

THE ROLE OF ACCOUNTANTS IN CARBON ACCOUNTING TO SUPPORT ENERGY RESILIENCE AMID GLOBAL GEOPOLITICAL DYNAMICS

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Abstract:

This study examines the role of accountants in leveraging carbon accounting as a strategic instrument to support energy security amidst global geopolitical dynamics. A qualitative descriptive approach was employed through a systematic literature review guided by the PRISMA framework, with data collected from various international academic databases covering publications from 2021 to 2026. Articles were selected based on relevance, indexing quality, and methodological clarity. The findings indicate that carbon accounting has evolved from a compliance-oriented reporting tool to a strategic information system that supports environmental transparency, energy efficiency, and managerial decision-making. Accountants are shown to play an increasingly central role in transforming carbon data into actionable strategic insights, particularly in managing energy risks generated by geopolitical tensions. However, implementation in Indonesia remains constrained by limited integration between accounting and energy management systems, a weak regulatory framework, and inadequate sustainability competencies among accounting professionals. The study concludes that integrating carbon accounting with the strategic role of accountants is crucial for strengthening corporate energy security, and recommends further empirical research in high-emission and energy-intensive sectors to validate the proposed integrative framework.

Keywords: Carbon Accounting, Geopolitics, System Integration, Energy Security, Role of Accountants

INTRODUCTION

Over the past decade, rising geopolitical tensions have increasingly disrupted global energy markets. The Russia-Ukraine conflict since 2022, the US-China trade rivalry, the South China Sea dispute, and the Middle East conflict in early March 2026 involving the United States, Israel, and Iran have collectively driven sharp volatility in global energy prices (Saeri et al., 2023; Rizqi S, 2025; Kusuma, 2026). Indonesian crude oil prices surged dramatically from US\$68.79/barrel in February 2026 to US\$102.26/barrel in March 2026, an increase of US\$33.47/barrel consistent with previous projections that the Middle East conflict triggered a rise in global oil prices, a trade deficit, and domestic inflationary pressures (Mano, 2026; Riyanto et al., 2023). These conditions emphasize the urgency of carbon accounting as a tool to manage energy risks and support energy security amidst global geopolitical uncertainty (Oktaviani et al., 2026). Energy security itself extends beyond supply availability to encompass the system's capacity to adapt, withstand, and recover from external disruptions (Martišauskas et al. 2022), making it an increasingly important strategic concern for energy-dependent economies like Indonesia (Rizqi S, 2025; Kang et al., 2025).

Conceptually, carbon accounting can be defined as a systematic process for identifying sources of greenhouse gas emissions, measuring carbon footprints, recording emissions and energy



consumption data, and reporting it in the form of information that can be used for compliance, environmental accountability, and strategic decision making (Syam et al., 2024; Kaur et al., 2024). Thus, carbon accounting serves not only as an environmental reporting mechanism but also as a managerial tool for assessing a company's energy efficiency, environmental costs, emission risks, and decarbonization opportunities.

Carbon accounting has emerged as a crucial instrument in modern accounting practice, enabling organizations to measure, record, and report greenhouse gas emissions arising from operational activities such as fossil fuel combustion, industrial processes, and organic decomposition (Puspita et al., 2024). Syam et al., 2024. Bibliometric studies confirm a substantial increase in carbon accounting research in recent years, reflecting the growing global concern for sustainability (Kurniawan et al., 2022). Beyond its reporting function, carbon accounting has evolved into a strategic decision-making instrument as climate change mitigation (Kaur et al., 2024) and serves as a key procedure for inventorying greenhouse gases and integrating that information into budgeting and reporting systems (Marlowe & Clarke, 2022). The implementation of Environmental Management Accounting (EMA) has demonstrated positive contributions to energy efficiency and environmental performance (Rahman et al., 2024), while the integration of carbon accounting into management accounting has significant potential to improve operational efficiency (Kaur et al., 2024). In Indonesia, growing institutional commitment is evident, with the Indonesia Stock Exchange launching the "I'm a Net-Zero Hero" campaign on Earth Day, April 22, 2026, to accelerate low-carbon lifestyles and strengthen the IDX Carbon ecosystem. (Nityaryana, 2026) However, in practice, the implementation of carbon accounting is still largely limited to disclosure and regulatory compliance, with most organizations not yet integrating carbon information into managerial decision-making systems (Puspita et al., 2024).

Stakeholder theory (Freeman 1984; Freeman & Reed, 1983), legitimacy theory (Dowling & Pfeffer, 1975), Resource-Based View/RBV (Barney, 1991) and Dynamic Capability (Teece et al., 1997) Carbon accounting can be understood as a transparency mechanism and strategic capability that strengthens corporate legitimacy, reduces information asymmetry, which in turn strengthens investor confidence, and strengthens competitive resilience in an era of global uncertainty (Puspita et al., 2024). As a reinforcement of the literature, this study also refers to sustainability thinking, accounting that positions environmental reporting as a corporate accountability mechanism (Gray et al., 1996; Deegan, 2014).

Despite the growing body of knowledge, research on carbon accounting, management accounting, and energy security continues to develop separately. Carbon accounting studies largely focus on disclosure, energy security studies emphasize technical and policy dimensions, and the role of accountants remains primarily examined through the lens of environmental performance rather than energy security (Kang et al., 2025; Rahman et al., 2024). This fragmentation represents a clear research gap. Therefore, this study aims to analyze the role of accountants in utilizing carbon accounting as a strategic instrument for energy security amidst global geopolitical dynamics, using a Systematic Literature Review (SLR) guided by PRISMA 2020. The novelty of this study lies in its integrative framework that simultaneously examines carbon accounting, the strategic role of accountants, and energy security in the context of geopolitical uncertainty, which has largely not been discussed in previous literature. Specifically, this study discusses: (1) how carbon accounting research has developed in relation to energy security; (2) how accountants integrate carbon information into strategic decision-making; (3) how carbon accounting can support energy security amidst global geopolitical dynamics; and (4) what research gaps still need to be addressed regarding carbon integration, accounting, the role of accountants, and energy security.

METHODS

This study uses a descriptive qualitative approach through a systematic review of the literature guided by the PRISMA 2020 framework to identify, select, evaluate, and synthesize relevant literature on carbon accounting, the role of accountants, and energy security (Page et al., 2021; Ramayanti et al., 2023; Wahid & Kususiyanah, 2024). Data analysis was conducted through a combination of content analysis and analysis. analysis, thematic analysis, comparative analysis, and critical gap analysis, which enable researchers to categorize key findings, compare results across previous studies, and identify gaps in carbon accounting, the role of accountants, and energy security in the context of shifting global geopolitical dynamics.

Table 1. Sample Criteria

PRISMA Stage	Criteria Applied	Results
Identification	Articles were collected from <i>Google Scholar, Scopus, ScienceDirect, Emerald Insight, and SpringerLink</i> using keywords related to <i>carbon accounting; energy resilience; role of accountant; Environmental Management Accounting (EMA); sustainability; accounting; energy risk management.</i>	186 articles identified
Duplicate Removal	Duplicate articles, inaccessible files, and non-academic documents are removed from the database screening process.	145 articles remaining
Filtering	Titles and abstracts are filtered based on relevance to <i>carbon accounting, energy resilience; role of accountant, sustainability accounting;</i>	35 articles were selected for full-text review.
Eligibility	Full-text articles were assessed using the inclusion criteria: peer-reviewed journals, indexed in Scopus /Sinta, published between 2021 and 2026, available in full text, and containing clear research methods and findings.	25 articles deemed highly relevant
Inclusion	The final articles were selected based on direct relevance to the research focus, contribution to theoretical synthesis, and consistency with the study objectives related to carbon accounting and energy security.	19 articles were included in the main analysis

RESULT AND DISCUSSION

The following table summarizes previous studies related to carbon accounting, sustainability, energy security, and the role of accountants. This summary is used to identify research trends, compare previous findings, and identify research gaps addressed in this study.

Table 2. Summary of Selected Literature

No.	Author & Year	Article Title, Publisher & Index	Main Variables	Method	Key Findings
1	Martišauskas et al., 2022	<i>A Framework to Assess the Resilience of Energy Systems Based on Quantitative Indicators; Energies, MDPI; Scopus Q2</i>	<i>Energy system resilience indicators</i>	<i>Framework/modeling</i>	Energy system resilience can be meaningfully measured through capacity and performance indicators, which offer a solid basis for assessing how well an energy system is able to withstand disturbances.



2	Jasiūnas et al., 2021	<i>Energy System Resilience – A Review; Renewable and Sustainable Energy Reviews, Elsevier; Scopus Q1</i>	<i>Energy resilience, threat landscape</i>	<i>Literature review</i>	Energy resilience is fundamentally concerned with a system's capacity to withstand, adapt to, and recover from extreme disturbances. This perspective directly influences how geopolitical threats to energy security should be understood.
3	Kang et al., 2025	<i>Research Progress, Hot Spot Evolution and Future Directions of Energy System Resilience; Energy Reports, Elsevier; Scopus Q1</i>	<i>Energy resilience, bibliometrics</i>	<i>Bibliometric</i>	Research interest in energy security has grown substantially, with geopolitical dynamics and energy security emerging as increasingly prominent themes shaping future research directions.
4	Syam et al., 2024	<i>Carbon accounting: Its Implications on Accounting Practices and Corporate Sustainability Reports; International Journal of Economics and Financial Issues, Econjournals; Scopus Q3</i>	<i>Carbon accounting practice, sustainability report</i>	<i>Literature review</i>	Carbon accounting is having a real impact on how accounting practices are structured and how corporate sustainability reports are prepared, highlighting the increasingly important role of carbon accounting for accountants and reporting organizations.
5	Dharma et al., 2024	<i>Profitability and Market Value Effect on Carbon Emission Disclosures; International Journal of Energy Economics and Policy, Econjournals; Scopus Q2</i>	<i>Carbon emission disclosure, profitability, market value</i>	<i>Quantitative</i>	Market value has been shown to have a positive influence on carbon emissions disclosure, suggesting that financially stronger companies are more likely to be transparent about their environmental performance.
6	Puspita et al., 2024	<i>Carbon Emissions Accounting Disclosure; International Journal of Energy Economics and Policy, Econjournals; Scopus Q2</i>	<i>CEAD, corporate governance, media exposure</i>	<i>PLS-SEM</i>	Both corporate governance quality and media coverage were found to have a positive effect on carbon emissions accounting disclosure, indicating that external oversight plays an important role in promoting transparency among Indonesian companies.
7	Rahman et al., 2024	<i>Unveiling the Link Between EMA, Energy Efficiency, and Accountability;</i>	<i>EMA, energy efficiency,</i>	<i>PLS-SEM & fsQCA</i>	EMA has been shown to increase transparency and accountability in energy use, with evidence that

		<i>Environmental Challenges, Elsevier; Scopus Q1</i>	<i>accountability</i>		implementing EMA has resulted in measurable improvements in energy efficiency across a range of companies.
8	Sudarmaji et al., 2024	<i>Quantifying Drivers of GHG Emissions in ASEAN; International Journal of Energy Economics and Policy; Scopus Q2</i>	<i>GHG emissions, GDP, energy intensity</i>	<i>LMDI & ARIMAX</i>	Economic growth (GDP) and energy intensity were identified as the main drivers of CO2 emissions across ASEAN, underscoring the importance of energy economic dynamics in regional decarbonization efforts.
9	Oktaviani et al., 2026	<i>Do Carbon Exchanges Make a Difference to Carbon Disclosure and Performance?; Journal of Risk and Financial Management, MDPI; Scopus Q2</i>	<i>Carbon exchange, disclosure, performance</i>	<i>Wilcoxon & DID</i>	Participation in the carbon exchange market has been shown to have a positive impact on the quality of carbon disclosure and overall carbon performance, demonstrating the role of market mechanisms in encouraging more substantial environmental accountability in Indonesia.
10	Kiswanto et al., 2023	<i>Twelve Years Research Journey of Carbon accounting; International Journal of Energy Economics and Policy; Scopus Q2</i>	<i>Carbon accounting, bibliometrics</i>	<i>SLR / content analysis</i>	Carbon accounting research has advanced rapidly over the past twelve years, but accountability frameworks remain underdeveloped, reflecting a continuing gap between reporting sophistication and true managerial integration.
11	Yadiati et al., 2024	<i>Exploring Carbon Disclosure Research for Future Research Agenda; International Journal of Energy Economics and Policy; Scopus Q2</i>	<i>Carbon disclosure, bibliometrics</i>	<i>Bibliometrics</i>	Carbon disclosure studies continue to evolve around four dominant clusters: strategies, determinants, qualities, and consequences, with the field still offering ample room for future empirical and theoretical development.
12	Silaban & Sitorus, 2025	<i>Leveraging Renewable Energy and ESG for a Sustainable Future; International Journal of Energy Economics and Policy; Scopus Q2</i>	<i>Renewable energy, ESG, green accounting, carbon emission management</i>	<i>SEM</i>	Green accounting is shown to mediate the relationship between ESG practices, renewable energy adoption, and carbon emissions management, confirming that accounting plays a bridging role in linking

13	Dalle et al., 2021	<i>The Influence of AIS and Energy Consumption on Carbon Emissions; International Journal of Energy Economics and Policy; Scopus Q2</i>	<i>AIS, energy consumption, carbon emission</i>	<i>PLS-SEM</i>	sustainability commitments to environmental outcomes. Accounting information systems (AIS) and energy consumption both have significant links to carbon emissions, highlighting the potential of information systems in supporting carbon monitoring and energy management decision-making.
14	Kaur et al., 2024	<i>The Concept of Carbon Accounting in Manufacturing Systems and Supply Chains; Energies, MDPI; Scopus Q2</i>	<i>Carbon accounting, manufacturing, supply chain</i>	<i>Systematic review / PRISMA</i>	standardized and integrated framework; current practices remain fragmented, leaving organizations without reliable tools for consistent and comparable emissions tracking.
15	Kurniawan et al., 2022	<i>Bibliometric Analysis of Carbon Accounting Research; International Journal of Energy Economics and Policy; Scopus Q2</i>	<i>Carbon accounting, bibliometrics</i>	<i>Bibliometric</i>	Carbon accounting as a research field is on an upward trajectory, with emissions reporting and disclosure consistently emerging as the most active thematic area in the literature.
16	Flouros et al., 2022	<i>Geopolitical Risk as a Determinant of Renewable Energy Investments; Energies, MDPI; Scopus Q1/Q2</i>	<i>Geopolitical risk, renewable energy investment</i>	<i>Quantitative / panel</i>	Geopolitical risk has been shown to have a statistically significant negative effect on renewable energy investment, underscoring how political instability can hinder the flow of capital needed for a clean energy transition.
17	Zhao & Huang, 2024	<i>How Does Geopolitical Risk Affect Renewable Energy Development?; Energies, MDPI; Scopus Q2</i>	<i>Geopolitical risk, renewable energy, energy security</i>	<i>Quantitative/c onceptual</i>	High geopolitical risks have been shown to hamper renewable energy development and pose broader challenges to energy security, reinforcing the need for resilience-oriented strategies that account for political volatility in energy planning.
18	De Villiers et al., 2025	<i>Accounting and Renewable Energy Integration for Sustainability; Business Strategy and</i>	<i>Accounting, auditing, and renewable energy</i>	<i>Review /SLR</i>	Accounting and audit functions were identified as critical to managing the renewable energy transition, with the study calling for

		<i>the Environment, Wiley; Scopus Q1</i>			greater integration between accounting practices and sustainability-oriented energy strategies.
19	Hazaea et al., 2023	<i>Carbon accounting Research Development; Frontiers in Energy Research; Scopus Q2</i>	<i>Carbon accounting, research, and development</i>	<i>Review / bibliometric</i>	Carbon accounting research is growing in both scope and sophistication, with energy and sustainability themes gaining prominence and signaling the field's increasing relevance to corporate strategy and environmental governance.

Source: Processed Data 2026

Carbon Accounting and the Development of Environmental Issues. A literature synthesis reveals that carbon accounting has evolved from a narrow emissions reporting practice to a broader environmental accounting instrument encompassing the measurement, recording, disclosure, and control of corporate carbon emissions (Syam et al. 2024; Kaur et al. 2024; Kiswanto et al., 2023). This development is driven by growing concerns about climate change, rising carbon emissions, and increasing demands for environmental transparency, all of which have forced organizations to incorporate carbon-related information into their business and sustainability reports (Puspita et al., 2024; Dharma et al., 2024; Yadiati et al., 2024).

The findings of this study indicate that carbon accounting is still widely treated as a compliance and reporting tool rather than as a strategic information system capable of providing information for managerial decision-making. This gap reflects the distance between carbon accounting's potential as an emissions control mechanism and the prevailing corporate tendency to pursue external legitimacy (Puspita et al., 2024; Dharma et al., 2024; Oktaviani et al., 2026).

Carbon Accounting and Energy Security. In the context of energy security, carbon accounting has significant relevance, as energy emissions and consumption data can be used to assess operational efficiency, energy-related risks, and the requirements for transitioning to a low-carbon energy system (Rahman et al. 2024; Sudarmaji et al., 2024; Kaur et al., 2024). Although geopolitical dynamics are not the primary focus of this study, they are positioned as external factors that pose significant energy risks to organizations.

Energy security goes beyond mere availability of supply, but also encompasses the capacity of a system to withstand, adapt to, and recover from external disturbances such as geopolitical conflict, energy price volatility, and shifting global policy frameworks (Jasiūnas et al. 2021; Martišauskas et al. 2022; Kang et al., 2025). In this context, carbon accounting can help organizations identify sources of emissions, evaluate their dependence on fossil fuels, and develop more measurable energy efficiency strategies (Rahman et al. 2024; Sudarmaji et al., 2024; Silaban & Sitorus, 2025).

This synthesis further reveals that existing research on energy security still largely focuses on the technical and policy dimensions, with its intersection with accounting largely underexplored. Therefore, integrating carbon accounting with energy security is crucial, as carbon-related information can serve as a basis for decision-making aimed at reducing energy costs, increasing efficiency, and managing corporate energy risks (Marlowe & Clarke, 2022; Rahman et al., 2024; Kaur et al., 2024).



The Role of Accountants in Supporting Sustainability. Analysis shows that the role of accountants has undergone a significant shift, moving from an administrative function to more strategic responsibilities that include processing carbon data, preparing sustainability reports, and supporting environmentally sound decision-making (Syam et al., 2024; Rahman et al., 2024; Kaur et al., 2024). Accountants are increasingly positioned as intermediaries who translate technical energy and emissions data into actionable business insights related to efficiency, energy risk, and sustainability strategies.

This role is crucial because carbon accounting requires not only record-keeping skills but also the ability to interpret emissions data, conduct environmental cost analyses, and present relevant information for decision-making to management and stakeholders (Syam et al., 2024; Rahman et al., 2024; Maulita et al., 2024). Thus, accountants are well-positioned to act as strategic advisors who help organizations integrate sustainability targets, energy efficiency goals, and business resilience into an integrated information system (Marlowe & Clarke, 2022; Kaur et al., 2024; Oktaviani et al., 2026).

Implementation Challenges in Indonesia. The implementation of carbon accounting in Indonesia faces significant challenges, particularly the limited integration between accounting systems, energy management systems, and corporate sustainability reporting frameworks (Puspita et al., 2024; Syam et al., 2024; Oktaviani et al., 2026). These limitations stem from inadequate alignment between accounting and energy management systems, a lack of strategic competency among accountants in handling environmental data, and the absence of strong regulatory pressure to encourage the strategic implementation of carbon accounting.

Carbon emissions disclosure practices in Indonesia remain largely voluntary, despite increasing pressure from governance mechanisms, the media, regulators, and emerging carbon markets (Puspita et al., 2024; Dharma et al., 2024; Oktaviani et al., 2026). This situation underscores the need for a stronger regulatory framework, enhanced accountant competency, and stricter carbon reporting standards, so that carbon accounting can go beyond its current role as a compliance instrument and actively support the country's broader energy transition strategy (Syam et al., 2024; Rahman et al., 2024; Kaur et al., 2024).

Research Gaps and Future Research Directions. The main research gap identified in this study lies in the persistent fragmentation between the fields of carbon accounting, management accounting, the role of accountants, and energy security. The majority of previous studies have concentrated on carbon reporting and disclosure, while research explicitly linking carbon accounting to energy efficiency, energy risk, and energy security in the context of global geopolitical dynamics remains limited (Puspita et al., 2024; Rahman et al. 2024; Kang et al., 2025). Therefore, future research should aim to develop empirical models that test the relationships between carbon accounting, the role of accountants, energy efficiency, and corporate energy security, with particular attention to sectors characterized by high energy intensity and significant carbon emissions (Sudarmaji dkk, 2024; Kaur et al., 2024; Oktaviani et al., 2026).

CONCLUSION

Based on a literature synthesis, this study concludes that carbon accounting serves as a strategic information system to support energy security, a role that is increasingly important as global geopolitical dynamics pose risks to energy prices, supply, and sustainability. Through carbon accounting, companies can identify emission sources, assess energy efficiency, control environmental costs, and formulate more measurable decarbonization strategies. This study also confirms that accountants play a central role in transforming carbon data into actionable information



for managerial decision-making, making it crucial for accountants to develop competencies in sustainability accounting, environmental management accounting, energy risk analysis, and sustainability assurance. Further research is recommended to conduct empirical testing in the energy, manufacturing, transportation, and other energy-intensive sectors to assess the extent to which carbon accounting is truly applied in corporate energy efficiency and energy security decision-making.

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