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The Effects of Green Accounting Disclosure, Eco-Efficiency, and Sales Growth on Firm Value: Evidence from IDX Energy Companies, 2020–2024

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Abstract

Indonesia's energy sector faces growing pressure to align financial performance with environmental sustainability, particularly in pursuit of the Net Zero Emissions agenda. Despite substantial scholarly attention, the impact of sustainability oriented practices, including green accounting disclosure, eco efficiency, and sales growth, on firm value remains inconclusive. This uncertainty is particularly pronounced in emerging economies, where sustainability reporting frameworks are still evolving and have not yet reached full maturity. This study examines how these three variables influence firm value among IDX-listed energy companies. A quantitative explanatory design was applied using panel data regression on 100 firm-year observations from 20 companies over the 2020–2024 period, selected via purposive sampling, with analyses conducted in EViews 13. Sequential Chow, Hausman, and Lagrange Multiplier tests identified the Common Effect Model (CEM) as the most appropriate specification; heteroscedasticity was addressed using CEM with White Diagonal robust standard errors. Results show that green accounting disclosure exerts a positive and significant effect on firm value ($\beta = 1.685753$; $p = 0.0199$), while eco-efficiency produces a significant negative effect ($\beta = -0.509943$; $p = 0.0021$). Sales growth is non-significant ($\beta = 0.005196$; $p = 0.6174$). The overall model is significant ($p = 0.0038$), though explanatory power is limited ($R^2 = 0.187$). These findings reveal that investors interpret sustainability signals differently: environmental disclosure is positively valued, whereas ISO 14001-based eco-efficiency is associated with reduced market valuation, underscoring the importance of distinguishing environmental reporting from environmental management practices in firm valuation.

KEYWORDS

green accounting disclosure; eco-efficiency; sales growth; firm value.

Introduction

The Indonesian energy sector commands a structurally important position in the national capital market, functioning simultaneously as a primary engine of economic expansion and a central focus of environmental governance debates. Operating within the Indonesia Stock Exchange Industrial Classification (IDX IC), companies in this sector span nonrenewable energy subsectors, such as petroleum, natural gas, and coal extraction, as well as renewable energy operations and supporting service industries. Over the 2020–2024 observation period, the number of publicly listed energy firms rose from 66 to 89, a trajectory that signals robust and enduring investor confidence alongside ongoing sectoral development ([Indonesia Stock Exchange, 2025](https://www.idx.co.id/en/stock-exchange/)). By 2024, the sector had attracted USD 32.3 billion in new investment, representing an 8 percent increase compared to the previous year. At the same time, its contribution to Indonesia's gross domestic product reached approximately 10 percent, underscoring its strategic role and fundamental importance to the national economy.

Simultaneously, however, the sector confronts intensifying environmental scrutiny arising from the worldwide shift toward cleaner energy systems. Under these conditions, firm value emerges as a critical metric in market assessments, encapsulating how investors evaluate not only a company's existing performance but also its anticipated

future trajectory (Anggita et al., 2022; Margie & Melinda, 2024). Investment decision-making has progressively expanded beyond narrowly financial criteria to incorporate environmental and social dimensions (Havi & Yuliandhari, 2026; Sukmadilaga et al., 2023). This evolution captures the broader importance of signaling theory, which explains that corporate disclosures function as mechanisms to bridge information gaps between company insiders and external market participants, thereby shaping investor interpretation of firm prospects.

Corporate sustainability practices, particularly green accounting disclosure and eco-efficiency reporting, serve as visible signals of environmental stewardship. In Indonesia, such disclosures are institutionally supported by POJK No. 51/POJK.03/2017 on sustainable finance (Otoritas Jasa Keuangan, 2017), a regulatory instrument that compels qualifying institutions to publish sustainability reports. While a significant body of literature has linked sustainability disclosures to improved investor perceptions, the magnitude and directionality of such effects on market-based firm value remain highly variable across empirical contexts (Darlis et al., 2024; Sari & Hidayat, 2025). Eco-efficiency, reflecting a firm's capacity to reduce its ecological footprint without sacrificing productive output, and sales growth, as a gauge of revenue dynamism, have each been investigated as potential determinants of firm value (Savitri & Abdullah, 2023). Environmental performance communication is gaining recognition as a market-relevant signal in developing economy settings (Fatkhurrozi & Haryati, 2024; Fernando et al., 2024).

Nevertheless, the body of evidence linking sustainability-oriented variables to firm valuation remains contested, particularly in resource-intensive emerging markets such as Indonesia's energy sector (Hapsari et al., 2024; Monica et al., 2024; Riyadi, 2024). Prior investigations yield divergent conclusions regarding green accounting disclosure, eco-efficiency, and sales growth, indicating the absence of an empirical consensus on their aggregate influence on market valuations.

Such inconsistencies recur throughout the sustainability accounting literature. Eco-efficiency initiatives and green accounting disclosures do not consistently yield superior firm valuations, largely because investor reactions are shaped by varying levels of market sophistication and differing interpretational frameworks (Fatkhurrozi & Haryati, 2024; Sari & Hidayat, 2025). In capital-intensive sectors, Tobin's Q is a widely adopted firm value indicator, as it encodes the ratio between a company's market capitalization and the estimated replacement value of its underlying assets (Jamaludin, 2024; Sabău-Popa et al., 2024). 24A Tobin's Q exceeding one signals that investors assign a premium above asset replacement cost, whereas a sub-unity ratio implies market undervaluation; an exact value of one reflects fair valuation alignment with asset replacement cost (Jamaludin, 2024).

Extant studies examining the determinants of firm value, with particular emphasis on green accounting disclosure, eco-efficiency, and sales growth, yield mixed and frequently contradictory findings. While certain studies document positive associations, others report null or even inverse effects, depending on industry characteristics and measurement choices. For instance, although sales growth captures a firm's revenue expansion capability, this does not inherently translate into profitability or market appreciation (Djatnicka et al., 2025). These discrepancies reinforce the view that sustainability-related variables and firm value maintain an inconclusive relationship, particularly within Indonesia, where sustainability-based valuation mechanisms are still taking shape.

An additional shortcoming in existing research is its

tendency to treat green accounting disclosure, eco-efficiency, and sales growth as separate, non-interacting constructs. This fragmented approach leaves open the question of how their combined influence shapes firm value specifically within the Indonesian energy sector. The sector is of particular analytical relevance given its outsized economic role and its acute exposure to decarbonization pressures, coinciding with Indonesia's post pandemic recovery and its Net Zero Emissions 2060 commitment (Kementerian Energi dan Sumber Daya Mineral, 2024b, 2024a).

This study addresses these gaps by constructing an integrated empirical model of firm value that simultaneously incorporates green accounting disclosure, eco-efficiency, and sales growth within the Indonesian energy sector. In contrast to studies that treat these variables separately or aggregate findings across sectors, the present research concentrates specifically on IDX-listed energy companies over 2020–2024 a period characterized by post-pandemic recovery dynamics and mounting Net Zero Emissions pressure. A panel data regression approach is employed to account for unobserved firm-level heterogeneity, thereby producing more reliable coefficient estimates relative to cross-sectional alternatives.

Methodologically, a quantitative explanatory approach is implemented using panel data regression, with model identification conducted through the sequential application of Chow, Hausman, and Lagrange Multiplier tests. From a theoretical standpoint, the study enriches signaling theory by demonstrating how environmental and financial disclosure signals are decoded in an emerging market valuation context. In practical terms, the results are intended to assist corporate managers, equity investors, and policymakers in navigating firm value considerations within Indonesia's energy sector. The overarching objective is to empirically investigate how green accounting disclosure, eco-efficiency, and sales growth affect the market valuations of IDX-listed energy companies during 2020–2024, with Tobin's Q serving as the firm value proxy.

Literature Review and Hypothesis Development Signaling Theory

Signaling theory, as originally formulated by Spence (1973), describes how firms communicate information to external parties to mitigate information asymmetry in capital markets. Corporate decisions and voluntary disclosures are commonly read as proxies for a firm's future performance, thereby shaping the behavior of investors and other market participants (Brigham & Houston, 2019). The degree to which these transmitted signals are perceived as credible plays a decisive role in how external stakeholders evaluate a firm's prospects (Connelly et al., 2025).

Within this framework, both financial and non-financial disclosures constitute signals that shape investor perceptions and influence valuation outcomes (Margie & Melinda, 2024). Favorable signals such as proactive sustainability reporting and adherence to regulatory standards tend to bolster investor confidence, while unfavorable signals, including evidence of poor environmental performance, may erode market trust (Connelly et al., 2025). Accordingly, green accounting disclosure, eco-efficiency, and sales growth each function as informational signals capable of affecting firm value through investor interpretation mechanisms.

Green Accounting Disclosure

Green accounting disclosure pertains to the voluntary and mandatory reporting of environmental costs, activities, and performance outcomes within corporate communications, thereby reflecting a firm's environmental accountability and openness (Sebastian, 2022). Operationally, it encompasses the systematic identification, quantification, recording, and communication of environmental costs and activities that originate from a firm's business operations (Sunarmin, 2020).

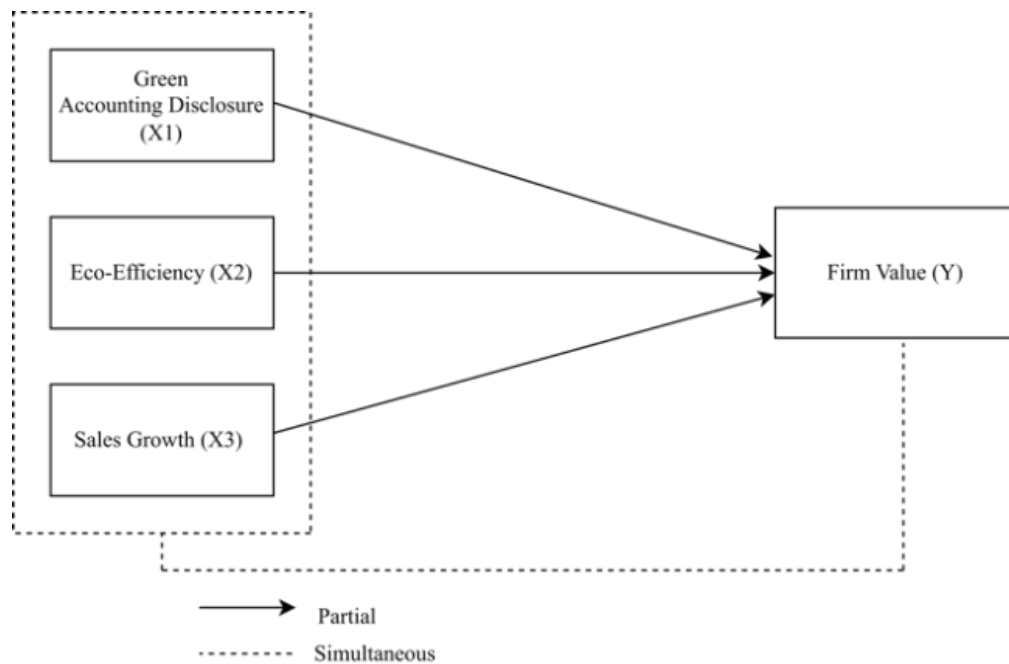


Figure 1. Frame of Mind

Beyond satisfying disclosure obligations, such reporting reinforces corporate responsibility by enabling stakeholders to assess environmental management quality. By elevating transparency surrounding environmental practices, green accounting disclosure has the potential to strengthen stakeholder confidence and favorably shape market perceptions of the firm (Darlis et al., 2024; Margie & Melinda, 2024).

Prior empirical studies have documented a constructive relationship between green accounting disclosure and market-based firm value, attributing this effect to enhanced investor confidence and improved perceptions of environmental responsibility (Anggita et al., 2022; Maharani & Handayani, 2021; Sari & Hidayat, 2025). Based on this body of evidence, the following hypothesis is formulated:

H1: Green accounting disclosure has a significant effect on firm value.

Eco-Efficiency

Eco-efficiency represents the degree to which a firm succeeds in generating superior economic output per unit of environmental impact, achieved through resource saving production methods and structured ecological management (Fairus & Murwaningsari, 2023; Fanda & Dwijayanti, 2024; Kurnianta & Dianawati, 2020). In research contexts, ISO 14001 certification serves as a widely accepted operational indicator of a firm's formal commitment to structured environmental management system adoption. Under signaling theory, the act of pursuing and maintaining eco-efficiency certification constitutes a deliberate environmental quality signal directed at market stakeholders. However, empirical evidence on whether eco-efficiency enhances, reduces, or has no bearing on firm value is inconsistent, with outcomes diverging substantially depending on sampling contexts, measurement instruments, and industry environments (Riaz et al., 2022; Savitri & Abdullah, 2023; Yuliandhari et al., 2023). Given the absence of consensus in prior work, this study imposes no directional expectation, and the corresponding hypothesis is stated as:

H2: Eco-efficiency has a significant effect on firm value.

Sales Growth

Sales growth quantifies the rate at which a firm expands

its revenue over successive periods and is broadly interpreted as an indicator of market traction, competitive positioning, and business vitality (Djatnicka et al., 2025; Liviani & Rachman, 2021). Within the signaling framework, vigorous revenue growth communicates upward demand momentum and favorable forward-looking financial expectations to investors. Empirically, firms demonstrating stronger sales growth tend to attract higher investor valuations, driven by expectations of improved cash flow generation in subsequent periods (Rahayu & Waluyo, 2024). On this basis, sales growth is incorporated in this study as a financially-grounded informational signal relevant to firm value assessment. The following hypothesis is therefore proposed:

H3: Sales growth has a significant effect on firm value.

Methods

Research Design

A quantitative explanatory research design is employed in this study, with panel data regression serving as the primary analytical instrument. Quantitative inquiry translates empirically observable phenomena into measurable constructs that allow for hypothesis testing through established statistical procedures (Sugiyono, 2023). The analytical framework positions firm value (Y) as the outcome variable, with green accounting disclosure (X1), eco-efficiency (X2), and sales growth (X3) as explanatory variables, each operationalizing a conceptually distinct dimension of sustainability-linked or financial performance expected to account for variation in market-based valuations.

The panel data regression specification is adopted because it accommodates variation across both firms and time periods within a unified estimator, enabling the simultaneous analysis of inter-firm heterogeneity and temporal dynamics across 20 sampled companies over the 2020–2024 window. Compared with purely cross-sectional or time-series approaches, panel models afford higher estimation efficiency and exploit greater informational richness in the data.

Variable operationalization is grounded in consolidated firm-level data to preserve internal consistency across all observations. ISO 14001 certification is adopted as the eco-efficiency proxy due to the limited availability of more granular environmental performance data in the emerging market

Table 1. Operational Variables

No	Variable	Description	Measurement
1	Firm Value	Captures market-based assessment of a firm's current worth and future earnings potential, measured through Tobin's Q (Ayu et al., 2025).	Tobin's Q = $(MVE + DEBT) \div TA$; MVE = stock price $\times$ number of shares outstanding; DEBT = total debt; TA = total assets (Dzahabiyya et al., 2020).
2	Green Accounting Disclosure	Refers to the degree of environmental cost, activity, and performance disclosure in corporate reports, reflecting environmental accountability (Sebastian, 2022).	GRI = Total Disclosures Obtained / Maximum Total Disclosure (Darlis et al., 2024).
3	Eco-Efficiency	A firm's operational capability to minimize environmental impact through resource-efficient processes supported by an environmental management system (Helmina et al., 2022).	1 = Firm holds ISO 14001 certification 0 = Firm does not hold ISO 14001 certification (Yuliandhari et al., 2023)
4	Sales Growth	Indicates the firm's capacity to generate revenue growth and sustain operational performance across periods (Liviani & Rachman, 2021).	Sales Growth = $(Sales_t - Sales_{t-1}) / Sales_{t-1}$ (Fauziah & Kustinah, 2023)

Source: Authors' elaboration based on prior studies

Table 2. Sample Selection Criteria

No	Description	Total
1	Energy sector firms listed on IDX (2020–2024)	89
2	Deducted: Firms lacking complete annual reports	(20)
3	Deducted: Firms with inaccessible official websites	(9)
4	Deducted: Firms without consistent sustainability reports	(40)
Final Sample		20
Study Duration (Years)		5
Total Firm-Year Observations		100

Source: Processed by the author (2026)

setting of this study; while widely recognized as an indicator of systematic environmental management adoption, this proxy does not capture variation in the depth or practical outcomes of environmental performance across firms.

Three candidate model specifications are assessed: the Common Effect Model (CEM), the Fixed Effect Model (FEM), and the Random Effect Model (REM). Selection among these alternatives is guided by a sequential testing protocol employing the Chow test, the Hausman test, and the Lagrange Multiplier (LM) test, as outlined by Basuki (2021). The Chow test evaluates whether pooled or fixed effects better characterize the data; the Hausman test adjudicates between fixed and random effects; and the LM test determines whether random effects represent a meaningful advance over the pooled estimator.

Operationalization of Variables

Measurement specifications for all research variables are presented in Table 1. Green accounting disclosure is quantified using the GRI G3/G3.1 framework, which furnishes a standardized, item-by-item inventory of environmental disclosure indicators suitable for cross-company comparisons. Eco-efficiency is captured via ISO 14001 certification status, recording whether the company has formally adopted a structured environmental management system geared toward minimizing ecological impacts.

As indicated in Table 1, the GRI G3 and G3.1 frameworks are adopted for measuring green accounting disclosure because they furnish standardized, itemized environmental disclosure indicators widely applied in sustainability reporting research. Building on the measurement instrument originally constructed by Braam et al. (2016) and subsequently employed by Darlis et al. (2024), the instrument consists of 82 items spanning six dimensions: management structure

and systems (A1), credibility (A2), environmental performance aspects (A3), environmental out-of-pocket expenditures (A4), strategy and vision (A5), and environmental initiatives (A6). Content analysis is conducted using dichotomous coding, wherein each item receives a score of 1 if disclosed or 0 if not, yielding a maximum attainable score of 82. The G3 and G3.1 editions are deliberately retained, rather than replaced by the narrative-oriented GRI Standards 2021, because they provide a more explicit, itemized, and quantifiable checklist, thereby ensuring greater scoring objectivity and measurement consistency.

Eco-efficiency is proxied via ISO 14001 certification status. Holding this certification indicates a firm's formal commitment to managing environmental impacts through a structured management system. A score of 1 reflects certification status, while a score of 0 reflects the absence of certification. This operationalization is applied because standardized environmental management system data are accessible within the emerging market context of this study. It is, however, acknowledged that this proxy does not capture variation in the actual intensity or practical effectiveness of environmental performance, given that firms sharing the same certification status may exhibit substantially different realized outcomes.

Population and Sample

The target population encompasses all energy sector companies that maintained continuous listings on the Indonesia Stock Exchange (IDX) throughout the full 2020–2024 observation period. The figure of 89 firms represents the aggregate of all energy-sector IDX issuers recorded in the exchange database over these five years, reflecting the most complete and current consolidated listing universe rather than a single-year cross-section.

Purposive sampling was applied based on four eligibility criteria: (1) uninterrupted listing on the IDX throughout 2020–2024; (2) publication of complete and auditable annual reports for every year within the study window; (3) consistent issuance of sustainability reports over the entire observation period; and (4) full availability of data for all research variables through corporate websites and the IDX information portal.

Table 2 outlines the sample construction process. Beginning with the full population of 89 IDX-listed energy firms, 20 were excluded for incomplete annual reports, 9 for inaccessible corporate websites, and 40 for the absence of consistent sustainability reports, yielding a final usable sample of 20 firms.

Observing 20 firms across five consecutive years produces a balanced panel comprising 100 firm-year observations, ensuring equal representation across cross-sectional and temporal dimensions.

Data Collection

All empirical data used in this study are secondary in nature, meaning they were sourced from existing institutional repositories rather than collected through primary contact with research subjects (Sekaran & Bougie, 2016). Data were retrieved from annual reports, sustainability disclosures, peer-reviewed academic publications, and relevant institutional documentation. The extraction process employed systematic documentation methods drawing from the official IDX data portal and individual firm websites, complemented by a structured review of pertinent academic literature.

Data Analysis

Descriptive statistics and panel data regression constitute the principal analytical procedures, with all computations executed in EViews 13. The panel data regression approach is well-suited to the study design because it enables simultaneous modeling of both the cross-sectional and time-varying dimensions of the dataset within a single estimation framework. Descriptive analysis characterizes each variable's distributional properties by reporting its minimum, maximum, mean, and standard deviation. Basuki (2021) highlights the value of descriptive statistics in providing an initial characterization of data patterns in panel-based research.

Model specification follows a three-stage protocol applying the Chow, Hausman, and Lagrange Multiplier tests to determine the most suitable estimator from among the CEM, FEM, and REM. Diagnostic procedures address two potential threats to inference quality: multicollinearity testing evaluates inter-predictor correlations that could destabilize coefficient estimates, while heteroscedasticity testing verifies the homogeneity of residual variance across observations.

Hypotheses are evaluated through the F-test for simultaneous significance, the t-test for individual predictor significance, and the coefficient of determination (R^2) for goodness-of-fit, all benchmarked at the 5% significance level (Ghozali, 2021). The regression equation is formally specified as:

$$FV = \alpha + \beta_1 GAD + \beta_2 EE + \beta_3 SG + \varepsilon$$

Where FV is firm value, GAD is green accounting disclosure, EE is eco-efficiency, SG is sales growth, α is the model constant, β_1 – β_3 are estimated slope coefficients, and ε captures the stochastic disturbance term.

Result and Discussion

Descriptive statistics for the study variables are reported in Table 3. Firm value (FV) has a sample mean of 1.023 and a standard deviation of 0.376, with values ranging from a minimum of 0.496 to a maximum of 2.689. This range reflects meaningful variation in market-based valuation across firms and across years.

The lowest firm value observation coincides with 2020, a year marked by the severe macroeconomic disruptions of the COVID-19 pandemic. Global contractions in industrial activity, energy demand, and transport mobility during this period depressed energy sector valuations considerably (Badan Pusat Statistik, 2021; Kementerian Energi dan Sumber Daya Mineral, 2020). A Tobin's Q below unity signals that the market price of a firm's assets is below their estimated replacement value, indicative of undervaluation. Conversely, the peak firm value of 2.689 was recorded in 2024, a year characterized by a strong investment rebound in the energy and mineral resources sector, which registered an 8 percent year-on-year growth in realized investment reaching USD 32.3 billion (Kementerian Energi dan Sumber Daya Mineral, 2025).

The green accounting disclosure (GAD) variable has a mean of 0.448 and a standard deviation of 0.115, reflecting relatively moderate and closely distributed disclosure levels

across firms. The minimum disclosure score of 0.146 in 2020 is consistent with scaled-back sustainability reporting amid pandemic-driven operational pressures (Badan Pusat Statistik, 2021). The maximum score of 0.671, recorded in 2024, coincides with heightened regulatory requirements and Indonesia's escalating policy ambitions under the Net Zero Emissions 2060 agenda (Kementerian Energi dan Sumber Daya Mineral, 2025).

The eco-efficiency (EE) variable has a mean value of 0.500, indicating that ISO 14001 certification is present in exactly half of the 100 firm-year observations, suggesting an approximately balanced split between certified and uncertified firms in the sample.

The sales growth (SG) variable registers a mean of 0.249, accompanied by a notably high standard deviation of 1.738, which reflects considerable heterogeneity in revenue growth trajectories. The most negative value, −0.736, observed in 2023, reflects revenue contraction experienced by certain firms during post-recovery market normalization in global energy markets (International Energy Agency, 2023). The maximum of 17.122, also recorded in 2023, underscores the sharp divergence in business performance among sample firms during the same calendar year.

Panel Data Model Selection

The first stage of model selection employs the Chow test to compare the suitability of the CEM relative to the FEM. A probability value below the 0.05 significance threshold leads to adoption of the FEM.

As shown in Table 4, the Chow test yields a Cross-section F-statistic of 1.619544 ($p = 0.0724$) and a Cross-section Chi-square statistic of 33.620637 ($p = 0.0204$). These two test statistics point toward opposite conclusions: the F-statistic supports retention of the CEM, while the Chi-square statistic favors the FEM. Because the Chow test alone does not resolve this ambiguity, additional tests were conducted. Consistent with the guidance in Baltagi (2021), the Hausman and LM tests were applied to arrive at a definitive specification choice.

The Hausman test was subsequently applied to discriminate between the FEM and the REM.

The Hausman test returns a probability of 0.1230, which exceeds the 0.05 critical value (see Table 5). The null hypothesis of no systematic differences between random and fixed effects estimators cannot be rejected; accordingly, the REM is preferred over the FEM.

The Lagrange Multiplier test is applied to assess whether the REM meaningfully outperforms the CEM. The Breusch-Pagan statistic yields a probability of 0.3135, exceeding the 0.05 threshold (see Table 6). The null hypothesis cannot be rejected, indicating that the REM does not provide a statistically appreciable improvement over the CEM. Consequently, the CEM is identified as the most appropriate model for this study, in line with the model selection protocols of Gujarati & Porter (2009) and Baltagi (2021).

The baseline CEM estimates, prior to correction for heteroscedasticity, are presented in Table 7.

Table 7 presents unadjusted coefficient estimates for the association between green accounting disclosure, eco-efficiency, sales growth, and firm value, before robust standard error correction is applied.

Diagnostic Tests

Table 8 presents the pairwise inter-predictor correlations. All correlations remain substantially below the problematic threshold of 0.85, confirming the absence of harmful multicollinearity. The largest correlation exists between green accounting disclosure and eco-efficiency (−0.233), while the other pairings stand at 0.078 and 0.082 respectively. The regression model is therefore free from multicollinearity concerns.

Table 3. Descriptive Statistics

Variable	N	Minimum	Maximum	Mean	Std. Deviation
FV	100	0.496	2.689	1.023	0.376
GAD	100	0.146	0.671	0.448	0.115
EE	100	0.000	1.000	0.500	0.503
SG	100	-0.736	17.122	0.249	1.738

Source: Data processed, 2026

Table 4. Chow Test Results

Effects Test	Statistic	d.f.	Prob.
Cross-section F	1.619544	(19, 77)	0.0724
Cross-section Chi-square	33.620637	19	0.0204

Source: Processed by the author from EViews 13 output (2026)

Table 5. Hausman Test Results

Test Summary	Prob.
Cross-section Random	0.1230

Source: Processed by the author from EViews 13 output (2026)

Table 6. LM Test Results

Test	Cross-section	Time	Both
Breusch-Pagan	0.418627	0.597049	1.015676
Prob.	(0.5176)	(0.4397)	(0.3135)

Source: Processed by the author from EViews 13 output (2026)

Heteroscedasticity was assessed by examining the variance structure of the model residuals. As shown in Table 9, the probability values for GAD (0.2414) and SG (0.3076) exceed 0.05, indicating homoscedastic residuals for these variables. However, EE returns a probability of 0.0415, which is below 0.05, suggesting the presence of heteroscedasticity. To remedy this, the regression was re-estimated using the CEM with White Diagonal robust standard errors (White, 1980). This correction produces heteroscedasticity-consistent standard errors, ensuring the reliability of t-statistics and significance levels throughout the analysis.

Panel Data Regression Results

Following heteroscedasticity correction, the final regression was estimated via the CEM with White Diagonal robust standard errors. The corrected results, presented in Table 10, report the effects of green accounting disclosure, eco-efficiency, and sales growth on Tobin's Q.

The regression intercept is -0.109126, representing predicted firm value when all explanatory variables are set to zero. Green accounting disclosure (GAD) carries a coefficient of 1.685753 at a significance level of $p = 0.0199$, well within the 5% threshold. This positive and statistically significant coefficient confirms that higher environmental disclosure is associated with elevated Tobin's Q among sampled energy firms.

The eco-efficiency coefficient ($EE = -0.509943$; $p = 0.0021$) is highly significant but bears a negative sign, indicating that firms holding ISO 14001 certification exhibited lower market valuations relative to their non-certified counterparts during the observation period.

Sales growth ($SG = 0.005196$; $p = 0.6174$) fails to achieve statistical significance at the 5% level, confirming that revenue expansion, taken in isolation, does not constitute a meaningful determinant of firm value among the sampled firms.

Firm Value = $-0.109126 + 1.685753GAD - 0.509943EE + 0.005196SG + \epsilon$

Hypothesis Testing

The R^2 value of 0.187 indicates that the three independent variables collectively account for 18.7% of the variation observed in firm value. The remaining 81.3% of variation is, explained by factors external to the present model. Although the model attains statistical significance, the low R^2 implies limited explanatory power (see Table 11). These results should therefore be interpreted as evidence of a statistically meaningful association rather than a strong predictive relationship, pointing to the likelihood that firm value in Indonesia's energy sector is shaped by a richer set of determinants than those examined here.

The probability associated with the F-statistic (0.000176) falls far below the 0.05 benchmark, verifying that the three predictors, when evaluated together, exert a statistically significant joint effect on firm value (see Table 12).

The partial hypothesis testing results confirm that green accounting disclosure has a significant positive effect on firm value ($p = 0.0199$), supporting H1. Eco-efficiency (EE) is also statistically significant ($p = 0.0021$) but inversely associated with firm value, supporting H2. Sales growth (SG) is not statistically significant ($p = 0.6174$) failing to support H3 (see Table 13).

Green Accounting Disclosure and Firm Value

Green accounting disclosure exerts a statistically significant and positive effect on firm value ($\beta = 1.685753$; $p = 0.0199$), supporting H1. Firms with broader environmental disclosure scope tend to command higher Tobin's Q ratios in the observed sample. The measurement approach in this study is based on the GRI G3/G3.1 disclosure index, which captures the extent of environmental transparency, consistent with the evidence reported by Sari & Hidayat (2025) and Anggita et al. (2022).

From a signaling theory standpoint, this outcome is consistent with the notion that environmental disclosure acts as a credible quality signal in Indonesia's capital market, effectively narrowing informational gaps between firms and outside investors and thereby supporting higher valuations during the 2020–2024 window. The finding implies that sustainability reporting has become an increasingly important component of investor assessment, augmenting rather than substituting for conventional financial metrics, consistent with the evidence reported by Sari & Hidayat (2025) and Anggita et al. (2022).

Eco-Efficiency and Firm Value

Eco-efficiency exhibits a statistically significant negative effect on firm value ($\beta = -0.509943$; $p = 0.0021$), providing empirical support for H2. While the presence of a significant association between eco-efficiency and firm value is confirmed, the direction of the effect is contrary to standard theoretical expectations. ISO 14001 certification status serves as the eco-efficiency proxy in this study. ISO 14001 certification is used as a proxy for eco-efficiency in this study due to its representation of structured environmental management practices.

Interpreted through signaling theory, this result suggests that environmental management certification does not function as a value-augmenting signal within Indonesia's energy sector over the 2020–2024 period. Although certification is theoretically intended to convey long-term environmental

Table 7. Baseline CEM Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.109126	0.340442	-0.320543	0.7493
X1_GAD	1.685753	0.684451	2.462929	0.0156
X2_EE	-0.509943	0.155338	-3.282785	0.0014
X3_SG	0.005196	0.043814	0.118582	0.9059

Source: Processed by the author from EViews 13 output (2026)

Table 8. Multicollinearity Test Results

Variable	X1_GAD	X2_EE	X3_SG
X1_GAD	1.000000	-0.233188	0.078477
X2_EE	-0.233188	1.000000	0.081683
X3_SG	0.078477	0.081683	1.000000

Source: Processed by the author from EViews 13 output (2026)

Table 9. Heteroscedasticity Test Results

Variable	Prob.
X1_GAD	0.2414
X2_EE	0.0415
X3_SG	0.3076

Source: Processed by the author from EViews 13 output (2026)

Table 10. CEM with White Diagonal Robust Standard Errors

Variable	Coefficient	Robust SE	t-Statistic	Prob.
C	-0.109126	0.344614	-0.316662	0.7522
X1_GAD	1.685753	0.712196	2.366979	0.0199
X2_EE	-0.509943	0.161311	-3.161247	0.0021
X3_SG	0.005196	0.010368	0.501107	0.6174

Source: Processed by the author from EViews 13 output (2026)

Table 11. Coefficient of Determination (R²)

Indicator	Value
R-squared (R ²)	0.187
Variance Explained	18.7%
Unexplained Variance	81.3%

Source: Processed by the author from EViews 13 output (2026)

Table 12. F-Test Results (Simultaneous)

Indicator	Value
Prob(F-statistic)	0.000176
Threshold	0.05
Conclusion	Significant

Source: Processed by the author from EViews 13 output (2026)

Table 13. T-Test Results (Partial)

Variable	t-Statistic	Prob.	Threshold	Decision
GAD	2.366979	0.0199	< 0.05	H1 Supported
EE	-3.161247	0.0021	< 0.05	H2 Supported
SG	0.501107	0.6174	< 0.05	H3 Not Supported

Source: Processed by the author from EViews 13 output (2026)

responsibility and stakeholder confidence, its market effect appears to be dampened by the near-term compliance costs and organizational restructuring that accompany certification acquisition and maintenance.

This pattern may reflect the tendency of emerging market investors to discount long term environmental benefits in

favor of short run financial performance, constraining the degree to which eco-efficiency signals are priced into equity valuations. These findings are broadly consistent with those of Damas et al. (2021) and Riaz et al. (2022), who report analogous market reactions to environmental management system adoption.

Sales Growth and Firm Value

Sales growth does not attain statistical significance as a firm value determinant ($\beta = 0.005196$; $p = 0.6174$), indicating that H3 cannot be supported. Revenue expansion on its own is insufficient to account for variation in equity market valuations among the energy firms in the study sample.

Consistent with Fauziyah & Kustinah (2023), the insignificant outcome suggests that top-line revenue signals do not independently generate investor valuation responses. Within the signaling framework, higher sales growth is theoretically expected to indicate improved operational momentum and enhanced future earnings capacity. Empirically, however, the evidence indicates that investors evaluate growth signals in tandem with profitability and operational efficiency metrics, rather than treating them as self-sufficient valuation determinants.

Joint Effect of Independent Variables on Firm Value

When assessed in combination, green accounting disclosure, eco-efficiency, and sales growth jointly exert a statistically significant effect on firm value. Nevertheless, the limited explanatory scope of the model ($R^2 = 0.187$) makes clear that these three variables collectively account for only a minor share of firm value variation, with the preponderance of variation likely attributable to factors not included in the model.

While the model is statistically significant, its explanatory power remains limited ($R^2 = 0.187$). This indicates that the variables included in the model explain only a modest proportion of the variation in firm value, while the remaining variation is attributable to other determinants not captured in the analysis, such as profitability, leverage, market risk factors, and firm specific characteristics. Nevertheless, the findings suggest that sustainability related indicators and financial growth measures provide incremental explanatory value for firm valuation, although their overall contribution remains relatively modest.

From a signaling theory perspective, market participants process multiple signals simultaneously; however, the relative importance assigned to each signal is conditioned by the capital-intensive nature and structural characteristics of the energy sector. As a result, environmental and growth related signals may influence firm value, but their effects are likely to coexist with a broader set of financial and market based considerations.

Limitations and Recommendations

Several methodological constraints merit acknowledgment. First, the sample is restricted to IDX-listed energy companies from 2020 to 2024, which may limit external validity across different industry settings or time horizons. Second, the model incorporates only three explanatory variables, and the R^2 of 18.7% signals that a substantial proportion of firm value variance is driven by omitted factors, including profitability indicators, financial leverage, market risk exposure, corporate

governance mechanisms, and comprehensive ESG performance metrics.

Third, eco-efficiency is captured via a binary ISO 14001 certification indicator, which records adoption status but does not distinguish between firms in terms of the intensity or effectiveness of their actual environmental management practices. This suggests avenues for future research to apply more detailed proxies, such as carbon emission intensity per unit of output, energy efficiency ratios, or composite environmental performance indices. Similarly, extending the observation period, enlarging the sample, and integrating additional variables including green innovation scores, carbon disclosure indices, and firm-level governance metrics would enhance the analytical breadth and robustness of future investigations.

Conclusion

This study investigated the effects of green accounting disclosure, eco-efficiency, and sales growth on the market valuation of IDX-listed energy sector companies over the 2020–2024 period. Empirically, the three predictors jointly and significantly influence firm value; yet the modest explanatory power ($R^2 = 0.187$) underlines that the bulk of firm value variation is shaped by determinants not captured in the present model.

At the individual variable level, green accounting disclosure has a positive and statistically significant association with firm value, while eco-efficiency shows a significant but inverse relationship. Sales growth, by contrast, exerts no statistically significant influence on firm value.

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These results suggest that market participants positively price environmental transparency, penalize ISO 14001-based eco-efficiency certification at least in the short term, and do not treat revenue growth as a self-sufficient valuation signal.

From a signaling theory perspective, the findings demonstrate that corporate signals are not uniformly interpreted across investors in an emerging market setting. Environmental disclosure is read as a positive quality signal that augments market value, whereas eco-efficiency certification appears to be evaluated in terms of its near-term cost burden rather than its strategic long-run benefits. This study thereby extends signaling theory by showing that the informativeness of environmental and financial signals in the Indonesian energy sector is conditional and context-dependent, rather than universal.

Directions for future research include examining the dynamic effects of ISO 14001 certification over time, contrasting the firm value implications of voluntary versus mandatory sustainability disclosures, and incorporating variables such as carbon emission disclosure, green innovation, and composite ESG scores to more comprehensively account for the determinants of firm value in emerging market settings.

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