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CARBON TAX ANTICIPATION, ESG DISCLOSURE, AND FINANCIAL ACCOUNTABILITY IN INDONESIA: EVIDENCE FROM IDXCARBON-LISTED ENERGY PROJECTS

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Abstract

This study examines how Indonesia's anticipated carbon tax is reflected in environmental accounting, ESG disclosure, and audited financial reporting in high-emission state-owned energy enterprises. Using qualitative content analysis, the study triangulates sustainability reports and audited financial statements of PT PLN (Persero) and PT Pertamina (Persero) for 2022–2025 with IDXCarbon project data listed between July 2024 and April 2025. It also applies an adapted ESG risk assessment based on publicly available disclosures, focusing on carbon transition exposure and management quality. The findings show that seven IDXCarbon-listed projects generated simulated cumulative carbon tax exposure of IDR 95.49 billion, calculated using the statutory minimum rate of IDR 30,000 per ton of CO_2e. However, this exposure is not explicitly recognised as provisions or disclosed as contingent liabilities in the examined financial statements. The evidence indicates a gap between emissions disclosure, carbon market participation, and financial accountability. The study contributes project-level evidence from Indonesia's emerging carbon market and highlights the need for clearer disclosure guidance, stronger carbon accounting, and closer alignment between ESG reporting and audited financial reporting for regulators, auditors, investors, and energy firms.

Keywords: carbon tax, carbon accounting, ESG disclosure, financial accountability, IDXCarbon

Abstrak

Penelitian ini mengkaji bagaimana antisipasi pajak karbon di Indonesia tercermin dalam praktik akuntansi lingkungan, pengungkapan ESG, dan pelaporan keuangan audit pada badan usaha milik negara sektor energi beremisi tinggi. Dengan analisis isi kualitatif, penelitian ini menelaah laporan keberlanjutan dan laporan keuangan audit PT PLN (Persero) dan PT Pertamina (Persero) periode 2022–2025 serta data proyek IDXCarbon yang terdaftar pada Juli 2024–April 2025. Penelitian ini juga menggunakan penilaian risiko ESG adaptif berbasis informasi publik, dengan fokus pada eksposur transisi karbon dan kualitas pengelolaan. Hasil penelitian menunjukkan bahwa tujuh proyek yang dianalisis menghasilkan simulasi eksposur kumulatif pajak karbon sebesar Rp95,49 miliar, dihitung dari tarif minimum Rp30.000 per ton CO_2e. Namun, eksposur tersebut belum secara eksplisit diakui sebagai provisi atau diungkapkan sebagai liabilitas kontinjensi dalam laporan keuangan. Temuan ini menunjukkan adanya kesenjangan antara pengungkapan emisi, partisipasi pasar karbon, dan akuntabilitas finansial. Secara empiris, studi ini memberikan bukti tingkat proyek dari pasar karbon awal Indonesia dan memperjelas batas antara pengungkapan keberlanjutan dan pengakuan akuntansi formal perusahaan. Penelitian ini menegaskan perlunya pedoman pengungkapan yang lebih jelas, penguatan akuntansi karbon, serta integrasi ESG dengan pelaporan keuangan audit.

Kata kunci: pajak karbon, akuntansi karbon, pengungkapan ESG, akuntabilitas finansial, IDXCarbon

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INTRODUCTION

Climate change has become a defining policy and accounting issue for governments, firms, and investors. Its consequences are no longer limited to environmental degradation, but also extend to fiscal policy, corporate risk management, investment decisions, and public accountability. In response, many countries have introduced market-based instruments to internalise the external costs of greenhouse gas (GHG) emissions. Carbon taxes and emissions trading systems have become the most widely used instruments because they translate emissions into economic signals that can influence corporate behaviour and investment choices. The World Bank's *State and Trends of Carbon Pricing 2025* reports that 80 carbon pricing instruments were in operation worldwide, indicating the growing role of carbon pricing in climate governance (World Bank, 2025). Within this policy landscape, the carbon tax is especially relevant because it directly links emissions with fiscal obligations and therefore raises important questions for corporate accounting and financial reporting.

In Indonesia, carbon pricing gained formal legal basis through Law No. 7 of 2021 on the Harmonization of Tax Regulations, which introduced a carbon tax framework with a statutory minimum rate of IDR 30 per kilogram of CO_2 equivalent. The policy was initially directed at coal-fired power plants through a cap-and-tax mechanism, while broader implementation across high-emission sectors remains gradual and dependent on regulatory, administrative, and market readiness (Government of Indonesia, 2021; Ministry of Finance of the Republic of Indonesia, 2021). Indonesia has also developed carbon market infrastructure through the launch of IDXCarbon in 2023, which provides an institutional platform for carbon trading and supports the country's transition toward a more formal carbon pricing ecosystem (Indonesia Stock Exchange, 2023). However, the phased nature of carbon tax implementation creates an important unresolved issue: whether firms are beginning to incorporate potential carbon-related fiscal exposure into their accounting systems, or whether they continue to treat it mainly as a sustainability disclosure matter.

From an accounting perspective, the relevance of a carbon tax depends not only on its statutory rate or policy design, but also on whether carbon-related exposure is recognised, measured, or disclosed in corporate reporting. Under IAS 37 and PSAK 57, a provision is recognised only when there is a present obligation, a probable outflow of economic resources, and a reliable estimate of the obligation. If these criteria are not met, carbon-related exposure may instead be considered for disclosure as a contingent liability, depending on its likelihood and materiality. Therefore, in Indonesia's current pre-enforcement context, the absence of recognised carbon tax liabilities does not necessarily indicate non-compliance. It may reflect the fact that the tax has not yet become fully enforceable across sectors. Nevertheless, the absence of disclosure may still limit the usefulness of financial statements for stakeholders seeking to assess climate-related fiscal risk. This issue has become more important following the issuance of IFRS S1 and IFRS S2, which strengthen expectations that sustainability-related and climate-related risks should be disclosed when they are material to users of general-purpose financial reports (IFRS Foundation, 2023a, 2023b).

Environmental accounting is central to this issue because it connects environmental performance with financial accountability. In the context of carbon taxation, emissions are not merely technical or environmental data; they may become the basis for future fiscal obligations. Environmental accounting, therefore, provides a mechanism through which emissions,

environmental costs, and climate-related liabilities can be identified, measured, and communicated in corporate reports (Tjoa & Widianingsih, 2022; Saxena & Verma, 2025). In Indonesia, this concern is also linked to the broader sustainable finance agenda, particularly POJK No. 51/POJK.03/2017, which requires financial institutions, issuers, and public companies to strengthen the integration of sustainability principles into business and reporting practices (Otoritas Jasa Keuangan, 2017). When connected with Environmental, Social, and Governance (ESG) frameworks, environmental accounting can improve transparency and support investor assessment of climate-related risks. However, when ESG reporting remains largely narrative and detached from audited financial statements, it may strengthen corporate legitimacy without necessarily improving fiscal accountability.

Existing studies on carbon taxation, environmental accounting, and ESG disclosure have developed in relatively separate directions. Carbon tax research has mainly examined policy design, implementation challenges, economic impacts, and revenue potential (Nugraha & Balogun, 2022; Matheus et al., 2023; Yoshimori, 2024). ESG studies have largely focused on disclosure quality, firm value, financial performance, and investor perception (Alsayegh et al., 2020; Gillan et al., 2021; Xaviera & Rahman, 2023). Meanwhile, environmental accounting research has paid attention to environmental costs, carbon accounting, and sustainability reporting, but has given less attention to how anticipated carbon tax exposure is reflected in audited financial statements, particularly in emerging economies where carbon regulation is still developing. This creates a gap in the literature: it remains unclear whether firms treat carbon tax anticipation as a matter of financial accountability or merely as part of broader sustainability communication.

This study addresses that gap by examining how the anticipated implementation of Indonesia's carbon tax is reflected in environmental accounting practices and ESG disclosures in high-emission sectors. The study focuses on two state-owned enterprises, PT PLN (Persero) and PT Pertamina (Persero), because both occupy strategic positions in Indonesia's energy sector and are directly exposed to the country's carbon pricing agenda. Their sustainability reports, audited financial statements, and involvement in carbon market-related mechanisms provide a relevant basis for analysing the relationship between emissions disclosure, ESG narratives, and financial reporting. Using qualitative content analysis, this study triangulates sustainability reports, audited financial statements, policy documents, and IDXCarbon project data to assess whether carbon tax exposure is reflected only in sustainability narratives or also in formal accounting disclosures.

The study is guided by the following research question: How is the anticipated implementation of the carbon tax influencing environmental accounting practices and ESG disclosures in Indonesia's high-emission sectors? This question is examined through the lens of legitimacy theory. The theory is relevant because firms facing environmental regulation may use sustainability disclosure to maintain social acceptance and respond to stakeholder expectations. However, the key issue examined in this study is whether such disclosure is accompanied by substantive financial accountability. In other words, the study does not treat ESG disclosure as sufficient evidence of climate accountability, but investigates the gap between what firms communicate in sustainability reports and what they recognise or disclose in audited financial statements.

This study contributes to the literature in three ways. Empirically, it provides early evidence from Indonesia's emerging carbon market on how carbon tax anticipation is reflected in corporate reporting before full policy enforcement. Theoretically, it extends legitimacy theory by showing how

ESG disclosure may function as a legitimacy-oriented response when carbon-related fiscal exposure is not yet formally recognised in financial statements. Practically, it offers insights for regulators, accounting standard-setters, auditors, investors, and corporate decision-makers who seek to align carbon pricing policy with transparent financial governance. The remainder of this paper is organised as follows. The next section reviews the relevant literature and theoretical framework. The following section explains the research method. The results and discussion are then presented, followed by the conclusion, policy implications, limitations, and suggestions for future research.

LITERATURE REVIEW

Carbon Tax as a Market-Based Environmental Instrument

A carbon tax is a price-based environmental policy instrument that assigns a monetary cost to greenhouse gas emissions, usually calculated per ton of CO_2 equivalent. Its main purpose is to internalise the negative externalities of carbon-intensive activities and encourage firms to reduce emissions through efficiency, fuel switching, and low-carbon investment (Tsai, 2020; Yoshimori, 2024). Unlike emissions trading systems, which rely on quantity limits and tradable permits, a carbon tax provides clearer price signals for corporate planning and investment decisions.

In Indonesia, the carbon tax was introduced through Law No. 7 of 2021 on the Harmonization of Tax Regulations, with a minimum rate of IDR 30 per kilogram of CO_2 equivalent. The policy adopts a cap-and-tax mechanism and was initially directed at coal-fired power plants, while broader implementation across high-emission sectors remains gradual (Government of Indonesia, 2021; Matheus et al., 2023). This transition is also supported by the establishment of IDXCarbon as part of Indonesia's emerging carbon market infrastructure. However, the gradual enforcement of the policy creates uncertainty over how firms should anticipate and report potential carbon tax exposure.

Although carbon taxation has strong policy relevance, its effectiveness depends not only on legal design but also on corporate readiness to measure, manage, and disclose carbon-related exposure. Previous studies have discussed implementation challenges such as administrative readiness, emissions measurement, industry resistance, and competitiveness concerns (Rachmany, 2020; Nugraha & Balogun, 2022; Deloitte, 2022). Yet, less attention has been given to how firms translate anticipated carbon tax exposure into environmental accounting practices and audited financial reporting.

Environmental Accounting and Financial Accountability

Environmental accounting refers to the process of identifying, measuring, and reporting environmental costs, emissions, and environment-related obligations within corporate accounting systems. It includes both physical information, such as emissions and energy use, and monetary information, such as compliance costs, environmental liabilities, and green investments (Schaltegger & Burritt, 2000; Tjoa & Widianingsih, 2022). In the context of carbon taxation, environmental accounting is important because emissions may become the basis for future fiscal obligations.

The accounting treatment of carbon tax exposure is closely related to IAS 37 and PSAK 57 on provisions and contingent liabilities. A provision is recognised only when there is a present obligation, a probable outflow of economic resources, and a reliable estimate of the obligation. If

these criteria are not met, disclosure as a contingent liability may still be relevant when the exposure is material. Therefore, in Indonesia's pre-enforcement context, the absence of recognised carbon tax liabilities may be understandable, but the absence of any disclosure may reduce the usefulness of financial statements for assessing climate-related fiscal risk.

Recent reporting developments strengthen the need to connect sustainability information with financial accountability. IFRS S1 requires disclosure of material sustainability-related risks and opportunities, while IFRS S2 focuses specifically on climate-related risks and opportunities (IFRS Foundation, 2023a, 2023b). GRI 305 also provides guidance for reporting greenhouse gas emissions, including Scope 1, Scope 2, and Scope 3 emissions (GRI, 2016). In Indonesia, POJK No. 51/POJK.03/2017 reinforces the sustainable finance agenda by requiring financial institutions, issuers, and public companies to integrate sustainability principles into business and reporting practices. However, many Indonesian firms still disclose emissions mainly in sustainability reports, with limited connection to audited financial statements, provisions, contingent liabilities, or carbon-related fiscal exposure (Meidijati & Augustine, 2022; Indarto & Ani, 2023).

ESG Disclosure, SDGs, and Legitimacy Theory

Environmental, Social, and Governance (ESG) disclosure has become a major framework for communicating corporate sustainability performance. ESG information is increasingly used by investors to assess long-term risk, resilience, and value creation (Gibson et al., 2020; Gillan et al., 2021). In Indonesia, ESG practices have gained momentum through sustainable finance regulation, investor demand, and ESG-related market indices. Prior studies suggest that ESG performance may be associated with firm value and financial performance, although the relationship varies across firms, sectors, and measurement approaches (Xaviera & Rahman, 2023; Masyitoh et al., 2024).

ESG disclosure is also related to the Sustainable Development Goals, particularly SDG 13 on Climate Action, SDG 12 on Responsible Consumption and Production, and SDG 9 on Industry, Innovation, and Infrastructure (Aji & Kartono, 2022). Carbon taxation can support these goals by encouraging emissions reduction and mobilising resources for climate transition. However, ESG disclosure should not automatically be treated as evidence of substantive accountability. Firms may provide extensive sustainability narratives while giving limited information about the financial consequences of carbon regulation.

This issue can be explained through legitimacy theory. The theory suggests that firms use disclosure to maintain social acceptance and respond to stakeholder expectations, especially when they operate in environmentally sensitive sectors (Suchman, 1995; Deegan, 2019). In the context of carbon taxation, ESG disclosure may represent a substantive accountability practice when it is supported by measurable emissions data, risk governance, and financial disclosure. Conversely, it may function as symbolic legitimacy when firms communicate environmental commitments without explaining the fiscal implications of carbon-related exposure.

Taken together, the literature shows a clear gap. Carbon tax studies tend to focus on policy design and implementation challenges, environmental accounting studies often examine emissions and environmental costs, while ESG studies emphasise disclosure and stakeholder communication. Fewer studies examine whether anticipated carbon tax exposure is reflected not only in sustainability narratives but also in formal accounting disclosure. This study addresses that gap by

analysing the relationship between carbon tax anticipation, ESG disclosure, and financial accountability in Indonesia's emerging carbon pricing regime.

RESEARCH METHODS

This study employs a qualitative research design using content analysis to examine how the anticipated implementation of Indonesia's carbon tax is reflected in environmental accounting practices, ESG disclosures, and audited financial reporting. A qualitative approach is appropriate because the study aims to interpret corporate disclosure practices rather than test statistical relationships. Content analysis enables the study to compare sustainability narratives with financial reporting evidence in a regulatory context where carbon tax implementation remains gradual and has not yet been fully enforced across sectors (Krippendorff, 2018; Neuendorf, 2017).

The analysis is grounded in environmental accounting and legitimacy theory. Environmental accounting is used to assess whether emissions and carbon-related information are translated into financial reporting practices, while legitimacy theory helps explain how firms may use ESG disclosure to respond to regulatory and stakeholder expectations. To assess financial accountability, the study refers to IAS 37 and PSAK 57 concerning provisions and contingent liabilities. These standards are relevant because potential carbon tax exposure may require recognition or disclosure only when the criteria of present obligation, probable economic outflow, reliable measurement, and materiality are met.

The empirical focus is on two major state-owned enterprises in Indonesia's energy sector: PT PLN (Persero) and PT Pertamina (Persero). These firms were selected because they hold strategic roles in national energy supply, have high exposure to carbon pricing policy, are connected to carbon market mechanisms, and provide publicly accessible sustainability reports and audited financial statements. The study therefore seeks analytical rather than statistical generalisation, with the findings intended to inform theoretical and policy discussions on the gap between ESG disclosure and financial accountability (Yin, 2018).

The study uses secondary data from publicly available sources. The main data consist of sustainability reports and audited financial statements of PT PLN (Persero) and PT Pertamina (Persero) covering the 2022–2025 reporting period, where available. These documents are examined to identify emissions disclosure, ESG narratives, environmental governance, financial statement notes, provisions, contingent liabilities, and carbon-related risk disclosure. The study also uses IDXCarbon project data from July 2024 to April 2025 to capture project-level carbon market participation. Law No. 7 of 2021 and related policy documents are used as the regulatory basis for the carbon tax simulation.

The unit of analysis consists of disclosure items related to emissions, carbon pricing, environmental liabilities, ESG governance, carbon market participation, and financial reporting notes. The coding process focused on five analytical dimensions: emissions disclosure, carbon market participation, financial accountability, ESG governance, and fiscal exposure. Emissions disclosure was assessed through reported emissions, emission sources, reporting periods, and reduction targets. Carbon market participation was assessed through IDXCarbon-listed projects and project-level emissions. Financial accountability was assessed through the presence or absence of provisions, contingent liabilities, environmental liabilities, and carbon-related financial notes.

ESG governance was assessed through climate risk management, sustainability governance, internal control, and transparency of disclosure.

The analysis was conducted in three stages. First, ESG- and emissions-related disclosures were coded and compared across sustainability reports and audited financial statements to identify consistency or gaps between narrative disclosure and formal financial reporting. Second, simulated carbon tax exposure was calculated for each IDXCarbon-listed project by applying the statutory minimum rate under Law No. 7 of 2021, namely IDR 30,000 per ton of CO_2 equivalent, to listed emissions. The formula used is:

$$\text{Simulated carbon tax exposure} = \text{listed emissions } (tCO_2e) \times \text{IDR } 30{,}000$$

The simulation represents cumulative project-level exposure based on listed emissions. It does not represent actual tax payable, recognised liability, or annual carbon tax obligation. This distinction is important because several projects report emissions across different year ranges. Therefore, the simulation is used only to illustrate relative fiscal exposure across projects and to support analysis of whether such exposure is reflected in corporate reporting.

Third, the simulated exposure was compared with audited financial statements to assess whether potential carbon-related obligations were recognised as provisions, disclosed as contingent liabilities, or omitted from financial reporting. The assessment was made with reference to IAS 37 / PSAK 57 and Indonesia's pre-enforcement carbon tax context. Because the carbon tax has not yet been fully implemented across sectors, the study does not assume that all simulated exposure must be recognised as a liability. Instead, it examines whether firms provide sufficient disclosure for stakeholders to understand possible carbon-related fiscal risk.

To strengthen the credibility of the analysis, the study applied source triangulation and document cross-checking. Sustainability reports were compared with audited financial statements to assess whether ESG narratives were supported by financial reporting evidence. IDXCarbon data were used to verify project-level emissions and carbon market participation, while policy documents were used to confirm the applicable tax rate and regulatory context. Differences in reporting periods were also considered to avoid treating cumulative emissions as annual emissions.

For ESG risk assessment, the study uses an adapted ESG risk assessment approach inspired by the Sustainalytics ESG Risk Rating framework. The assessment is based only on publicly available disclosures and does not represent official Sustainalytics scores. ESG risk was evaluated qualitatively through two dimensions: exposure to carbon transition risk and management quality. Exposure was assessed from emission scale, technology type, and relevance to carbon pricing, while management quality was assessed from disclosure transparency, governance structure, and climate risk management. The resulting assessment was then mapped into broad risk categories to support interpretation of the disclosure gap.

This methodological design enables the study to examine whether carbon tax anticipation is reflected only in sustainability narratives or also in formal accounting disclosure. By triangulating sustainability reports, audited financial statements, policy documents, and IDXCarbon project data, the study provides an integrated basis for analysing the gap between ESG disclosure and financial accountability in Indonesia's emerging carbon pricing regime.

RESEARCH RESULTS

The results are interpreted based on the listed emissions and reporting periods disclosed for each IDXCarbon project. Carbon tax exposure is simulated as cumulative project-level exposure by applying the statutory minimum carbon tax rate under Law No. 7 of 2021 to listed emissions. Therefore, the simulation does not represent actual tax payable, recognised liability, or annual carbon tax obligation. ESG risk classifications are presented as an adapted assessment based on publicly available disclosures, focusing on exposure to carbon transition risk and the quality of disclosed management practices.

Carbon Credit Projects and Emissions Data

This subsection presents evidence that Indonesia's early carbon market participation is concentrated among state-owned energy enterprises, particularly PLN-affiliated power generation projects.

Table 1 Carbon Credit Projects on IDXCarbon, 2024–2025

No.	Project	Company	Listed Emissions (tCO_2e)	Reporting Period
1	Proyek Lahendong Unit 5 & 6	PT Pertamina Geothermal Energy Tbk	864,209.00	2016–2020
2	PLTGU Blok 3 (PJB Muara Karang)	PT PLN Nusantara Power	926,873.00	2022
3	PLTM Gunung Wugul	PT PLN Indonesia Power	12,932.00	2021–2022
4	PLTGU Priok Blok 4	PT PLN Indonesia Power	763,653.00	2021
5	PLTGU Grati Blok 2	PT PLN Indonesia Power	407,390.00	2021
6	PLTGU Muara Tawar Blok 2	PT PLN Nusantara Power	34,000.00	2023
7	PLTMG Sumbagut 2 Peaker	PT PLN Nusantara Power	173,878.00	2021–2023

Source: IDXCarbon Monthly Reports, 2024–2025, processed by the authors

Table 1 shows that seven carbon credit projects listed on IDXCarbon during the observation period were associated with PT PLN and PT Pertamina. Six of the seven projects were operated by PLN subsidiaries, while one project was operated by PT Pertamina Geothermal Energy Tbk. The total listed emissions amounted to 3,182,935.00 tCO_2e. PLN-affiliated projects accounted for 2,318,726.00 tCO_2e, or approximately 72.85% of the total listed emissions, while the Pertamina geothermal project accounted for 864,209.00 tCO_2e, or approximately 27.15%.

The largest listed emission came from PLTGU Blok 3 (PJB Muara Karang), with 926,873.00 tCO_2e, representing approximately 29.12% of total listed emissions. This was followed by Proyek Lahendong Unit 5 & 6 with 864,209.00 tCO_2e or 27.15%, PLTGU Priok Blok 4 with 763,653.00 tCO_2e or 23.99%, and PLTGU Grati Blok 2 with 407,390.00 tCO_2e or 12.80%. By contrast, PLTM Gunung Wugul recorded the lowest listed emissions, at 12,932.00 tCO_2e, or only 0.41% of the total.

These figures indicate that the listed emissions are highly concentrated in a small number of large power-generation projects. However, the values should be interpreted carefully because the reporting periods differ across projects. Lahendong covers 2016–2020, Gunung Wugul covers 2021–2022, and Sumbagut covers 2021–2023, whereas several PLTGU projects report emissions for a single year. Therefore, the figures are used to describe listed emissions and relative project-level exposure, not to compare annual emission intensity across projects.

Simulated Cumulative Carbon Tax Exposure

Using the minimum carbon tax rate stipulated under Law No. 7 of 2021, namely IDR 30 per kilogram of CO_2e or IDR 30,000 per ton of CO_2e, this study simulates the cumulative carbon tax exposure of each project based on listed emissions. The simulation focuses only on the tax component and does not account for sectoral caps, exemptions, offsets, implementation delays, or company-specific tax treatment.

Table 2 Simulated Cumulative Carbon Tax Exposure Based on Listed Emissions

No.	Project	Listed Emissions (tCO_2e)	Period	Tax Basis	Simulated Carbon Tax Exposure
1	Proyek Lahendong Unit 5 & 6	864,209.00	2016–2020	Listed emissions × IDR 30,000	IDR 25,926,270,000
2	PLTGU Blok 3 (PJB Muara Karang)	926,873.00	2022	Listed emissions × IDR 30,000	IDR 27,806,190,000
3	PLTM Gunung Wugul	12,932.00	2021–2022	Listed emissions × IDR 30,000	IDR 387,960,000
4	PLTGU Priok Blok 4	763,653.00	2021	Listed emissions × IDR 30,000	IDR 22,909,590,000
5	PLTGU Grati Blok 2	407,390.00	2021	Listed emissions × IDR 30,000	IDR 12,221,700,000
6	PLTGU Muara Tawar Blok 2	34,000.00	2023	Listed emissions × IDR 30,000	IDR 1,020,000,000
7	PLTMG Sumbagut 2 Peaker	173,878.00	2021–2023	Listed emissions × IDR 30,000	IDR 5,216,340,000
	Total	3,182,935.00			IDR 95,488,050,000

Note: The simulation represents cumulative project-level exposure based on listed emissions. It does not represent actual tax payable, annual liability, or recognised accounting liability

Source: Authors' calculation based on IDXCarbon data and Law No. 7 of 2021

Table 2 shows that the seven IDXCarbon-listed projects generate a simulated cumulative carbon tax exposure of IDR 95.49 billion. The highest exposure is associated with PLTGU Blok 3 (PJB Muara Karang), at IDR 27.81 billion, followed by Proyek Lahendong Unit 5 & 6 at IDR 25.93 billion, PLTGU Priok Blok 4 at IDR 22.91 billion, and PLTGU Grati Blok 2 at IDR 12.22 billion. The lowest simulated exposure is associated with PLTM Gunung Wugul, at IDR 387.96 million.

The simulation indicates that carbon pricing may create measurable fiscal exposure for high-emission energy projects. However, because the calculation is based on listed emissions rather than taxable emissions under a fully implemented cap-and-tax system, the results should be read as an estimate of potential exposure rather than as a formal tax obligation. This distinction is important for aligning the results with IAS 37 / PSAK 57, which require a present obligation, probable outflow of resources, and reliable measurement before a provision can be recognised.

When compared with audited financial reporting, no explicit recognition of carbon tax-related provisions or contingent liabilities was identified in the examined financial statements. This does not necessarily imply non-compliance, given that Indonesia's carbon tax has not yet been fully implemented across sectors. Nevertheless, the absence of carbon tax-related financial notes suggests that potential exposure is still not fully integrated into formal financial reporting. This finding supports the central argument of the study: carbon-related information is more visible in sustainability and carbon market disclosures than in audited financial statements.

ESG Performance and Disclosure Gaps

The ESG-related evidence shows that the examined companies disclose environmental initiatives, emissions information, and carbon market participation, but the link between ESG disclosure and financial accountability remains limited. From the environmental dimension, the listed projects indicate corporate participation in carbon market mechanisms and emissions reporting. Renewable-related projects, such as Lahendong geothermal and Gunung Wugul mini-hydro, show lower-carbon technology profiles compared with gas-fired projects. However, the data also show that renewable and transitional energy projects may still produce measurable emissions, particularly when cumulative reporting periods are considered.

From the social dimension, the available disclosures remain general and are not consistently linked to carbon pricing, transition costs, green employment, community transition support, or the social implications of decarbonisation. From the governance dimension, participation in IDXCarbon indicates a degree of institutional engagement with carbon market mechanisms. However, the examined disclosures provide limited detail on internal carbon audit systems, board-level oversight of carbon pricing risk, carbon tax scenario analysis, or the integration of carbon exposure into financial reporting controls.

Four disclosure gaps can be identified. First, reporting periods differ across projects, which limits direct comparability. Second, carbon market participation is disclosed more clearly than the financial implications of carbon pricing. Third, ESG disclosures remain stronger on environmental narratives than on social and governance implications of carbon transition. Fourth, the audited financial statements do not explicitly connect emissions data with provisions, contingent liabilities, or carbon-related financial risk notes. These gaps indicate that ESG disclosure has not yet been fully integrated with financial accountability.

Adapted ESG Risk Assessment

To support interpretation of the disclosure gap, this study applies an adapted ESG risk assessment inspired by the Sustainalytics ESG Risk Rating framework. The assessment is based only on publicly available disclosures and does not represent official Sustainalytics scores. The assessment considers two dimensions: exposure to carbon transition risk and management quality. Exposure is assessed based on listed emissions, technology type, and relevance to carbon pricing, while management quality is assessed based on disclosure transparency, ESG governance, and the extent to which carbon-related exposure is linked to financial reporting.

Table 3 Adapted ESG Risk Assessment of IDXCarbon-listed Projects

Project	Exposure to Carbon Transition Risk	Management Quality Based on Disclosure	Indicative Risk Category
Proyek Lahendong Unit 5 & 6	Medium: renewable technology but sizeable cumulative listed emissions	Moderate–High: clearer renewable positioning, but limited financial linkage	Medium
PLTGU Blok 3 (PJB Muara Karang)	High: largest listed emissions and gas-based power generation	Moderate: emissions disclosed, but no explicit carbon tax financial disclosure	High
PLTM Gunung Wugul	Low: lowest listed emissions and mini-hydro technology	Moderate: project disclosed, but limited broader ESG-financial linkage	Low
PLTGU Priok Blok 4	High: large listed emissions and gas-based power generation	Moderate: emissions disclosed, but financial implications not clearly reported	High

Project	Exposure to Carbon Transition Risk	Management Quality Based on Disclosure	Indicative Risk Category
PLTGU Grati Blok 2	Medium–High: substantial listed emissions from gas-based generation	Moderate: project-level disclosure available, but limited fiscal integration	Medium–High
PLTGU Muara Tawar Blok 2	Medium: gas-based project with lower listed emissions	Moderate: project disclosed, but limited carbon tax risk explanation	Medium
PLTMG Sumbagut 2 Peaker	Medium: gas-engine peaker project with multi-year listed emissions	Low–Moderate: limited disclosure on transition and financial implications	Medium

Source: Authors' adapted assessment based on IDXCarbon data and publicly available corporate disclosures

The table 3 shows that projects with larger listed emissions and gas-based generation profiles tend to carry higher indicative transition risk. However, the risk category is not determined by emissions alone. Management quality, including disclosure transparency and the integration of carbon-related risk into financial reporting, also affects the assessment.

Overall, the findings show that Indonesia's emerging carbon market has encouraged firms to disclose emissions and participate in carbon credit mechanisms. However, the evidence also shows a gap between carbon-related sustainability disclosure and formal financial accountability. Listed emissions can be translated into measurable simulated fiscal exposure, but this exposure is not yet clearly reflected in audited financial statements through provisions, contingent liabilities, or detailed financial risk notes. This gap provides the basis for the subsequent discussion on legitimacy, environmental accounting, and the limits of ESG disclosure as a substitute for financial accountability.

DISCUSSION

The findings reveal a clear gap between carbon-related sustainability disclosure and financial accountability in Indonesia's emerging carbon pricing regime. Evidence from IDXCarbon shows that carbon market participation among the examined projects is dominated by PLN-affiliated power generation projects, while Pertamina's participation is represented through the Lahendong geothermal project. Using the statutory minimum carbon tax rate of IDR 30,000 per ton of CO_2e under Law No. 7 of 2021, the seven IDXCarbon-listed projects generate a simulated cumulative carbon tax exposure of IDR 95.49 billion. This figure should not be interpreted as actual tax payable, annual liability, or recognised accounting liability, but as an estimate of potential project-level fiscal exposure based on listed emissions. This distinction is important because several projects report emissions over different periods and Indonesia's carbon tax has not yet been fully enforced across sectors.

From an environmental accounting perspective, the results show that emissions data are increasingly available through sustainability reports and carbon market mechanisms, but they are not yet consistently connected to audited financial statements. The simulation demonstrates that listed emissions can be translated into measurable fiscal exposure, yet the examined financial statements do not explicitly recognise carbon tax-related provisions or disclose contingent liabilities associated with such exposure. Under IAS 37 / PSAK 57, this absence of recognition may be understandable because a provision requires a present obligation, a probable outflow of economic resources, and a reliable estimate of the obligation. However, from a disclosure perspective, the absence of carbon-related financial notes may limit stakeholders' ability to assess

future climate-related fiscal risks, particularly as carbon pricing coverage and enforcement are expected to develop over time. This finding is consistent with prior studies showing that environmental and carbon accounting practices in Indonesia often remain weakly integrated into mainstream financial reporting (Tjoa & Widianingsih, 2022; Indarto & Ani, 2023).

The findings also support the relevance of legitimacy theory, but they should be interpreted carefully. The evidence does not prove that ESG disclosure is merely symbolic; rather, it suggests that ESG disclosure may function partly as a legitimacy-oriented communication mechanism when sustainability narratives are not accompanied by corresponding financial recognition or disclosure of carbon-related fiscal exposure. The examined companies disclose emissions, environmental initiatives, and carbon market participation, which may help demonstrate responsiveness to regulatory and stakeholder expectations. However, these disclosures are not yet matched by detailed financial reporting on carbon tax exposure. This pattern is consistent with legitimacy theory, which explains how firms use disclosure to maintain social acceptance under regulatory and reputational pressure (Suchman, 1995; Deegan, 2019). It also aligns with previous ESG literature indicating that sustainability disclosure may enhance transparency, but does not automatically guarantee financial accountability (Alsayegh et al., 2020; Gillan et al., 2021).

The corrected results further show that the disclosure gap is not uniform across projects. Projects with larger listed emissions, such as PLTGU Blok 3, PLTGU Priok Blok 4, and PLTGU Grati Blok 2, generate higher simulated carbon tax exposure and therefore carry more visible transition-related fiscal implications. By contrast, smaller or lower-carbon projects such as PLTM Gunung Wugul show lower simulated exposure. The Lahendong geothermal project requires careful interpretation because its listed emissions cover a multi-year period from 2016 to 2020. It's relatively high simulated exposure reflects cumulative listed emissions rather than evidence that geothermal power is more carbon-intensive than gas-fired generation. This confirms the importance of distinguishing cumulative listed emissions from annual emissions or emission intensity. Without this distinction, the financial implications of carbon pricing may be overstated or misread.

The adapted ESG risk assessment also strengthens the interpretation of the results, provided that its limitations are explicitly acknowledged. The assessment used in this study is not an official Sustainalytics rating and does not apply Sustainalytics' proprietary scoring model. It is an adapted qualitative assessment based on publicly available disclosures, focusing on carbon transition exposure and management quality. The revised assessment shows that gas-based projects with larger listed emissions tend to carry higher indicative transition risk, while renewable or smaller-scale projects tend to show lower risk. However, the key issue is not only exposure level, but also the quality of disclosure. Even when companies disclose environmental initiatives and participate in IDXCarbon, the absence of explicit links between emissions data, carbon pricing assumptions, and financial reporting weakens the accountability value of ESG disclosure. This finding is consistent with the broader concern that ESG metrics and ratings may vary across methodologies and may not fully capture financially material transition risks (Berg et al., 2022).

These results have several implications. For regulators, the findings indicate the need for clearer guidance on how firms should disclose carbon pricing exposure during the transition period before full enforcement of the carbon tax. Such guidance does not necessarily require immediate recognition of liabilities, but it may require clearer disclosure of assumptions, scenarios, and

potential exposure when such information is material to stakeholders. This is consistent with the direction of IFRS S1 and IFRS S2, which emphasise material sustainability-related and climate-related risks that may affect enterprise value and users' decision-making (IFRS Foundation, 2023a, 2023b). For accounting standard-setters, the findings suggest a need to clarify how IAS 37 / PSAK 57 should be interpreted in relation to anticipated carbon pricing obligations, especially in jurisdictions where climate regulation is legally established but not yet fully implemented.

For companies, the results highlight the importance of integrating emissions data into accounting systems, not only sustainability reports. Carbon accounting should support scenario analysis, internal carbon pricing, risk governance, and financial reporting notes, particularly for high-emission assets that may become subject to future tax obligations. For investors, the findings suggest that ESG disclosure should be complemented by carbon pricing analysis. Investors who rely only on ESG narratives may underestimate future transition costs if emissions exposure is not linked to financial reporting. For auditors and assurance providers, the findings indicate a growing need to evaluate the reliability of emissions data, the assumptions used in carbon cost estimation, and the adequacy of climate-related financial disclosures.

Several limitations should be acknowledged. The study focuses on two state-owned enterprises and seven IDXCarbon-listed projects, so the findings are not intended to represent all firms in Indonesia's energy sector. The simulated exposure is calculated using the statutory minimum rate of IDR 30,000 per ton of CO_2e and does not account for sectoral caps, exemptions, offsets, phased implementation, or company-specific tax treatment. The study also relies on publicly available secondary data and therefore cannot capture internal management judgments, auditor assessments, or unpublished regulatory correspondence. Future studies may extend this analysis by using broader cross-sectoral samples, longitudinal data, interviews with corporate and audit practitioners, or market-based analysis of investor responses to carbon pricing announcements.

Overall, the findings suggest that Indonesia's emerging carbon market has encouraged firms to improve emissions disclosure and participate in carbon-related mechanisms. However, this progress has not yet been matched by a comparable integration of carbon-related fiscal exposure into audited financial reporting. The existence of simulated cumulative carbon tax exposure alongside limited financial disclosure points to a continuing gap between ESG communication and financial accountability. Bridging this gap requires stronger regulatory guidance, better integration between sustainability and financial reporting systems, and more explicit disclosure of carbon pricing assumptions, scenarios, and potential financial implications.

CONCLUSION

This study examined how Indonesia's anticipated carbon tax is reflected in environmental accounting practices, ESG disclosures, and audited financial reporting within high-emission state-owned enterprises. Based on IDXCarbon-listed projects, sustainability reports, audited financial statements, and policy documents, the study finds a clear gap between sustainability disclosure and financial accountability. The seven analysed projects generated a simulated cumulative carbon tax exposure of IDR 95.49 billion, calculated from listed emissions using the statutory minimum rate of IDR 30,000 per ton of CO_2e. This amount does not represent actual tax payable or recognised liability, but illustrates potential project-level fiscal exposure under Indonesia's emerging carbon pricing regime.

The findings show that the examined firms have improved emissions disclosure and participated in carbon market mechanisms, yet this information has not been clearly integrated into audited financial statements. No explicit recognition of carbon tax-related provisions or disclosure of contingent liabilities was identified. This absence should be interpreted carefully because Indonesia's carbon tax has not yet been fully enforced across sectors. However, the limited financial disclosure suggests that carbon pricing risk remains weakly connected to formal accounting practices.

Empirically, this study provides early project-level evidence on the relationship between carbon market participation, simulated fiscal exposure, and financial reporting in Indonesia. Theoretically, it shows that ESG disclosure may function partly as a legitimacy-oriented response when sustainability narratives are not supported by detailed financial recognition or fiscal risk disclosure. Therefore, ESG reporting should not be treated as sufficient evidence of climate-related financial accountability unless it is connected to accounting systems and financial reporting.

Practically, the findings indicate the need for stronger integration between emissions data, carbon pricing assumptions, risk governance, and financial reporting. Regulators should provide clearer disclosure guidance during the transition period before full carbon tax enforcement. Firms should strengthen carbon accounting and scenario analysis, while auditors should pay greater attention to the reliability of emissions data and the adequacy of climate-related financial disclosures.

This study is limited to two state-owned enterprises and seven IDXCarbon-listed projects, so the findings are not intended to represent all firms in Indonesia's energy sector. The simulation also does not account for sectoral caps, exemptions, offsets, phased enforcement, or firm-specific tax treatment. Future studies may expand the analysis through broader sectoral samples, longitudinal data, interviews with preparers and auditors, or market-based analysis of investor responses to carbon pricing policies.

Overall, this study concludes that Indonesia's emerging carbon pricing regime has encouraged greater emissions disclosure and carbon market participation, but has not yet produced comparable integration of carbon-related fiscal exposure into audited financial reporting. Bridging this gap requires clearer disclosure rules, stronger environmental accounting systems, and closer alignment between ESG disclosure and financial accountability.

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