• CO₂ emissions • Use of renewable energy • Gender diversity	• Emissions calculations (Scope 1, 2, and 3) • Renewable energy monitoring • Gender diversity tracking
Baxi	• GHG emissions • Packaging recyclability • Employee engagement	• Emissions monitoring • Recycling evaluation • Employee surveys
Daikin	• Environmental impact of refrigerants • Energy efficiency • Stakeholder engagement	• Energy performance evaluations • Sustainability training participation
Ferroli	• CO₂ emissions • Use of renewable energy • Workplace incidents	• Emissions monitoring • Energy use analysis • Incident tracking
Italtherm	• CO₂ emissions • Energy efficiency	• Emissions measurement • Energy efficiency monitoring
Midea	• Use of recycled materials • Reduction of production waste • Energy efficiency	• Material analysis • Waste reduction evaluation • Energy performance tests
Mitsubishi	• GHG emissions • Product recyclability rate • Stakeholder engagement	• Emissions monitoring • Product lifecycle analysis • Stakeholder surveys
Riello	• GHG emissions • Energy efficiency • Employee safety	• Emissions calculations • Energy efficiency analysis • Incident reports
Samsung	• Carbon emissions • Technological innovation • Supplier engagement	• Technology adoption indicators • Evaluation of new technologies
Vaillant	• CO₂ emissions • Energy consumption • Workplace safety • Gender diversity	• Direct measurements • Internal surveys • Safety and diversity tracking
Viessmann	• Scope 1-3 emissions • Product efficiency • Employee satisfaction	• Emissions measurement • Product efficiency evaluation • Employee satisfaction surveys