

The Effect of Media Exposure, Firm Size, and Leverage on Carbon Emission Disclosure in Energy Companies

Gadis Yesile¹, Shiwi Angelica Cindiyasari², Yanti Puspita Sari³, Marsi Fella Rizki⁴, Imam Ahmad⁵

Universitas Teknokrat Indonesia^{1,2,3,4,5}

gadisyebile@teknokrat.ac.id¹, shiwi.angelica@teknokrat.ac.id², yanti.puspita.sari@teknokrat.ac.id³,
marsifella.rizki@teknokrat.ac.id⁴, imamahmad@teknokrat.ac.id⁵

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Abstract:

Climate change has become a major global concern, with the energy sector recognized as one of the largest contributors to carbon emissions in Indonesia. This condition has increased demands for greater corporate transparency through carbon emission disclosure as part of sustainable business practices. This study aims to examine the effects of media exposure, firm size, and leverage on carbon emission disclosure among energy companies listed on the Indonesia Stock Exchange during the 2021–2024 period. A quantitative research approach was employed using purposive sampling, resulting in 22 companies with 88 firm-year observations. The data were analyzed using panel data regression with EViews 12. The findings indicate that media exposure has a positive and significant effect on carbon emission disclosure, while firm size and leverage do not have a significant effect. These results suggest that external public pressure through media attention plays a more important role in encouraging corporate transparency than internal company characteristics. This study concludes that media exposure is an important determinant of carbon emission disclosure in Indonesian energy companies. The findings contribute to the environmental accounting literature and provide practical implications for regulators and corporate management in strengthening sustainability reporting and improving transparency in carbon emission disclosure.

Keywords: Media Exposure, Firm Size, Leverage, Carbon Emissions Disclosure.

Abstrak :

Perubahan iklim menjadi isu global yang semakin mendesak, dengan sektor energi sebagai salah satu penyumbang emisi karbon terbesar di Indonesia. Kondisi ini mendorong meningkatnya tuntutan terhadap transparansi perusahaan melalui pengungkapan emisi karbon sebagai bagian dari praktik bisnis berkelanjutan. Penelitian ini bertujuan menganalisis pengaruh media exposure, ukuran perusahaan, dan leverage terhadap pengungkapan emisi karbon pada perusahaan sektor energi yang terdaftar di Bursa Efek Indonesia pada periode 2021–2024. Penelitian menggunakan pendekatan kuantitatif dengan teknik purposive sampling sehingga diperoleh 22 perusahaan atau 88 observasi perusahaan-tahun. Analisis data dilakukan menggunakan regresi data panel dengan bantuan perangkat lunak EViews 12. Hasil penelitian menunjukkan bahwa media exposure berpengaruh positif dan signifikan terhadap pengungkapan emisi karbon, sedangkan ukuran perusahaan dan leverage tidak berpengaruh signifikan. Temuan ini menunjukkan bahwa tekanan eksternal melalui perhatian media lebih berperan dalam mendorong transparansi perusahaan dibandingkan dengan karakteristik internal perusahaan. Penelitian ini menyimpulkan bahwa media exposure merupakan determinan penting dalam pengungkapan emisi karbon pada perusahaan energi di Indonesia. Hasil penelitian memberikan kontribusi terhadap pengembangan literatur akuntansi lingkungan serta menjadi masukan bagi regulator dan manajemen perusahaan dalam meningkatkan kualitas pelaporan keberlanjutan dan transparansi pengungkapan emisi karbon.

Kata Kunci: Paparan Media, Ukuran Perusahaan, Leverage, Pengungkapan Emisi Karbon.

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INTRODUCTION

Climate change represents a worldwide challenge that has gained considerable focus over the past few years. The main cause of global warming is the increase in greenhouse gas emissions, especially carbon dioxide (CO₂), stemming from human actions like industrial activities, deforestation, and fossil fuel combustion. These factors result in escalating global temperatures, alterations in climate patterns, and a surge in the occurrence of natural disasters (IPCC, 2023). As a consequence of climate change, various nations, with Indonesia being a key example, are implementing environmental policies and corporate approaches to curb carbon emissions. In 2021, Indonesia was identified as the seventh-largest greenhouse gas (GHG) emitter globally, accounting for 1.23 Mt CO₂e (Climate Watch, 2022). According to data retrieved from Climate Watch (1990-2021), the energy sector is primarily responsible for Greenhouse gas emissions in Indonesia, which are 679.00 million metric tons of CO₂. This amount is significantly higher than the emissions from the transportation sector, which produces 140.72 million metric tons of CO₂, the manufacturing sector at 132.10 million metric tons of CO₂, and other fuel sectors, contributing 3.46 million metric tons of CO₂ (Climate Watch, 2022).

The energy sector plays a crucial role in carbon emissions in Indonesia due to the country's substantial reliance on oil, natural gas, and coal (Agency, I.E., 2023). According to the 2024 Global Carbon Budget report, CO₂ emissions from the burning of fossil fuels are projected to reach 37.6 Gt CO₂ in 2024, up 0.8% from 2023. When combined with emissions from land-use change totaling 4.2 billion metric tons, total CO₂ emissions are estimated to reach 41.6 billion metric tons in 2024, up from 40.6 billion metric tons the previous year. Research by Downar et al. (2021) explains that carbon disclosure is part of companies' efforts to increase transparency regarding emissions and environmental impacts to the public and stakeholders. However, in practice, Indonesian energy companies engage in this through voluntary disclosure.

In the context of legitimacy theory, companies seek to obtain and maintain legitimacy from society by aligning their activities with prevailing values and norms (Suchman, 1995). Carbon emissions disclosure has become one of the strategies companies use to demonstrate environmental responsibility and gain public trust (Tilling, 2004). Companies that fail to meet public expectations regarding environmental issues risk losing legitimacy, which can impact their performance and sustainability. This legitimacy gap can lead to a decline in reputation, increased pressure from regulators and stakeholders, and ultimately threaten the company's business sustainability. Therefore, transparency in carbon emissions disclosure is becoming increasingly important, especially for companies with high levels of public exposure (Dowling & Pfeffer, 1975).

One element that affects the reporting of carbon emissions is exposure in the media. Media exposure means how often a business or organization appears in information or messages spread via mass media and online channels. When a company negatively impacts the environment, mainstream media and online platforms respond accordingly. If an organization shows a commitment to environmental sustainability, it is likely to receive a favorable perception from the public (Berliana and Putri, 2024). Media can significantly impact how the public views a company and can intensify the demand for transparency regarding its environmental practices. Firms that experience substantial media attention typically implement strong initiatives to enhance the disclosure of environmental information in response to public pressures (Luo, Xiong and Mardani, 2022). However, research conducted by Ardiany et al., (2023) suggests that media exposure does not significantly affect the broader disclosure of carbon emissions information.

Firm size is generally acknowledged as a significant factor influencing the disclosure of environmental and carbon emissions data. This is indicative of the magnitude of the business activities, resource availability, and the extent of public scrutiny an organization encounters (Budiman et al., 2024). The size of a firm is quantified through the logarithm of its total assets,

which serves to standardize data distribution and mitigate the impact of outliers (Satria, 2026). Larger firms usually possess ample resources and attract greater public attention, leading them to be more open regarding their carbon emissions disclosures. However, a study by Siddique et al., (2021) suggests that the size of a firm does not affect the disclosure of carbon emissions.

Leverage refers to an organization's capability to settle long-term debts using its own equity (Satria, 2026). The debt-to-equity ratio, a frequently employed metric for measuring leverage, juxtaposes total liabilities against total equity, with a higher ratio signifying increased dependence on borrowing (Sulistyawati et al., 2025).. While a high leverage ratio can heighten a company's financial vulnerability, it can also prove advantageous if handled properly to stimulate growth and increase profits (Widjanarko, 2026). Firms with significant leverage often exhibit greater caution when sharing information due to demands from their creditors (Laksani, Andesto and Kirana, 2020).

Based on previous studies over the past five years, there have been mixed (inconsistent) results regarding the effects of media exposure, firm size, and leverage on carbon emissions disclosure. These inconsistent results stem from differences in country characteristics, industry sectors, and applicable regulatory levels. Furthermore, research specifically examining energy sector companies in Indonesia during the period following the increased implementation of ESG policies remains relatively limited. This study contributes to the development of the literature on carbon emissions disclosure. First, this study uses the 2021–2024 observation period, which follows the increased implementation of Environmental, Social, and Governance (ESG) principles and Indonesia's commitment to reducing greenhouse gas emissions. Second, the study focuses on companies in the energy sector, which is the sector with the largest contribution to carbon emissions in Indonesia, thereby providing a more specific picture compared to previous studies that generally covered various industrial sectors. Third, this study simultaneously analyzes the effects of media exposure, firm size, and leverage on carbon emissions disclosure, with the aim of providing a more comprehensive understanding of the determinants of carbon emissions disclosure in the context of energy companies in Indonesia.

Therefore, this study was conducted to provide more comprehensive empirical evidence regarding the factors that influence carbon emissions disclosure among energy companies in Indonesia. This study was conducted to test and analyze “The Effects of Media Exposure, Firm Size, and Leverage on Carbon Emissions Disclosure Among Energy Companies Listed on the Indonesia Stock Exchange from 2021 to 2024”. The results of this study are expected to contribute to the development of the literature on carbon emissions disclosure and to provide guidance to regulators, investors, and company management on improving the transparency of environmental information as part of the implementation of sustainable business practices. According to the hypothesis of this study are:

H1: Media exposure has a positive and significant effect on carbon emissions disclosure.

H2: Firm size has a positive and significant effect on carbon emissions disclosure.

H3: Leverage has a positive and significant effect on carbon emissions disclosure.

RESEARCH METHODOLOGY

The population for this study is all energy companies listed on the Indonesia Stock Exchange from 2021 to 2024. Purposive sampling, a method of selecting a sample based on specific criteria established by the study, is used in this study.

Table 1. Criteria Sample

No	Research Criteria	Number
1	Energy Companies listed on the Indonesia Stock Exchange (IDX) during 2021-2024	87
2	Energy companies are not consistently listed on the IDX during 2021-2024	(21)
3	Energy companies that did not consistently publish sustainability reports or annual reports during 2021-2024	(25)
4	Companies using a currency other than USD	(19)
Total Research Sample		22
Total Research Observations = 22 x 4		88

This study employs a purposive sampling technique, which is a method of selecting a sample based on specific criteria tailored to the research objectives. This technique was chosen to ensure that the companies included in the sample possess characteristics relevant to the analysis of carbon emissions disclosure. The criteria used in this study are as follows:

1. Energy sector companies listed on the Indonesia Stock Exchange (IDX) during the 2021–2024 period.
2. Companies that were not delisted and remained consistently listed on the Indonesia Stock Exchange throughout the 2021–2024 observation period.
3. Companies that consistently published annual reports and sustainability reports during the 2021–2024 period.
4. Companies that present their financial statements in U.S. dollars (USD).

Based on the criteria in Table 1, a total of 22 companies were identified as meeting the requirements to serve as the research sample. With an observation period of four years (2021–2024), the number of observations used in this study is 88 firm-year observations. This study uses independent and dependent variables. The independent variables in this study are media exposure, firm size, and leverage. Media exposure is measured using a dummy variable based on three media sources: news, sustainability reports, and annual reports. Firm size is measured by calculating the logarithm of a company's total assets, and leverage is measured by comparing a company's total liabilities to its total equity specifically by comparing the amount of debt to the amount of equity. The dependent variable is measured by calculating the carbon emissions index using GRI 305 in accordance with information from the CDP (Carbon Disclosure Project). The operational definitions of the independent and dependent variables of this study, along with their measurements, are presented in Table 2 below.

Table 2. Operational Definitions and Measurement of Variables

Variable	Definition	Measurement
Media Exposure (X1)	The extent of a company's exposure in the mass media to information related to carbon emissions	Dummy variable: 1 = the company is covered by the mass media regarding carbon emissions, and mass media do not cover 0 = the company regarding carbon emissions
Firm Size (X2)	The size of a company, as measured by its total assets	Measured using the natural logarithm of total assets: Firm Size = $\ln(\text{Total Assets})$
Leverage (X3)	Leverage is measured using the Debt-to-Assets Ratio (DAR), which indicates the proportion of total assets and reflects the company's level of financial risk exposure	The debt ratio in this study is measured using the Debt-to-Equity Ratio (DER), which is calculated by comparing total liabilities to total equity: DER = Total Liabilities/Total Equity.
Disclosure of Carbon Emissions (Y)	The extent to which a company discloses information related to carbon emissions in its annual report or sustainability report	Carbon emissions disclosure is measured based on the Global Reporting Initiative (GRI) 305, which consists of the following seven categories: GRI 305-1; GRI 305-2; GRI 305-3; GRI 305-4; GRI 305-5; GRI 305-6; GRI 305-7. Companies that disclose carbon emission information in accordance with the GRI 305 indicators are assigned a score of 1, whereas companies that do not disclose such information are assigned a score of 0. The carbon emissions disclosure (CED) index is calculated using the following formula: CED = Number of item disclosed/Total number of GRI 305 Items.

This study uses descriptive statistical analysis to provide a comprehensive overview of the data, as reflected in the mean, minimum, and standard deviation. It also employs panel data regression analysis using EViews to select the best model through the Chow test, Hausman test, and Lagrange multiplier test. The Chow test is used to choose between the common-effects model and the fixed-effects model. The Hausman test is used to determine whether the data should be analyzed using a fixed-effects model or a random-effects model. The Lagrange multiplier test is used to determine whether the random-effects model is a better fit than the common-effects model (OLS). A Lagrange multiplier value greater than the chi-square value indicates that the random-effects model is the appropriate choice.

This study uses a panel data regression model. Panel data regression analysis is a method that combines cross-sectional data with time-series data. The panel data regression model used in this study is presented as follows:

$$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \epsilon$$

Note: Y = Carbon Emissions Disclosure, α = Constant, β = Regression Coefficient, ϵ = Standard Error, X_1 = Media Exposure Variable, X_2 = Firm Size Variable, X_3 = Leverage Variable, i = Company, t = Time.

This study also tests classical assumptions (normality test, multicollinearity test, and heteroscedasticity test) to assess the suitability of the regression model in examining the relationship between independent and dependent variables. The purpose of a normality test is to determine whether the disturbance variables or residuals in a regression model follow a normal distribution. The purpose of a multicollinearity test is to examine whether there is a high or perfect correlation among the independent variables in a regression model, in order to detect the presence or absence of multicollinearity. The heteroscedasticity test is used to determine whether the variances of the residuals differ across observations. If the variances are unequal, heteroscedasticity is present, which can lead to inefficient model estimates.

This study also employs hypothesis testing using the coefficient of determination (R^2) and the t-test.

DISCUSSION

Descriptive Statistics

The results of the descriptive statistical analysis are presented below.

Table 3. Descriptive Statistics

Statistik Deskriptif	Y	X1	X2	X3
Mean	0.784091	0.443182	20.26518	1.207011
Median	0.785714	0.000000	20.21107	0.537255
Maximum	1.000000	1.000000	23.10117	8.453471
Minimum	0.285714	0.000000	13.99310	0.000387
Std. dev	0.183783	0.499608	1.730560	1.634991

Based on the descriptive statistics in Table 3, in general, the research data exhibit fairly good characteristics with a relatively controlled level of dispersion. The dependent variable (Y) has a high mean and low variation, indicating that the observed values tend to be concentrated around the mean. Meanwhile, the independent variables exhibit diverse characteristics. Overall, the descriptive statistics show that the data have sufficient variation for further analysis using inferential methods, making them suitable for testing the relationships between variables in this study. Furthermore, based on the results of tests conducted using EViews, all data are normally distributed and free from multicollinearity and heteroscedasticity.

Classical Assumption Tests

Classical assumption tests were conducted to assess the suitability of the regression model in this study regarding the relationship between the independent and dependent variables. These tests were performed immediately before the regression analysis to avoid any deviations that might lead to errors in the ongoing research. Based on the results of the testing using EViews, it was found that all variables in the study were normally distributed and free from multicollinearity and heteroscedasticity.

Table 4. Chow Test Results

Effect Test	Prob.
<i>Cross-section F</i>	0.0106
<i>Cross-section Chi-square</i>	0.0008

Based on the table 4 above, it can be seen that the probability value for the cross-section F-statistic is 0.0106, and the probability value for the cross-section chi-square statistic is 0.0008. These probability values are smaller than the significance level of 0.05; therefore, it can be concluded that H_0 is rejected and H_1 is accepted. Based on this, the Fixed Effects Model (FEM) is used.

Table 5. Hausman Test

Test Summary	Prob.
<i>Cross-section random</i>	0.3088

Based on the table 5 above, it can be seen that the p-value for the cross-sectional random effects hypothesis is 0.3088. Since this p-value is greater than 0.05, we can conclude that H_0 is accepted and H_1 rejected. These results indicate that the model used is the Random Effects Model (REM).

Table 6. Lagrange Multiplier (LM) Test

	<i>Cross-section</i>
<i>Breusch-Pagan</i>	0.0410

Based on the table 6 above, it can be seen that the Breusch-Pagan probability value of 0.0410 is less than 0.05; therefore, it can be concluded that the accepted panel model is the REM. Thus, based on the overall results of the panel data model selection test, the best model to use in this study is the REM.

Panel Data Regression Results

Based on the results of the panel data regression analysis, the estimated regression equation is as follows.

$$Y = 0.4807 + 0.1393 \cdot X_1 + 0.0109 \cdot X_2 + 0.0160 X_3 + e$$

Table 7. Panel Data Regression Results

Variable	Constanta	t-statistic	Prob.
CED (Y)	0.4807	2.2756	0.0254
Media Exposure (X1)	0.1393	3.3924	0.0011
Firm Size (X2)	0.0109	0.4382	0.6623
Leverage (X3)	0.0160	0.8698	0.3869

Based on the results of the panel data regression model in Table 7, the following findings were obtained.

1. The constant of 0.4807 indicates that if the variables of media exposure, firm size, and leverage remain constant, the value of carbon emissions disclosure will be 0.4807.
2. The media exposure variables have a constant value of 0.1393, indicating that every one-unit increase in media exposure will increase the value of the carbon emissions

disclosure variable by 0.1393. Based on the probability value of 0.0011 (< 0.05), the media exposure variable has a positive and significant effect on carbon emissions disclosure.

3. The firm size variable has a constant value of 0.0109, indicating that a one-unit increase in the firm size variable increases the carbon emissions disclosure variable by 0.0109. However, given the probability value of 0.6623 (> 0.05), the firm size variable does not affect the carbon emissions disclosure variable.
4. The leverage variable has a constant value of 0.0160, indicating that a one-unit increase in the leverage variable will increase the carbon emissions disclosure variable by 0.0160. However, given the probability value of 0.3869 (> 0.05), the variable does not affect the carbon emissions disclosure variable.

Hypothesis Testing Results

Coefficient of Determination (R^2)

Table 8. Coefficient of Determination (R^2)

Description	Value
<i>R-squared</i>	0.141711
<i>Adjusted R-squared</i>	0.111058

Based on the table 8 above, the adjusted R-Squared value is 0.111058. This indicates that the independent variables (media exposure, firm size, and leverage) account for 11.11% of the variance in the carbon emissions disclosure variable. Meanwhile, the remaining 88.89% is explained by other variables outside the scope of this study's model.

T-test Result

Table 9. T-test Result

Variable	Coefficient	T-statistic	Prob.
<i>Media exposure (x1)</i>	0.133743	3.392438	0.0011
<i>Firm size (X2)</i>	0.005708	0.438238	0.6623
<i>Leverage (X3)</i>	0.011320	0.869863	0.3869

Based on the results of the t-test in Table 9, the following findings were obtained:

1. The results of the t-test show that the media exposure variable has a p-value of 0.0011 (< 0.05). This indicates that the media exposure variable has a positive and significant effect on carbon emissions disclosure.
2. The t-test results show that firm size has a p-value of 0.6623 (> 0.05). This indicates that firm size does not affect carbon emissions disclosure.
3. The t-test results show that leverage has a p-value of 0.3869 (> 0.05). This indicates that leverage does not affect carbon emissions disclosure.

The Effect of Media Exposure on Carbon Emission Disclosure

Based on the results of the hypothesis testing, media exposure has a positive and significant effect on carbon emissions disclosure. These results indicate that the greater a company's media exposure, the more likely it is to disclose all information related to environmental issues, particularly carbon emissions. Media exposure as external pressure that can influence a company's disclosure of environmental information. When a company's activities receive media attention, it increases

transparency into its operational activities, particularly those related to the environmental impacts it causes. Media exposure can shape public opinion about a company's commitment to climate change, prompting it to disclose its carbon emissions to maintain its image in the eyes of the public and all stakeholders. These findings are supported by research conducted by Harahap et al., (2025), which found evidence that media exposure has a positive and significant effect on carbon emissions disclosure. The study explains that companies that receive greater media attention tend to disclose carbon emissions information more extensively due to the incentive to demonstrate their commitment to environmental responsibility. These findings can be explained through legitimacy theory. Legitimacy theory states that companies seek to obtain, maintain, and enhance their legitimacy in the eyes of the public through activities that align with social norms, values, and expectations (Dowling & Pfeffer, 1975). In this context, the media serves as a means of disseminating information that can influence public perception of companies. When a company receives media attention particularly regarding environmental issues it will seek to align its actions with public expectations by disclosing carbon emissions more extensively.

The Effect of Firm Size on Carbon Emissions Disclosure

The results of the hypothesis testing indicate that firm size does not affect carbon emissions disclosure. These results suggest that firm size is not a primary factor determining carbon emissions disclosure. Large firms, which possess optimal resources, strong financial capabilities, and more complex operational activities, do not automatically become more transparent in disclosing carbon emission information. Based on previous research, carbon emissions disclosure is largely influenced by a company's awareness of environmental issues, stakeholder pressure, corporate policies, and the regulations in effect in a particular country. The findings of this study are supported by Alamanda et al., (2025), who found that firm size does not affect carbon emissions disclosure in Indonesia. The study explains that company size does not always reflect a company's level of commitment to environmental transparency, as there are still large companies that have not consistently disclosed carbon emissions information in their sustainability reports. In relation to legitimacy theory, the results of this study indicate that company size has not yet become a determining factor in achieving social legitimacy through carbon emissions disclosure. Legitimacy theory states that companies will strive to align their activities and disclosures with societal values and expectations in order to gain social acceptance (Dowling & Pfeffer, 1975). In this context, large companies do tend to receive greater public attention than small companies. However, the study's findings show that this attention is not always met with increased carbon emissions disclosure.

The Effect of Leverage on Carbon Emissions Disclosure

The results of the hypothesis testing indicate that leverage does not affect carbon emissions disclosure. This suggests that a company's debt level is not a primary consideration in its carbon emissions disclosure. Leverage refers to a company's ability to use debt to increase its profit potential. Companies with high leverage levels are generally more cautious in allocating costs, including those related to environmental disclosure. This situation leads companies to prioritize fulfilling their obligations to creditors over disclosing carbon emissions. These findings are supported by research conducted by Syahdanti & Marietza, (2024), which demonstrated that leverage does not affect carbon emissions disclosure. The study explains that companies with high debt levels tend to focus more on maintaining financial stability and the ability to pay their obligations than on increasing environmental disclosure. In relation to legitimacy theory, the results of this study indicate that leverage levels have not yet been able to encourage companies to gain social legitimacy through the disclosure of carbon emissions. Legitimacy theory explains that companies will seek to gain public support by aligning their activities with prevailing social values

and expectations (Dowling & Pfeffer, 1975). In this context, companies with high leverage should have an incentive to increase transparency in order to maintain the trust of investors and creditors.

CONCLUSION

The results of this study indicate that the media exposure variable has a positive and significant effect on carbon emissions disclosure. Meanwhile, firm size and leverage do not affect carbon emissions disclosure. These results suggest that a company's size and debt level are not primary determinants of carbon emissions disclosure. This study used only a sample of energy companies listed on the Indonesia Stock Exchange (IDX) with an observation period of four years. The study has limitations regarding the time period and sector, which may mean the results do not fully reflect companies' actual conditions.

Additionally, this study only uses three independent variables: media exposure, firm size, and leverage to explain carbon emissions disclosure. Therefore, future researchers are advised to include additional independent variables that may influence carbon emissions disclosure, such as profitability, environmental performance, good corporate governance, and government regulations. Future research could expand the study's scope by including additional industrial sectors and extending the study period to yield more accurate results that provide a broader picture of companies' conditions.

This study makes an empirical contribution by enriching the literature on the factors influencing carbon emissions disclosure, particularly among companies in the energy sector in Indonesia during the 2021–2024 period. This study also provides the latest evidence on the impact of media exposure on carbon emissions disclosure during a period of increasing implementation of sustainability and Environmental, Social, and Governance (ESG) practices in Indonesia. It is hoped that this study will serve as input for company management to improve the quality and transparency of carbon emissions disclosure as part of corporate sustainability strategies. For regulators, the results of this study can serve as a basis for formulating policies that promote improved sustainability reporting, particularly in the energy sector, which is the largest contributor to carbon emissions in Indonesia. Additionally, for investors and other stakeholders, information regarding carbon emissions disclosure can be used as a factor in making investment decisions that prioritize sustainability.

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