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RESEARCH ARTICLE
Accounting

Challenges in Implementing IFRS S1 and IFRS S2: Evidence from the Turkish Electricity Generation Sector

IFRS S1 ve IFRS S2'nin Uygulanmasındaki Zorluklar: Türkiye Elektrik Üretim Sektöründen Bulgular

Neşegül Parlak [1]

ABSTRACT

The global transition toward sustainability reporting has accelerated following the introduction of IFRS S1 and IFRS S2 by the International Sustainability Standards Board (ISSB). This study examines the main challenges associated with implementing these standards in Türkiye's electricity generation sector, which is characterized by high carbon intensity and strict regulatory oversight. The electricity generation sector provides an important context for evaluating the applicability of sustainability reporting standards in emerging economies.

A qualitative, document-based research design was employed. Reports published by the IFRS Foundation, IOSCO, IAASB, and EFRAG between 2021 and 2024 were analyzed together with the 2023 sustainability reports of twelve electricity generation companies operating in Türkiye. The analysis focused on corporate capacity and governance, data measurement and consistency, assurance mechanisms, and digital reporting infrastructure.

The findings indicate progress toward alignment with IFRS S1 and IFRS S2 through the Turkish Sustainability Reporting Standards (TSRS). However, incomplete Scope 3 emissions data, reliance on limited assurance, and insufficient digital reporting infrastructure remain significant challenges. The study highlights the importance of strengthening corporate governance, improving data standards, and enhancing digital reporting systems.

Keywords: IFRS S1, IFRS S2, Sustainability Reporting, Assurance, Energy Sector.

ÖZET

Küresel ölçekte sürdürülebilirlik raporlaması, Uluslararası Sürdürülebilirlik Standartları Kurulu (ISSB) tarafından yayımlanan IFRS S1 ve IFRS S2 standartlarının yürürlüğe girmesiyle hız kazanmıştır. Bu çalışma, karbon yoğunluğu yüksek ve sıkı düzenlemelere tabi olan Türkiye elektrik üretim sektöründe bu standartların uygulanmasında karşılaşılan temel zorlukları incelemeyi amaçlamaktadır. Elektrik üretim sektörü, gelişmekte olan ekonomilerde sürdürülebilirlik raporlama standartlarının uygulanabilirliğini değerlendirmek açısından önemli bir örnek oluşturmaktadır.

Araştırmada nitel ve belge temelli bir yöntem kullanılmıştır. Bu kapsamda IFRS Foundation, IOSCO, IAASB ve EFRAG tarafından 2021–2024 yılları arasında yayımlanan raporlar ile Türkiye'de faaliyet gösteren on iki elektrik üretim şirketinin 2023 yılı sürdürülebilirlik raporları analiz edilmiştir. İnceleme kurumsal kapasite ve yönetişim, veri ölçümü ve tutarlılığı, güvence mekanizmaları ve dijital raporlama altyapısı boyutlarında gerçekleştirilmiştir.

Bulgular, Türkiye Sürdürülebilirlik Raporlama Standartları (TSRS) ile IFRS S1 ve IFRS S2'ye uyum sürecinde ilerleme sağlandığını göstermektedir. Ancak Scope 3 emisyon verilerindeki eksiklikler, sınırlı güvence uygulamaları ve yetersiz dijital raporlama altyapısı uygulamada önemli zorluklar yaratmaktadır. Çalışma, kurumsal yönetişimin güçlendirilmesi, veri standartlarının geliştirilmesi ve dijital raporlama altyapısının iyileştirilmesinin önemini vurgulamaktadır.

Anahtar Kelimeler: IFRS S1, IFRS S2, Sürdürülebilirlik Raporlaması, Güvence, Enerji Sektörü

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INTRODUCTION

The concept of sustainability has evolved beyond a mere understanding of environmental or social responsibility and has become one of the fundamental components of corporate strategies aimed at long-term value creation, risk management, and stakeholder trust. In addition to financial performance, the interaction of businesses with environmental, social, and governance (ESG) factors plays an increasingly decisive role in investor decisions and capital allocation processes (OECD, 2023).

In this context, sustainability reporting is not only a tool of corporate responsibility but also a strategic information system that influences financial resilience, market value, and competitiveness. Du Toit (2024, pp. 3–5) emphasizes that sustainability disclosures enhance investor confidence, reduce the cost of capital, and directly contribute to the firm's long-term value creation capacity. This transformation necessitates the systematic measurement of sustainability data, its comparability across entities, and its integration with financial information.

Globally, sustainability reporting had long been based on voluntary frameworks. Initiatives such as the Global Reporting Initiative (GRI), the Sustainability Accounting Standards Board (SASB), and the Task Force on Climate-related Financial Disclosures (TCFD) provided diverse focal points; however, this diversity eventually led to the

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problem of "framework multiplicity" (Goswami, Islam & Evers, 2023). Companies began to face uncertainty regarding which standard to adopt, which indicators to prioritize, and which criteria to use for disclosure.

To address this fragmented landscape, the International Sustainability Standards Board (ISSB) was established in 2021 and published the IFRS S1 and IFRS S2 standards in 2023 to create a "global baseline" for sustainability-related financial disclosures. IFRS S1 requires companies to disclose all sustainability-related risks and opportunities that could affect cash flows, access to finance, or the cost of capital (IFRS Foundation, 2023a), while IFRS S2 focuses specifically on climate-related "physical" and "transition" risks and calls for detailed emissions reporting (IFRS Foundation, 2023b).

However, several barriers remain in the national implementation of these standards. IOSCO (2021) highlights that regulatory differences, institutional capacity gaps, and varying assurance mechanisms across jurisdictions weaken consistency in IFRS S1–S2 applications. This challenge is particularly pronounced in energy-intensive sectors. The Turkish electricity generation sector represents a strategic area for testing the applicability of IFRS S1–S2, given its high carbon emissions, transition requirements toward renewable energy, and pressures from international financing mechanisms.

The Turkish Sustainability Reporting Standards (TSRS), together with KGK's Board Decision on their scope of application, represent a significant step toward establishing a national sustainability reporting framework aligned with ISSB standards (KGK, 2024). Nevertheless, sector-based assessments indicate the persistence of structural issues, including a lack of standardization in data collection processes, challenges in measuring Scope 3 supply chain emissions, limited XBRL-based digital reporting infrastructure, and insufficient assurance practices under ISAE 3000 (Revised) (KPMG Türkiye, 2024; EPDK, 2024).

Accordingly, this study aims to provide a comprehensive analysis of the institutional, technical, and assurance-related challenges faced by electricity generation companies in Turkey during the implementation of IFRS S1 and IFRS S2. It examines the alignment between ISSB's global standards and Turkey's national sustainability reporting framework introduced by KGK, including the TSRS and their implementation scope, while addressing the following core research question:

What institutional, technical, and assurance-related challenges do companies in the Turkish electricity generation sector face in implementing IFRS S1 and IFRS S2 standards?

By incorporating both international implementation experiences and sector-specific evidence from Turkey, this study bridges the technical framework of IFRS S1–S2 with real-world industry practices. It aims to generate policy-relevant and practitioner-oriented insights that can guide the future development of sustainability reporting in emerging markets.

CONCEPTUAL FRAMEWORK

This section discusses the conceptual foundations of sustainability reporting and its evolution within the context of international standards, highlighting methodological divergences among various reporting frameworks.

Evolution of Sustainability Reporting and Global Approaches

Sustainability reporting is based on the notion that corporate activities should be evaluated not only in terms of financial performance but also with respect to their environmental, social, and governance (ESG) impacts. The process of standardization at the corporate level began in the late 1990s with the Global Reporting Initiative (GRI) indicators and later expanded through the initiatives of the Sustainability Accounting Standards Board (SASB) and the Task Force on Climate-related Financial Disclosures (TCFD) (GRI, 2016; SASB, 2018; TCFD, 2017). However, this multiplicity of frameworks created confusion in practice, known in the literature as framework multiplicity (Goswami et al., 2023). The differing definitions of measurement, disclosure, and scope criteria for similar topics across standards have limited the comparability and reliability of sustainability data.

To address this problem, the International Financial Reporting Standards Foundation (IFRS Foundation) established the International Sustainability Standards Board (ISSB) in 2021 to bring global consistency to sustainability reporting. In 2023, the ISSB issued two key standards — IFRS S1: General Requirements for Disclosure of Sustainability-related Financial Information and IFRS S2: Climate-related Disclosures — introducing a "global baseline" approach that emphasizes investor-oriented, decision-useful financial information (IFRS Foundation, 2023a, 2023b).

IFRS S1 requires entities to disclose all sustainability-related risks and opportunities that could influence financial performance and cash flows. IFRS S2, in contrast, focuses on climate-specific disclosures, addressing physical and transition risks, greenhouse gas emissions (Scopes 1–2–3), and progress toward climate targets (IFRS Foundation,

2023b). Together, these standards are structured around four pillars of corporate strategy: governance, strategy, risk management, and metrics and targets.

Harmonization within the European Union and at the National Level

The European Union has adopted a distinct double materiality perspective in sustainability reporting, diverging from the IFRS S1–S2 single materiality focus. The European Sustainability Reporting Standards (ESRS), developed by the European Financial Reporting Advisory Group (EFRAG), require disclosures not only on the financial consequences of environmental and social impacts but also on their broader societal implications (EFRAG, 2023). In contrast, IFRS S1–S2 prioritize investor relevance and financial materiality. The coexistence of these two approaches has led to methodological inconsistencies in international practice.

In Turkey, this harmonization process has advanced through the introduction of the Turkish Sustainability Reporting Standards (TSRS) and KGK's related regulatory framework on their scope of application. Taken together, these developments suggest an effort to align the national sustainability reporting framework with both IFRS S1–S2 and broader European sustainability reporting requirements (KGK, 2024).

Assurance and Verifiability Dimension

The reliability of sustainability reporting depends not only on the scope of disclosed information but also on whether such information is subjected to independent verification and assurance processes. The International Auditing and Assurance Standards Board (IAASB) addressed this through ISAE 3000 (Revised), which provides the foundational framework for assuring non-financial information (IAASB, 2013). Furthermore, the ISSA 5000 standard, issued by IAASB in 2024, provides a more systematic structure for sustainability assurance and began to be supported with implementation materials in 2025 (IAASB, 2024).

According to IOSCO (2021), differences in assurance practices among countries reduce the comparability of sustainability information. In the Turkish context, the regulatory framework introduced by KGK suggests an effort to align national reporting practices with IFRS S1–S2 while preserving broader compatibility considerations related to the European reporting environment (KGK, 2024). Sectoral assessments further suggest that the practical implementation of this framework is shaped by firm-level reporting capacity and operational constraints (KPMG Türkiye, 2024).

Digital Reporting and Data Management

In 2024, the ISSB published the IFRS Sustainability Disclosure Taxonomy, which mandated XBRL-based data tagging in sustainability reporting, marking a major step toward fully digitalized disclosures (IFRS Foundation, 2024a, pp. 4–5). This system enables the integration of sustainability information with financial reports and facilitates machine-readability for investors and regulators.

However, Turkey's digital reporting infrastructure has not yet reached this level of maturity. Data from EPDK (2024) indicate that most energy generation companies still collect sustainability indicators manually. This limitation prevents the full realization of the IFRS S1 principles of data integrity and auditability.

Overall, sustainability reporting is being reshaped globally along three key axes: investor confidence, data comparability, and digital verifiability. The IFRS S1–S2 standards aim to embed sustainability-related information within the financial reporting ecosystem, establishing a transparent and verifiable structure that supports informed investment decisions (IFRS Foundation, 2023a).

Yet in developing economies, this integration remains constrained by institutional capacity gaps, limited digital infrastructure, and underdeveloped assurance mechanisms (IOSCO, 2021). In Turkey, these challenges are particularly evident in energy-intensive sectors. The electricity generation sector, characterized by high carbon intensity, mixed energy portfolios, renewable transition dynamics, and dependence on international financing, provides an appropriate testing ground for the practical applicability of IFRS S1–S2.

At this juncture, comparing the focus areas, materiality principles, assurance levels, and integration capacities of various sustainability reporting standards helps clarify the position of IFRS S1–S2. The following table presents a comparative analysis of IFRS S1 and S2 vis-à-vis TCFD, ESRS E1, and GRI frameworks.

Table 1: Comparison of Sustainability Reporting Standards

Dimension / Criterion	IFRS S1	IFRS S2	TCFD (2017)	ESRS E1 (2023)	GRI (2016)
Focus Area	All sustainability topics (investor perspective)	Climate-related risks and opportunities	Financial climate risks	Environmental and social impacts of climate change	ESG indicators
Objective	Integration with financial information	Linking climate risks to financial performance	Risk disclosure	Double materiality-based disclosure	Stakeholder-oriented reporting
Materiality	Single materiality	Single materiality	Financial	Double materiality	Impact materiality

			materiality		
Scope	All sustainability topics	GHG Scopes 1–3	Climate risks	Climate and energy	General ESG metrics
Mandatory Status	Global baseline	Global baseline	Voluntary guidance	Mandatory (EU CSRD)	Voluntary
Assurance Standard	ISAE 3000 (Revised)	ISAE 3410 (GHG)	None	Mandatory (CSRD)	Voluntary
Alignment / Integration	Compatible with ESRS & GRI	Fully aligned with TCFD	Covered by IFRS S2	Interoperable with IFRS S2	Alignable with IFRS / ESRS

Source: Author's compilation (2025)

As illustrated in Table 1, the IFRS S1–S2 standards adopt an investor-oriented single materiality perspective to enhance the quality of financial disclosures, whereas the ESRS E1 standard is grounded in the double materiality principle, encompassing both social and environmental impacts. This divergence creates reporting complexity, particularly for Turkish energy companies operating within the European Union (EFRAG, 2023). Conversely, the direct alignment of IFRS S2 with the TCFD structure enhances global comparability in climate risk disclosures. The GRI framework, meanwhile, remains predominantly stakeholder-oriented and voluntary (GRI, 2016).

From Turkey's standpoint, the KGK framework appears to reflect an effort to align TSRS with IFRS S1–S2 while preserving broader compatibility with ESRS-related expectations. Nonetheless, unless institutional capacity, digital infrastructure, and assurance mechanisms are strengthened, this reporting framework is unlikely to be fully realized in practice.

METHODOLOGY

This study employs a qualitative document analysis approach to examine the applicability of IFRS S1 and IFRS S2 in Turkey's electricity generation sector. The analysis draws on both international standard-setting materials and corporate sustainability-related reports and focuses on four interrelated dimensions: corporate governance and institutional capacity, measurement and data quality, assurance practices, and digital reporting infrastructure.

Research Design and Scope

The study was designed as a qualitative, document-based inquiry into the practical conditions shaping the implementation of IFRS S1 and IFRS S2 in an energy-intensive sector. Turkey's electricity generation sector was selected because of its relatively high exposure to climate-related disclosure requirements, its relevance for transition finance, and its importance within the broader sustainability reporting environment.

The analysis was conducted at two levels. At the international level, the study reviewed standards, guidelines, and policy materials issued between 2021 and 2024 by the IFRS Foundation, IOSCO, IAASB, IFAC, and EFRAG. At the national level, it examined KGK's 2024 regulatory framework concerning TSRS and their scope of application, sector reports published by EPDK, the SPK sustainability framework, TÜREB assessments, and sector-specific implementation materials.

Data Sources

The dataset was compiled from international standards, national regulatory documents, and corporate reports published between 2021 and 2024. This timeframe was selected because it captures the transition period surrounding the introduction and early implementation of IFRS S1 and IFRS S2.

International sources included IFRS Foundation (2023a, 2023b, 2024a), ISSB and EFRAG (2024), IAASB (2013, 2024), IOSCO (2021, 2023), and IFAC (2023). National sources included KGK (2024) documents concerning TSRS and their scope of application, EPDK (2024), SPK (2020), TÜREB (2024), and sector-specific implementation materials. These sources were selected with reference to recency, institutional relevance, transparency, and their relationship to IFRS- and ESRS-based reporting developments.

Sample and Data Type

The empirical dataset consists of the publicly available 2023 sustainability, integrated annual, and environmental performance reports of twelve electricity generation companies operating in Turkey. The sample was constructed through purposive sampling in order to reflect variation in ownership structure, operational profile, and energy source composition.

In broad terms, the sample included public enterprises, private renewable energy producers, and natural gas or thermal electricity producers. The purpose of this grouping was not statistical representativeness, but analytical variation across segments of the sector that may differ in reporting practices, organizational capacity, and exposure to climate-related disclosure requirements.

To be included in the sample, firms had to meet three conditions: first, they had to be actively engaged in electricity generation in Turkey; second, a publicly accessible 2023 sustainability-related report had to be available in PDF or HTML format; and third, the report had to contain sufficient disclosure on governance, environmental performance, emissions, or assurance practices to support IFRS S1–S2-oriented analysis. Reports that were primarily promotional, lacked substantive sustainability-related disclosure, or did not provide analyzable information were excluded. Although selected 2021–2022 reports were consulted for limited comparison and consistency checks, the 2023 reporting cycle served as the primary analytical base because it provided the most recent and broadly comparable disclosures during the early implementation phase of IFRS S1 and IFRS S2.

Company names are not reported individually because the aim of the study is to examine sector-level reporting patterns rather than evaluate or rank specific firms. Anonymization was therefore used to preserve analytical neutrality and to keep the discussion focused on recurring disclosure practices.

Coding Framework

The analysis was guided by a coding framework developed with reference to IFRS S1, IFRS S2, ISAE 3000 (Revised), ISSA 5000, and the related literature on sustainability reporting and assurance. The framework was organized around four analytical dimensions.

The first dimension, corporate capacity and governance, covered issues such as governance oversight, sustainability committees, ESG expertise, cross-departmental coordination, and reporting-related organizational capacity. The second dimension, measurement and data quality, focused on Scope 1, Scope 2, and Scope 3 emissions disclosure, methodological transparency, emission factor usage, and GHG Protocol alignment. The third dimension, assurance and verification mechanisms, included assurance level, reference to ISAE 3000 or ISSA 5000, internal audit involvement, traceability of evidence, and third-party verification practices. The fourth dimension, digital reporting infrastructure, covered ERP/SCADA integration, automated data mapping, XBRL readiness, digital verification tools, and reporting-related technical capacity.

These dimensions were used as a structured guide for reading and comparing both company reports and selected regulatory materials.

Analytical Procedure

Each report was reviewed in full, and the presence, absence, or partial presence of relevant disclosures was noted. In addition, brief indicator-level notes were prepared to retain contextual detail and support consistency across cases. These notes functioned as short analytical annotations rather than as formal scores.

For example, disclosures on Scope 3 emissions were distinguished according to whether they were supported by a clear methodological explanation, presented only partially, or not meaningfully reported. Governance-related disclosures were likewise distinguished according to whether formal oversight structures, indirect references, or no clearly stated governance mechanisms were identified. This procedure made it possible to consider not only whether a disclosure appeared, but also how specifically it was presented.

The identified disclosures were then compared across the sample in order to detect recurring implementation issues in Turkey's electricity generation sector.

For comparative interpretation, the coded disclosures were translated into descriptive counts and percentages. Percentages reported in the findings indicate the proportion of companies within the sample (n = 12) in which a given indicator was observed. Capacity levels presented in the tables were grouped descriptively using threshold-based categories: indicators identified in 75% or more of the sample were classified as high, those identified in 25% to 74% as medium, and those identified below 25% as low. These categories were used only for descriptive comparison and should not be interpreted as statistical inference.

Validity and Reliability

Validity was supported through the use of multiple document types and the comparative reading of international and national materials. The inclusion of documents published between 2021 and 2024 that are directly related to IFRS- and ESRS-based frameworks helped support conceptual consistency and analytical relevance.

Because the analysis was conducted by a single researcher, the study does not claim intercoder reliability. Instead, consistency was supported through the repeated application of the same analytical framework across all documents, the use of indicator-level notes, and repeated reading of the materials in their original formats. These steps were intended to reduce interpretive inconsistency and to maintain alignment between earlier and later coding decisions.

Where relevant, citations from IFRS and IAASB documents were referenced at the paragraph and page levels. Taken together, these procedures were intended to improve the transparency and traceability of the analysis within the limits of qualitative document-based research.

FINDINGS

The findings presented in this section should be understood as descriptive patterns derived from document analysis rather than as statistically generalizable results. The purpose is to identify recurring implementation issues observable in publicly available company disclosures and regulatory materials concerning the applicability of IFRS S1 and IFRS S2 in Turkey's electricity generation sector.

Corporate Capacity and Organizational Competence

The analysis suggests that the governance and data coordination structures envisaged by IFRS S1 are still developing in Turkey's electricity generation sector. Sectoral sources indicate that many companies continue to collect sustainability-related indicators through largely manual processes, while only a limited number appear to use integrated ERP- or SCADA-based systems (EPDK, 2024; KPMG Türkiye, 2024). This situation may constrain the implementation of the IFRS S1 requirement to disclose sustainability-related risks, opportunities, and associated financial effects in a systematic and decision-useful manner (IFRS Foundation, 2023a).

In addition, a notable share of firms appear not to have formal sustainability committees or clearly defined board-level oversight mechanisms dedicated to ESG-related matters.

Table 2: Corporate Capacity and Data Infrastructure in the Turkish Electricity Generation Sector

Indicators	High Capacity (≥ 75%)	Medium Capacity (25–74%)	Low Capacity (< 25%)	Average (%)
ERP/SCADA-based integrated data systems	2 companies	4 companies	6 companies	23
Sustainability committee or board representation	3	5	4	33
Data verification (internal audit or independent assurance)	2	6	4	38
Cross-departmental data coordination	3	5	4	41
ESG reporting training or expert staff	2	5	5	35
Annual budget allocation for sustainability reporting	1	4	7	28

Source: Author's compiled dataset (n = 12)

As indicated in Table 2, sustainability-related practices in the sector appear to remain concentrated at the operational level. Reporting processes are often managed by environmental or financial units, with more limited involvement from strategic decision-making structures. This pattern suggests that sustainability reporting is still evolving as an organizational function and may not yet be fully embedded in governance arrangements.

From the perspective of IFRS S1, these findings suggest the potential importance of stronger board oversight, clearer allocation of reporting responsibilities, and more formalized internal coordination mechanisms (IFRS Foundation, 2023a).

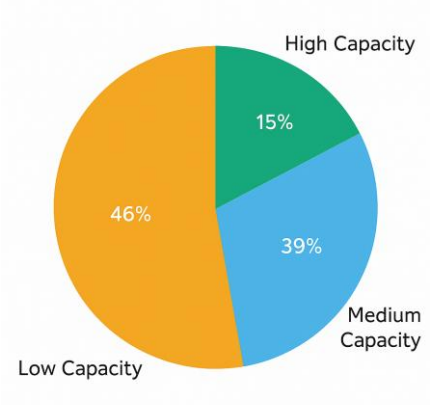

Figure 1: Distribution of Corporate Capacity Levels (%)
Source: Prepared by the author

Figure 1 indicates that overall corporate capacity in the sample remains uneven. Approximately 46% of firms fall into the low-capacity category, 39% into the medium-capacity category, and 15% into the high-capacity category. Although some firms appear to have developed more structured governance, internal audit, and assurance practices, the sector as a whole still seems to be in an early stage of institutional consolidation in sustainability reporting.

In sum, the sector remains in an early stage of sustainability management maturity, showing gradual yet steady progress toward institutional integration.

Measurement, Data Quality, and Reporting Consistency

The analysis indicates that greenhouse gas measurement and disclosure practices, particularly in relation to Scope 3 emissions, appear to constitute one of the main implementation challenges under IFRS S2. While most firms appear able to report Scope 1 emissions and, to a lesser extent, Scope 2 emissions, Scope 3 disclosures remain more limited and uneven (KPMG Türkiye, 2024). This appears to weaken methodological consistency between corporate reporting practices and the broader expectations of IFRS S2 and the GHG Protocol.

Differences were also observed in the choice of emission factors and calculation approaches. Some firms appear to rely on IPCC-based factors, while others refer to national conversion coefficients or sector-based data sources. Such variation may reduce comparability across firms and may also complicate the interpretation of climate-related metrics.

Table 3: Measurement Methods, Data Sources, and Challenges in IFRS S2 Implementation

Component	Implementation Status (n = 12)	Common Issue / Uncertainty	Relevant Standard or Source
Scope 1 (Direct Emissions)	12 companies (full measurement)	Differences by fuel type	IFRS S2 §29(a), GHG Protocol (2004)
Scope 2 (Indirect Energy Emissions)	10 companies	Annual variations in grid factors	IFRS S2 §29(b)
Scope 3 (Supply Chain Emissions)	4 companies (partial)	Data gaps, dependence on supplier declarations	IFRS S2 §29(c); IOSCO (2021)
Emission Factor Source	IPCC 2021 (5), TÜBİTAK (3), National Energy Data (4)	Incomparable methodologies	IPCC (2021), EPDK (2024)
Data Verification / Assurance	5 companies (ISAE 3000 Revised)	High cost of external assurance	IAASB (2024), ISSA 5000
GRI 305 Alignment	6 companies	Lack of systematic GRI–S2 mapping	GRI (2016), IFRS S2 §34

Source: Author's compiled dataset (n = 12)

Table 3 suggests that data quality and methodological alignment remain among the main constraints in the implementation of IFRS S2 across the sample. In particular, incomplete Scope 3 reporting and differences in emissions methodology appear to limit comparability and reduce the reliability of investor-oriented disclosures.

Figure 2: Scope 1–2–3 Data Disclosure Rates (%)
Source: GHG Protocol (2004); IFRS Foundation (2023b); KPMG Türkiye (2024); EPDK (2024); Author's dataset

Figure 2 shows that all companies in the sample disclosed Scope 1 emissions, while 83% disclosed Scope 2 emissions. By contrast, only 33% disclosed Scope 3 emissions in a meaningful way. This pattern may reflect the greater dependence of Scope 3 accounting on supplier information, external data availability, and verification capacity.

Taken together, these findings suggest that further progress in IFRS S2 implementation is likely to depend on more standardized emissions methodologies, clearer use of emission factors, and stronger verification practices, especially in relation to supply-chain data.

Materiality Approach and Scope Ambiguity

IFRS S1 and IFRS S2 are grounded in an investor-oriented single materiality perspective, under which disclosures focus on sustainability-related risks and opportunities that may affect financial performance (IFRS Foundation, 2023a, 2023b). By contrast, ESRS E1 reflects a double materiality approach that also considers environmental and social impacts in their own right (EFRAG, 2023).

In the Turkish context, the sustainability reporting framework introduced by KGK appears to combine an IFRS-oriented reporting logic with broader compatibility considerations related to the European regulatory environment

(KGK, 2024). This may be understood as an effort to preserve the investor-focused baseline of IFRS S1–S2 while maintaining a degree of responsiveness to ESRS-related expectations.

Sectoral patterns in the sample indicate that large public or joint-venture firms tend to emphasize financial materiality more explicitly, whereas private renewable energy producers appear somewhat more oriented toward impact-related disclosure. Although this pattern should be interpreted cautiously, it may reflect differences in ownership structure, stakeholder pressure, and reporting strategy.

Table 4: Comparison of Materiality Approaches: IFRS S1–S2 vs. ESRS E1

Criterion	IFRS S1–S2 (ISSB)	ESRS E1 (EFRAG)	KGK Framework on TSRS (Turkey, 2024)
Approach	Single materiality	Double materiality	Hybrid (aligned)
Focus	Investor-oriented financial information	Financial + environmental/social impact	Balance of national and EU requirements
Core Question	"Does this matter to investors?"	"Does this matter to society or the environment?"	"Is disclosure needed in both dimensions?"
Mandatory Status	Global baseline (voluntary → mandatory transition)	Mandatory under EU CSRD	Mandatory (KGK alignment)
Coverage	All sustainability risks and opportunities	Climate, energy, social impact	All sustainability topics
Implementation Interface	IFRS S1–S2 (TCFD-based)	ESRS E1 / GRI 305 interoperable	Proposed IFRS–ESRS mapping

Source: IFRS Foundation (2023a, 2023b); EFRAG (2023); KGK (2024); IOSCO (2023).

The findings suggest that, for firms operating in a setting shaped by both international capital market expectations and European sustainability requirements, a combined reporting logic may offer a practical reference point. At the same time, the analysis indicates that materiality determination remains weakly standardized in practice. Many firms do not appear to disclose detailed materiality matrices, methodological notes, or the criteria used to identify stakeholder priorities and reporting boundaries. This may limit transparency and reduce comparability across firms.

Assurance and Data Verification Mechanisms

The findings indicate that assurance practices in the sample remain relatively limited in scope. Most firms appear to rely on limited assurance engagements under ISAE 3000 (Revised), while only a very small number show signs of more advanced assurance arrangements. This suggests that sustainability verification is still developing institutionally rather than functioning as a fully integrated assurance system.

According to IFAC (2023) and IAASB (2024), one of the main constraints in this area concerns the integration of ESG-related data into internal information systems and the coordination between internal and external assurance functions. In the sample reviewed here, Scope 3 data in particular appear to rely heavily on supplier declarations, with limited third-party evidence. In addition, evidence chains for transition plans, targets, and progress indicators often appear incomplete.

Table 5: Sustainability Assurance Practices in Turkey's Electricity Generation Sector

Criterion	Implementation Rate (%)	Level / Method	Reference Standard or Source
Applied assurance standard	83	ISAE 3000 (Revised) – Limited assurance	IAASB (2013); IFAC (2023)
Reasonable assurance application	8	Pilot use of ISSA 5000	IAASB (2024)
Data verification method	42	SCADA/ERP data + external declarations	IFRS S2 §29–30
Scope 3 verification	25	Supplier surveys / insufficient third-party evidence	IOSCO (2023)
Inclusion of internal audit	33	ESG data excluded from financial audit scope	IFAC (2023)
Evidence chain	18	Lack of traceability	IFRS S2 §34; ISAE 3000 §90

Source: Author's compiled dataset (n = 12)

These results suggest that sustainability assurance in the sector remains at a relatively early stage of institutionalization. ESG-related data are still often treated separately from mainstream financial audit processes, which may weaken transparency, traceability, and investor confidence.

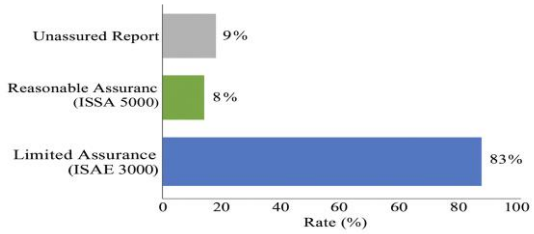

Figure 3: Distribution of Assurance Levels (%)
Source: Prepared by the author

Figure 3 is broadly consistent with this pattern and suggests that stronger evidence chains, greater internal integration, and improved professional capacity may be important for the gradual development of more robust assurance practices.

Digital Infrastructure and Technological Alignment

The IFRS Sustainability Disclosure Taxonomy introduced by the ISSB represents an important step toward machine-readable and digitally integrated sustainability reporting (IFRS Foundation, 2024a). However, the findings suggest that digital readiness in Turkey's electricity generation sector remains limited. Only a relatively small share of firms appear to use automated data mapping or more advanced digital reporting tools (TÜREB, 2024).

Table 6: Digital Alignment Indicators in Turkey's Electricity Generation Sector

Indicator	High (≥ 75%)	Medium (25–74%)	Low (< 25%)	Average (%)
XBRL-based reporting system	1	2	9	15
Data mapping automation	2	3	7	18
ERP/SCADA integration	3	5	4	39
Digital verification (blockchain/API)	1	2	9	14
XBRL awareness and training	3	4	5	35
Corporate digital training investment	2	4	6	28

Source: Author's compiled dataset (n = 12)

As shown in Table 6, digital transformation in sustainability reporting appears to remain at an early stage. Data collection is still largely manual, and more advanced forms of digital reporting, such as XBRL-based tagging and automated mapping, are visible only in a limited number of cases. This may constrain the implementation of data integrity and auditability principles associated with IFRS S1–S2.

Three recurring barriers appear to shape this pattern: limited institutional coordination, shortage of technical expertise, and the cost burden associated with digital transformation. These constraints suggest that digital reporting capacity is not merely a technical issue, but also an organizational and institutional one. Overall, the findings indicate that improvements in digital infrastructure are likely to play an important role in the future quality, traceability, and comparability of sustainability reporting practices in the sector.

CONCLUSION

This study examined the applicability of IFRS S1 and IFRS S2 in Turkey's electricity generation sector through a qualitative document analysis of international standards, national regulatory materials, and publicly available sustainability-related reports of twelve electricity generation companies. The analysis focused on corporate capacity, measurement and reporting consistency, materiality, assurance quality, and digital reporting infrastructure.

The findings suggest that Turkey has made visible progress toward aligning its sustainability reporting framework with international developments. At the same time, the practical implementation of IFRS S1 and IFRS S2 appears to remain uneven across the sector. Sustainability reporting still seems to be shaped largely by compliance-oriented practices; Scope 3 emissions disclosures remain incomplete and methodologically inconsistent in many cases; assurance practices appear to be limited in scope; and digital reporting systems remain relatively underdeveloped. Taken together, these factors may continue to affect comparability, assurance quality, and the overall usefulness of sustainability-related disclosures.

The study therefore indicates that Turkey's electricity generation sector may still be regarded as being in a transitional phase in the implementation of IFRS S1 and IFRS S2. While the regulatory framework has become more visible, the effectiveness of implementation is likely to depend on the gradual strengthening of institutional capacity, data practices, assurance arrangements, and digital infrastructure.

These findings also point to several implications for regulatory practice, firm-level implementation, and professional capacity development. The continued implementation of TSRS and related guidance may benefit from sustained alignment with IFRS S1 and IFRS S2 while maintaining interoperability with ESRS where relevant. At the firm

level, stronger governance structures, clearer internal responsibility for sustainability data, and greater digital integration may contribute to more consistent and reliable reporting practices. At the professional level, further development in sustainability assurance, data analytics, and digital reporting competencies may help address existing capability gaps.

This study contributes to the literature by linking the technical architecture of IFRS S1 and IFRS S2 with sector-specific implementation conditions in an emerging-market context. At the same time, its findings should be interpreted within the limits of qualitative document analysis and a purposive sample of twelve companies.

Future research may extend this analysis through cross-sectoral comparisons and longitudinal studies of reporting quality, assurance maturity, and digital reporting development. Overall, the findings suggest that the quality and credibility of sustainability reporting in Turkey are likely to depend not only on regulatory alignment, but also on the coordinated development of institutional, methodological, and technological capacity across firms and regulatory settings.

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