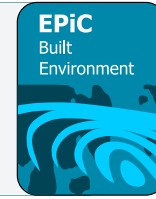




## EPiC Series in Built Environment

Volume 7, 2026, Pages 465–474

Proceedings of Associated Schools of Construction 62nd Annual International Conference



# Assessing Sustainability in the Electrical Construction Industry: Comparing Suppliers and Contractors

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The electrical industry plays a central role in advancing global sustainability, yet its Environmental, Social, and Governance (ESG) practices remain unevenly developed across the supply chain. This study examines ESG adoption within the U.S. electrical construction industry through a cross-sectional qualitative analysis, using manual coding, of 19 corporate ESG and sustainability reports, 10 from major electrical suppliers and 9 from top electrical contractors. Using a qualitative content analysis approach, 400 discrete ESG actions were identified and categorized into 24 sustainability themes adapted from prior ESG literature. Results reveal that suppliers exhibit greater reporting maturity, emphasizing emissions reduction, renewable energy investment, and policy-driven environmental management, while contractors focus primarily on workforce safety, inclusion, and project-based sustainability implementation. Despite differing motivations, both groups share common priorities such as emission reduction goals, safety training, and governance transparency. These findings highlight contrasting ESG reporting approaches between suppliers and contractors. Suppliers generally institutionalize sustainability through formalized, metric-based actions, while contractors emphasize project-embedded and workforce-centered practices. Bridging these approaches through clearer reporting guidance and capacity building will help lead to cohesive, industry-wide sustainability integration.

Keywords: Sustainability, Electrical Industry, ESG Reporting

## Introduction

The electrical industry plays a pivotal role in shaping global sustainability outcomes (Jansson & Udo, 2003). It powers homes, businesses, and cities, enabling progress in nearly every sector of the economy. However, this indispensable role also places the industry at the center of the sustainability challenge. The electrical sector is both a significant consumer of natural resources and a key enabler of low-carbon technologies, meaning its actions directly influence energy efficiency, greenhouse gas emissions, and the transition toward renewable energy systems. As demand for electricity continues to rise due to urbanization, digitalization, and electrification of transportation and industry, the need for sustainable practices within electrical construction has become increasingly urgent (Gogan & Wyckoff, 2012). In the electrical construction industry sustainability expectations and reporting capacity differ substantially between upstream suppliers and downstream contractors. Design and construction companies play a critical role in advancing sustainability across the built environment by shaping how systems are planned, integrated, and delivered. These organizations act as the bridge between policy goals and on-the-ground implementation, translating abstract sustainability

commitments into tangible outcomes through project design, material selection, and construction practices. Within this ecosystem, electrical contractors occupy a unique position, directly responsible for implementing technologies that improve energy efficiency, enable renewable integration, and support the smart infrastructure essential for sustainable cities. Consequently, their ability to adapt to new sustainability requirements and frameworks is fundamental to achieving industry-wide transformation.

This study compares ESG reporting practices between electrical suppliers and electrical contractors to identify differences in reporting maturity, thematic focus, and disclosure capacity. The incorporation of sustainability frameworks presents a range of challenges, including the complexity of sustainability metrics, evolving policy and industry regulations, shifting market demands, and the integration of new practices within existing business models (Eskantar et al., 2024; Elkins et al., 2024; Cort & Esty, 2020). Preliminary discussions with electrical contractors indicate that sustainability reporting requirements are becoming more prevalent, yet limited guidance exists on how to implement these measures effectively. Prior research on construction and engineering firms similarly shows that specialty contractors face distinct ESG reporting challenges due to project-based work structures and limited reporting infrastructure (Celoza & Owens, 2025; Ure et al., 2024). This research seeks to bridge that gap by evaluating the challenges companies face and providing a collective understanding of current and future industry trends related to sustainability reporting mechanisms, structures, and requirements. Ultimately, this study aims to empower electrical construction firms to adopt more proactive approaches for measuring, assessing, and reporting sustainability performance in alignment with emerging industry standards.

### **Background**

In recent years, sustainability has become a central concern in the built environment, as buildings and infrastructure account for a substantial share of global energy use, emissions, and waste. While the importance of integrating sustainability principles into planning, design, construction, and operations is widely acknowledged, many approaches for implementing and assessing these principles in practice remain inconsistently defined and applied (Amini-Toosi et al., 2023; Wang et al., 2024). The rapid growth of Environmental, Social, and Governance (ESG) frameworks reflects broader shifts in corporate sustainability, driven by increasing pressure from investors, regulators, and other stakeholders (Passas, 2024; Orlando, 2024). Many ESG actions are directly connected to the built environment, yet smaller and project-based firms often face difficulty interpreting and responding to ESG expectations established by larger organizations within their supply chains (Ure et al., 2024; Morais et al., 2022). This trickle-down effect frequently creates uncertainty regarding how sustainability actions should be implemented, measured, and reported in practice (Nour et al., 2024).

Despite the growing emphasis on ESG, the methods used to evaluate and report sustainability performance remain inconsistent and fragmented across industries. Companies frequently adopt multiple frameworks, such as the Global Reporting Initiative (GRI), the Sustainability Accounting Standards Board (SASB), the Task Force on Climate-Related Financial Disclosures (TCFD), or alignment with the United Nations Sustainable Development Goals (SDGs), each of which emphasizes different metrics, data boundaries, and reporting structures (Bown, 2025; Christensen et al., 2022; Amel-Zadeh & Serafeim, 2018). These differences make it difficult to compare sustainability performance across companies and industries, even when organizations report under the same ESG label (Korinth & Lueg, 2022). For the electrical construction sector, this inconsistency is particularly problematic because sustainability performance is often embedded within larger construction or infrastructure projects, obscuring the specific contributions of electrical contractors to energy efficiency, emissions reduction, and resource management. At the same time, ESG

transparency is increasingly linked to financial decision-making, regulatory compliance, and risk management, transforming sustainability reporting from a voluntary exercise into a strategic necessity (Galletta et al., 2022; Lin, 2024). However, many construction and electrical firms, particularly small and medium-sized enterprises, lack the reporting infrastructure and technical capacity needed to meet these expectations effectively (Morais et al., 2022).

Consequently, a clear gap exists between the growing importance of ESG reporting and the practical capacity of electrical construction companies to engage with it. While many contractors recognize the relevance of sustainability, few have formalized systems to measure, report, or communicate their efforts meaningfully (Celoza & Owens, 2025). Similar challenges have been identified in other built environment-related sectors, such as utilities and real estate, where early ESG adoption has largely focused on environmental metrics while overlooking the social and governance dimensions of performance (Khalid et al., 2021; Kempeener et al., 2021). Others, such as Pladaite (2023) and the American Society of Civil Engineers (ASCE, 2013), stress that built environment professionals must play a central role in operationalizing sustainability goals, yet practical frameworks for doing so remain limited. Consequently, the electrical construction sector provides a valuable case for understanding how sustainability frameworks are translated into actionable practice. Thus, this research explores how current ESG practices are affecting the electrical construction industry. In this study, ESG actions are understood to relate either to organizational operations (e.g., fleet, facilities, energy use) or to project-embedded installation practices (e.g., system design, construction, and commissioning), rather than to embodied product performance alone.

### Methods

This study employed a cross-sectional qualitative content analysis of corporate ESG reports from electrical suppliers and electrical contractors in the United States. The purpose was to identify and compare sustainability reporting trends between these two groups. A qualitative content analysis approach was adopted to guide data collection and analysis. Qualitative content analysis is appropriate for research that seeks to develop insights or hypotheses from rich, descriptive qualitative data rather than to test a predefined theory. This approach enabled a systematic and inductive exploration of ESG disclosures, allowing themes and patterns to emerge from the data itself. To ensure relevance and comparability, only the most recent ESG or sustainability reports available at the time of research (2023 or 2024) were analyzed. Reports published prior to 2023 were excluded to maintain alignment with current corporate sustainability and regulatory reporting practices.

The data collection process consisted of two phases: identifying eligible companies and locating their most recent ESG or sustainability reports. Electrical suppliers were identified using the Fortune 500 Companies list, which ranks U.S. firms by annual revenue. Those categorized under *Utilities: Gas and Electric* yielded 23 companies, and each website was reviewed for publicly available ESG or sustainability reports. The ten highest-ranked supplier reports were selected for analysis. Focusing on the highest-ranked firms ensured inclusion of organizations most likely to publish comprehensive and influential ESG disclosures. A similar process was used for electrical contractors, drawing from the Top 50 Electrical Contractors in the United States (2024) ranking. Each contractor's website was reviewed, and only nine companies (ranked 1, 2, 3, 4, 5, 14, 16, 17, and 18) had publicly accessible ESG or sustainability reports, which comprised the final contractor dataset.

All reports were read in full and manually coded by one researcher to identify reported ESG actions, with category assignments reviewed by a second author to check for consistency and reduce individual bias. An ESG action was defined as any corporate initiative, policy, or activity intended to impact environmental performance, social responsibility, or governance practices. Identified actions

were compiled for systematic analysis. Each ESG action was categorized according to a predefined coding framework of 24 categories adapted from Ure et al. (2024). When a reported initiative addressed multiple ESG categories, it was disaggregated into separate actions and coded independently. All category assignments were reviewed by a second author to reduce individual bias. These categories provided a structured framework for classifying sustainability activities across industries. During coding, subcategories were also developed to capture more specific actions unique to individual reports (for example, renewable energy targets, workforce diversity initiatives, or supplier ethics programs). Extracted data were then reviewed and cross-verified to ensure consistency across both supplier and contractor datasets. Finally, the coded ESG actions for suppliers and contractors were analyzed comparatively to identify recurring themes, reporting patterns, and sector-specific differences in sustainability focus areas.

## Results

The first phase of data analysis yielded a total of 400 discrete ESG actions across the 19 reports examined, 266 actions from electrical suppliers and 154 actions from electrical contractors. This distribution suggests that suppliers disclose a broader range of ESG activities, which may reflect differences in reporting capacity and documentation. Among these, electrical suppliers reported 77 unique ESG action subcategories, compared to 60 unique subcategories identified in contractor reports. When the two datasets were combined, 95 distinct subcategories of ESG actions were identified, reflecting a diverse spectrum of environmental, social, and governance practices within the electrical industry. The identification of these subcategories provided a robust foundation for comparing sector-specific priorities and patterns in sustainability reporting. However, a pronounced disparity in ESG disclosure rates was observed between suppliers and contractors. All 23 of the 23 electrical suppliers (100%) had publicly available ESG or sustainability reports, indicating widespread adoption of formal sustainability reporting frameworks within the utilities and energy supply sectors. In contrast, only 9 of the top 50 electrical contractors (18%) had published ESG or sustainability reports. This gap indicates a lower prevalence of publicly available ESG or sustainability reports among electrical contractors compared to suppliers. The limited availability of contractor reports highlights potential barriers to ESG adoption, such as limited organizational capacity, fewer reporting resources, or uncertainty about applicable reporting frameworks, compared to the more heavily regulated and investor-scrutinized supplier sector. Table 1 shows a summary of unique environmental actions performed by the electrical industry organizations studied. In Table 1, values shown as (xS, xC) indicate the number of supplier (S) and contractor (C) reports in which each action was identified.

Table 1 shows the 13 total primary environmental categories represented, clearly illustrating a broad range of efforts across energy, water, emissions, waste, and renewable initiatives. Overall, electrical suppliers demonstrated a higher diversity and frequency of environmental actions than contractors, indicating greater reporting maturity and structured sustainability practices within the supplier segment. The most frequently reported categories among suppliers were emissions reduction, waste reduction, and research and development (R&D) for sustainable objectives. Nine suppliers disclosed measurable reductions across all three scopes of emissions, reflecting alignment with international greenhouse gas (GHG) reporting standards. Suppliers also showed leadership in hazardous waste reduction and R&D for sustainable technologies, demonstrating both operational improvements and innovation-driven environmental goals. Electrical contractors, while less comprehensive in reporting, emphasized goal-setting for emission reduction and renewable energy adoption. Six contractors identified specific emission reduction targets, suggesting a growing and emerging alignment with supplier practices. Contractors also highlighted active involvement in renewable energy projects, particularly through battery storage capacity expansion and installation of electric vehicle (EV) charging stations, actions that directly support decarbonization efforts within the built environment.

These findings indicate that contractors are actively participating in the transition to clean energy primarily through project implementation, whereas suppliers are driving change through operational transformation and strategic investment.

**Table 1.** Unique Environmental Sustainability Actions (# Suppliers, # Contractors)

Category	Action 1	Action 2	Action 3	Action 4	Action 5
Improve energy efficiency	Uses LED lighting (1S,1C)	New technologies that increase efficiency (1S,1C)	Programs to improve cooling systems (1C)	---	---
Improve water efficiency	Reduction of water use / consumption (5S,1C)	High percentage of water is returned to source (4S)	Research and testing for reduction in water use (1S)	---	---
Improved data collection / measurement systems	Better monitoring practices for emissions (1S,1C)	Researching better ways to track data (1S,3C)	Trying new technologies to prevent risks (2S)	Better technology for managing land use (1C)	---
Increase recyclability / life cycle of products	Installing fiber optic cable (2S)	Prevent damage to gas pipelines (1S)	---	---	---
Install renewables	Increase battery storage capacity (5S,2C)	Construct renewable energy facilities (3C)	---	---	---
Invest in natural capital	Respects environmental policies and laws (5S,3C)	Invests in endangered species (3S,1C)	Reduce impact on wildlife during construction (6S,4C)	Minimize impact on wildlife for projects (2C)	---
Invest in renewable energy	Maintenance of renewable energy facilities (1S,2C)	Invests money in clean energy (3S)	Supports clean energy bills / movements (3S)	Provides service for renewable projects (4C)	Goal to increase renewable energy capacity (2C)
R&D for sustainable objectives	Researched sustainable technologies (6S,1C)	Analyzed environmental risks and trends (3S,1C)	Planned a long-term sustainable goal (3S)	---	---
Reduce waste to landfill	Reduced hazardous waste (7S,1C)	Researched how to better handle waste (3S)	Reduced e-waste (1S)	Increased recycling (2C)	Minimized onsite waste (1C)
Reduction of emissions	Decreased emissions (3 scopes) (9S,3C)	Used more green energy (3S,1C)	Reduced coal units and capacity (4S,1C)	Have a goal to decrease emissions (6S,6C)	Fixed circuit breakers (1S)
Sustainable new construction	Chose optimal siting to avoid threatened animals (1S)	Had environment inspections on new construction (1S)	Put powerlines underground (2S)	Incorporated sustainability into their construction (2S)	Planted native vegetation post construction (1S)
Transition to low-carbon / EV fleet	Increase in electric vehicle fleet (5S,2C)	Invests in electrification of vehicles (3S,1C)	Encourages customers to use electric cars (3S)	Invests in installing EV charging stations (5C)	---
Exit From harmful industries / practices	Decommissioned various harmful factories (1C)	---	---	---	---

Several categories reveal opportunities for improvement, particularly among contractors. Only one contractor reported water efficiency measures, and few mentioned waste reduction or recycling

initiatives, highlighting limited engagement with resource conservation practices. Similarly, supplier-led categories such as natural capital investment and R&D for sustainable objectives were rarely mirrored by contractors, suggesting a gap in long-term environmental planning. This discrepancy may stem from differences in regulatory oversight and resource availability, as contractors often operate within tighter project budgets and shorter timelines than suppliers. Notably, the category of transition to low-carbon fleets showed growing activity across both groups, with multiple companies reporting EV investments and infrastructure development, demonstrating alignment with commonly reported decarbonization trends. Overall, the environmental data suggests that suppliers have institutionalized sustainability through policy and innovation, while contractors remain in earlier stages of environmental integration, primarily adopting actions tied to specific projects or client-driven requirements. This imbalance underscores the need for more comprehensive sustainability frameworks and reporting guidance within the electrical contracting sector, particularly as ESG expectations expand across the construction supply chain.

**Table 2.** Comparison of significantly reported ESG actions for suppliers and contractors

<b>Suppliers (≥ 5/10 companies reported)</b>	<b>Suppliers and Contractors Reported Significantly</b>	<b>Contractors (≥ 4/9 companies reported)</b>
Reduction of water use / consumption	Reduces impact on wildlife during construction	Invests in installing EV charging stations
Decreased emissions by 3 scopes	Have a goal to decrease emissions	Employee volunteer service hours
Reduced hazardous waste	Safety in the workplace training	More representation of people of color
Increase in electric vehicle fleet	Focus / culture of inclusion	Commitment to employee safety
Researched sustainable technologies	Donations to communities and infrastructure	
Respects environmental policies and laws	Governing board to control leadership	
Increase battery storage capacity	Committee dedicated to risk management	
Contractors have safety / sustainability tests	Protects customer information	
Suppliers must agree to codes of conduct	Has a board / committee for sustainability	
Engages with local tribes / disadvantaged communities		
Donates to nonprofit organizations		
Wellness programs and initiatives		
Values workforce development		
Contributed to several political organizations		

While Table 1 summarizes the range of unique environmental actions identified, Table 2 narrows the analysis to the most frequently reported ESG actions across environmental, social, and governance dimensions. Thresholds were selected to highlight actions reported significantly by each subgroup (≥ 5 of 10 suppliers; ≥ 4 of 9 contractors), allowing comparison of commonly disclosed ESG actions while accounting for the smaller contractor sample size. The table identifies the actions most commonly disclosed by electrical suppliers and contractors, as individual subgroups, as well as those reported significantly by both groups. The ESG actions reported by electrical suppliers reveal a mature, policy-driven, and institutionally embedded approach to sustainability. The most frequently reported supplier actions, such as reductions in water use, emissions, and hazardous waste; investments in EV fleets and renewable energy infrastructure; and research into sustainable technologies, reflect a commitment to measurable, systemic environmental management. These actions are characteristic of organizations operating under substantial regulatory scrutiny and investor

oversight, where transparency and compliance are central to long-term corporate strategy. Suppliers' sustainability engagement appears to be motivated primarily by risk mitigation, regulatory alignment, and market positioning. Actions like establishing supplier codes of conduct, engaging local and disadvantaged communities, and supporting workforce wellness suggest that ESG is not only an environmental obligation but also a means of reinforcing social license and corporate legitimacy. Moreover, references to political contributions and advocacy indicate that suppliers are not passive participants but active shapers of the policy environment that governs sustainability in the energy sector. In meaning, supplier ESG practices reflect a strategic institutionalization of sustainability—an evolution from corporate responsibility to operational necessity. Their ESG activities are integrated across environmental, social, and governance dimensions, reinforcing both organizational resilience and stakeholder trust. This reflects the broader trend of ESG as a differentiator for reputation, risk management, and access to capital in regulated industries such as energy and utilities.

In contrast, the few ESG practices performed solely by electrical contractors indicate an emerging but less formalized integration of sustainability principles. The most common actions (installing EV charging stations, employee volunteer initiatives, improving workforce diversity, and maintaining strong safety commitments) illustrate a project-level, people-oriented approach rather than a fully developed corporate ESG framework. Contractor motivations appear to stem from client expectations, workforce values, and community relationships rather than investor or regulatory pressures. Operating within competitive, project-based markets, contractors often guide ESG actions by operational feasibility and contractual demands instead of institutionalized policy frameworks. The emphasis on safety, inclusion, and employee engagement seems to suggest how contractors interpret sustainability through the lens of human well-being and ethical workplace practice. This emerging form of ESG participation represents a bottom-up approach to sustainability, grounded in culture and practice rather than formal reporting systems. Contractors' efforts, though less comprehensive, are essential for operationalizing sustainability principles on the ground and complement the environmental and governance sophistication observed among suppliers, revealing interdependence across the electrical industry's sustainability ecosystem.

The shared ESG actions reported by both suppliers and contractors point to convergence in sustainability priorities across the electrical industry. Both groups frequently cited emission reduction goals, safety training, and cultures of inclusion, reflecting recognition of core sustainability values. Similarly, suppliers and contractors reported donations to communities and infrastructure, protection of customer data, and the establishment of governing or sustainability committees, signaling an evolving understanding of corporate governance and accountability. These overlapping practices suggest that sustainability in the electrical sector is shifting from fragmented, organization-specific initiatives toward alignment around key ESG principles. Importantly, this convergence reflects shared external pressures rather than uniform implementation, as suppliers and contractors face different regulatory, financial, and operational constraints. As a result, similar ESG priorities may be expressed through different mechanisms, levels of formalization, and reporting practices across the two groups. While suppliers tend to lead through compliance and strategic investment and contractors through people- and project-based practices, both contribute to a shared sustainability narrative grounded in environmental responsibility, safety, inclusion, and governance transparency. In meaning, these findings highlight contrasting ESG reporting approaches rather than divergent goals. Together, these dynamics illustrate the multi-scalar nature of sustainability implementation, combining systemic leadership from suppliers with grassroots engagement from contractors. Bridging these approaches can help achieve cohesive, industry-wide sustainability integration.

## Conclusions

This study reveals a distinct divide in ESG maturity, reporting capacity, and strategic integration between electrical suppliers and electrical contractors. Electrical suppliers' ESG activities, ranging from comprehensive emission reduction strategies to workforce development and community engagement, reflect both external pressures from investors and internal motivations to strengthen long-term corporate resilience. Suppliers have largely embedded ESG into governance and operational systems, positioning sustainability as a strategic necessity rather than a voluntary commitment. In contrast, electrical contractors are in the early stages of ESG adoption. Their actions tend to be operational, people-focused, and project-driven, emphasizing employee safety, inclusion, volunteerism, and participation in clean energy construction projects such as EV infrastructure. These findings suggest that contractors are implementing sustainability on the ground but lack the formalized structures, data management systems, and external accountability mechanisms that characterize supplier reporting, as reflected in publicly disclosed reports. As a result, ESG among contractors functions more as a cultural and ethical practice than a standardized strategic framework. These findings also suggest several practical implications. Industry leaders and professional associations could support contractors by developing reporting guidance and tools tailored to project-based firms with limited reporting capacity. Policymakers and standard-setters may also consider differentiated ESG reporting expectations that reflect the operational realities of construction and contracting organizations. Greater alignment between suppliers and contractors on reporting practices could improve transparency and strengthen sustainability integration across the electrical construction supply chain.

Despite these differences, the research identifies meaningful areas of convergence. Both suppliers and contractors frequently report emission reduction goals, workplace safety, inclusion, and governance transparency. These shared practices indicate that the electrical industry is transitioning from fragmented ESG initiatives toward integrated, cross-sector sustainability standards. The overlap also points to growing recognition of interdependence between suppliers and contractors, where suppliers provide systems, policies, and technologies that enable sustainability, and contractors translate those commitments into tangible project outcomes. Collectively, the findings suggest contrasting ESG reporting approaches between suppliers and contractors. While suppliers lead through compliance and strategic investment, contractors are developing bottom-up sustainability practices that bring human and operational dimensions to the forefront.

Viewed together, these patterns highlight ESG reporting capacity as a critical mediating factor between sustainability intent and sustainability visibility within the electrical construction industry. Differences observed between suppliers and contractors therefore reflect not only organizational priorities but also the structural conditions under which ESG information is generated, measured, and disclosed. Recognizing this distinction is essential for interpreting ESG maturity claims in project-based industries, where sustainability impacts may be substantial yet unevenly documented.

Because this study is qualitative, cross-sectional, and based exclusively on publicly available corporate ESG and sustainability reports, the analysis is limited to publicly disclosed actions rather than verified sustainability performance. As a result, contractors' project-level and installation-specific contributions, particularly those embedded within design, construction, and commissioning activities, may be underrepresented in corporate reporting. These constraints underscore the need for future research that more fully captures how sustainability is implemented, measured, and reported across the electrical construction supply chain. Future research should examine how alignment mechanisms between suppliers and contractors can be designed and implemented in practice, including the development of sustainability reporting frameworks tailored to construction and contracting contexts, the effectiveness of education and capacity-building initiatives for smaller firms, and the role of collaboration among utilities, contractors, and policymakers in shaping ESG adoption. In particular, triangulating corporate disclosures with project documentation, third-party ESG

datasets, and longitudinal reporting trends would enable a more comprehensive assessment of sustainability performance and its evolution over time. Ultimately, bridging supplier- and contractor-level approaches, by aligning reporting expectations, expanding access to ESG resources, and fostering industry-wide knowledge exchange, is necessary to help accelerate comprehensive sustainability integration across the electrical value chain. Such efforts can help transform ESG from a compliance-driven exercise into a unified practice that captures the full sustainability impact of the electrical construction industry.

### Acknowledgment

The authors used generative AI tools (ChatGPT 5.2) to assist with language editing and clarity improvements after the final research and draft of this manuscript was completed. All intellectual content, data interpretation, and conclusions are the authors' own.

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