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FACTORS DETERMINING OF CARBON EMISSIONS VOLUNTARY DISCLOSURE IN INDONESIA'S ENERGY SECTOR COMPANIES

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Abstract:
Reporting information on carbon emissions from company operations is a form of social and environmental responsibility that contributes to reducing greenhouse gas emissions to achieve the SDGs target by 2030. This carbon-related reporting is the role of accountants through carbon accounting as a form of transparency and accountability, as well as an effort to reduce GHG emissions produced by companies. This research is intended to see how energy sector companies implement voluntary disclosure of carbon emissions with several determinants reflected in the company size scale, the exposure carried out by companies in the company's website media, and shareholding owned by institutions. The research population is in energy sector companies listed on the Indonesia Stock Exchange (IDX) during 2018-2022. This research used purposive sampling, so 50 observational data were obtained from 10 energy sector companies in 5 years. Results show that media exposure influences carbon emission disclosure. Companies that present media exposure have an increase in the carbon emission disclosure level. Meanwhile, firm size and institutional ownership do not influence the disclosure of carbon emissions. A company with a large scale and high institutional shareholding does not guarantee that it will report carbon emission information thoroughly.

Keywords: Carbon Emission Disclosure, Firm Size, Institutional Ownership, Media Exposure

INTRODUCTION

The environment is still a significant issue worldwide due to global warming and climate change caused by greenhouse gas (GHG) emissions, especially from the company's operational activities. Several groups of chemicals, such as carbon dioxide (CO2), nitrous oxide (N2O), methane (CH4), chlorofluorocarbons (CFCs), sulfur hexafluoride (SF6), hydrofluorocarbons (HFCs), and perfluorocarbons (PFCs) are released and absorbed into the earth's atmosphere as the main factors causing GHG emissions (Datt et al., 2021). There is a significant need to tackle the challenges of global warming and climate change because it can threaten various life in the world into the future (Kılıç & Kuzey, 2018). It mandates that companies disclose information about their carbon emissions to maintain accountability and transparency and reduce emission levels (Bedi & Singh, 2024b).

Indonesia was the seventh largest GHG emitter globally in 2021, contributing 1,48 Gt CO2e (Climate Watch, 2022). Since industrialization, the increase in GHG emissions by human activities has been more significant than the natural increase, with up to 50% of the carbon from fossil fuel extraction (NASA, 2023). Climate watch observations over the period 1990-2021 reveal that GHG emissions in Indonesia are primarily released in the energy sector, reaching 679,00 Mt CO2e in 2021. This figure is far compared to transportation of 140,72 Mt CO2e, manufacturing of 132,10 Mt CO2e, and other fuel combustion of 3,46 Mt CO2e (Climate Watch, 2022). In addition, GHG emissions globally are also primarily released in the energy sector, reaching 73,2% (Ritchie, 2020). It proves that most carbon emissions came from the energy sector, among other sectors. The energy sector

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plays a vital role in economic growth, but its operational activities will continue to produce GHGs and cause environmental pollution.

International agreements, including the Kyoto Protocol in 2004 and the Paris Agreement in 2015, required the establishment of Nationally Determined Contributions (NDCs) as a plan to decrease carbon emissions in order to address climate change impacts. In addition, the United Nations established the 2030 agenda to address global challenges through the 17 Sustainable Development Goals (SDGs) and guiding companies on business sustainability and carbon performance that are integrated into corporate sustainability reports (Toukabri & Youssef, 2022). The ratification of the Kyoto Protocol also raises carbon accounting and requires companies to acknowledge, measure, capture, represent, and disclose carbon emissions (Irwhantoko & Basuki, 2016). Carbon accounting is a way to contribute to the concept of Corporate Social Responsibility (CSR) (Datt et al., 2021).

The company's seriousness in dealing with the adverse impacts of climate change caused by GHGs is reflected in the disclosure of carbon emissions. However, every company has yet to implement carbon emission disclosure. One example is the air pollution caused by a subsidiary of Medco International, Medco E&P Malaka. The Aceh Provincial Environment and Forestry Agency and the East Aceh District Environment Agency investigated the company for leaking toxic hydrogen sulfide (H2S) gas. This problem has been disturbed by residents who smelled an unpleasant odor for four years, from 2019 to early 2023. It caused as many as 30 residents to suffer poisoning due to inhalation of the toxic gas, and as many as 678 residents were displaced due to the smell of the toxic gas. The impacts caused by the operational activities of Medco E&P Malaka do not reflect the actual carbon emission disclosure.

Furthermore, the author conducted a preliminary review of energy sector companies of the listed Indonesia Stock Exchange (IDX) within the 2018-2022 periods with criteria for sampling regarding the level of carbon emission disclosure by 18 carbon disclosure checklist items developed by Choi et al. (2013) still has diversity because the disclosure is still voluntary. Based on a preliminary review, four unstable companies disclosed carbon emission items during the five-year observation period, and six increased companies disclosed carbon emission items. However, the increase in disclosure of carbon emission items has yet to be fully identified in the 18 checklist items of carbon disclosure.

Declaring the reporting of carbon emissions disclosure can be determined based on various factors. These determinants can be seen through firm size, media exposure, and institutional ownership. Firm size is a scale of small, middle, or significant in terms of resources owned, so it can be a major determinant in the company to report information related to carbon emissions voluntarily (Choi et al., 2013). A previous research conducted by Abdullah et al. (2020), Afrizal et al. (2023), Akbaş & Canikli (2018), Desai (2022), Hapsari & Prasetyo (2020), Hapsoro et al. (2020), Hermawan et al. (2018), Hidayat et al. (2022), Nuskiya et al. (2021), and Yu et al. (2020) said there is positive effect of firm size towards carbon emission disclosure. Large companies will be the center of attention and have more significant pressure for social and environmental responsibility, so the percentage of companies that obtain legitimacy by voluntarily disclosing carbon emissions will be more significant. In contrast, Kholmi et al. (2020), Krisnawanto & Solikhah (2019), Pratiwi (2018), Riantono & Sunarto (2022), Ulupui et al. (2020), and Winarsih & Supandi (2020) said there is no effect of firm size towards carbon emission disclosure. Carbon emission disclosure is still considered voluntary and has no additional benefit to the company's future, so they assume that obtaining legitimacy can be carried out in other ways besides disclosing carbon emissions.

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Media exposure is a communication tool for companies to realize their social and environmental responsibilities through their website, so it can be sustainable for companies to publish more information, including voluntary carbon emissions (Kiswanto et al., 2023). Previous research conducted by Darlis et al. (2020), Hidayat et al. (2022), Kiswanto et al. (2023), Ulupui et al. (2020), and Winarsih & Supandi (2020) said there is a positive effect of media exposure towards carbon emission disclosure. Environmental concerns of the company publicizing the company's activities through the media will receive support from various parties, so companies that are active in providing information to the media will increase awareness to publish voluntary carbon emission disclosures. A previous research conducted by Asmeri et al. (2023) said media exposure hurts carbon emission disclosure. Companies must be mindful of the risks associated with being exposed to the media, as it can impact their reputation, so the media is only sometimes the reason to announce carbon emissions.

In contrast, Krisnawanto and Solikhah (2019) and Putri and Arieftiara (2023) said that media exposure does not affect carbon emission disclosure. The company focuses on its financial performance, so it needs to pay attention to media coverage when revealing its carbon emissions. However, it believes that media scrutiny is not an essential factor.

Institutional ownership refers to the proportion of shareholding by institutions or organizations that can optimize company supervision to encourage company management to disclose carbon emissions voluntarily (Hermawan et al., 2018). Previous research conducted by Akbaş & Canikli (2018), Bedi & Singh (2024a), Jaggi et al. (2018), and Pratiwi (2018) said there is a positive effect of institutional ownership toward carbon emission disclosure. The company's high institutional shareholding will encourage its performance in supervising to sustain its business, so the company will be encouraged to carry out information transparency, including carbon emission disclosure. Previous research by (Halimah and Yanto, 2018) said institutional ownership hurts carbon emission disclosure. The company's high institutional shareholding will be under the power of institutional owners, which will prevent the company from feeling pressure to conduct carbon emission disclosure because institutional owners focus on profit. Hence, they are unable to encourage companies to conduct carbon emission disclosure.

In contrast, Darlis et al. (2020), Hermawan et al. (2018), and Riantono and Sunarto (2022) said there is no effect of institutional ownership on carbon emission disclosure. Each organization is set up with its policies to make decisions on disclosure, so companies with high or low institutional ownership must refrain from encouraging companies to disclose carbon emissions voluntarily. Due to inconsistent results in the literature, several researchers have found positive or negative relationships with carbon emission disclosure; thus, the researcher opted for variable firm size, media exposure, and institutional ownership.

Literature Review. Various theories, such as legitimacy theory and stakeholder theory, have explained voluntary disclosure of carbon emissions. Legitimacy theory refers to an organization's effort to align its business activities with social norms and values (Dowling & Pfeffer, 1975). Legitimacy is established through the interaction between the appropriateness of the organization's actions and the public's expectations (Martens & Bui, 2023). Suppose the public observes a discrepancy in organizational actions compared to their expectations. In that case, a legitimacy gap exists and can impact the sustainability of a company's business (Choi et al., 2013). Recently, the public has observed climate change activities. It motivates companies to conduct information transparency, including voluntary carbon emissions, to deal with social pressure, so the legitimacy of the company will be bolstered by its ability to meet public expectations (Bedi & Singh, 2024a; Martens & Bui, 2023).

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Furthermore, stakeholder theory is the relationship between an organization and its stakeholders. Stakeholder theory states that an organization should be able to provide information that is considered necessary by stakeholders so that the organization can be helpful to other parties, including stakeholders and override management interests (Desai, 2022). According to stakeholder theory, the sustainability of an organization is assured by the stakeholder's support (Akbaş & Canikli, 2018). The stakeholder's concern for critical issues, such as climate change, can inform business decision-making (Barney & Harrison, 2020). Carbon emissions can be disclosed voluntarily as one way of approaching the company through stakeholder responses and communication in establishing relationships with stakeholders so that stakeholder pressure can be addressed (Desai, 2022; Yu et al., 2020).

Carbon Emission Disclosure. Carbon emission disclosure involves sharing information about a company's operational activities with stakeholders that outlines social and environmental responsibility issues related to climate change (Bedi & Singh, 2024a). Requiring disclosure of carbon emissions can protect companies from various risks to reputation, operating costs, and business demand, as well as sanctions and fines (Berthelot & Robert, 2011). The Carbon Disclosure Project (CDP) information sheet serves as the basis for determining whether carbon emissions are disclosed. A non-profit organization, CDP has the world's most extensive data set on climate change and helps companies engage with investors (Choi et al., 2013; Kılıç & Kuzey, 2018). Reporting amounts to 18 items in a checklist for carbon emissions, divided into five categories relevant to climate change (CC), greenhouse gas (GHG), energy consumption (E.C.), reduction and cost of carbon emission (R.C.), as well as accountability of carbon emission (ACC). Companies that provide information on each item in these categories receive a value of 1, otherwise a value of 0, so the score must be at least 0 and not exceed 18 in the maximum score. Furthermore, carbon emission disclosure was quantified by comparing declared items against the total.

Firm Size. The firm size can be categorized into three groups, which are small, middle, and large, and it is classified according to total assets, total sales, market capitalization, and other business resources (Hapsoro et al., 2020). The activity increases proportionally with the size of the company, as well as increasing the acquisition of internal and external funding sources. Large companies generally have more stable finances than small companies because some cost constraints are on small companies (Nuskiya et al., 2021). This research uses total assets to determine the size of the company. The total assets in the firm size can show the wealth of own resources, as more extensive and more resources increase the company activities to reflect the size of a company (Hapsoro et al., 2020). Legitimacy theory suggests that large scale tend to be in the public's attention. It encourages companies to justify their existence with broader voluntary disclosures as part of a business strategy to avoid high costs due to public demands in the future so that company activities will receive legitimacy. The statement is in agreement with Abdullah et al. (2020), Afrizal et al. (2023), Akbaş & Canikli (2018), Desai (2022), Hapsari & Prasetyo (2020), Hapsoro et al. (2020), Hermawan et al. (2018), Hidayat et al. (2022), Nuskiya et al. (2021), and Yu et al. (2020) ensure that the firm size positively influences carbon emission disclosure. Public pressure on large-scale companies to take social and environmental responsibility for their operations is more commonly asserted. Companies will likely be motivated to gain public trust by disclosing carbon emissions. The public trust boosts the company's reputation and attracts investors to invest. According to this interpretation, the hypothesis that it follows:

H1: Firm size is significantly positively influencing carbon emission disclosure.

Media Exposure. Media is a form of communication that informs the public in arranged and systematic ways (Kiswanto et al., 2023). Media exposure relates to a company's awareness and

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transparency of information presented through media. Media exposure is essential in providing more significant information to stakeholders. Media exposure as a tool for corporate communication becomes a public monitoring mechanism that indicates public pressure on the company (Widiastuti et al., 2018). A dummy variable with a value of 1 is used to calculate media exposure for companies that publish information about carbon emissions on their website and other media releases (e.g., annual reports and sustainability reports). At the same time, the company's website and also other media releases that do not publish information about carbon emissions have a value of 0 (Abdullah et al., 2020). Legitimacy theory suggests that media has a part in encouraging companies to disclose information publicly, especially environmental performance. When the company servers media exposure, it will be considered by the public in giving pressure to legitimize the company. In addition, stakeholder theory suggests that media has a part to play in encouraging companies to provide information that stakeholders will require. It helps the company to fulfill stakeholder expectations and gain support from various parties to ensure its sustainability. The statement is in agreement with Darlis et al. (2020), Hidayat et al. (2022), Kiswanto et al. (2023), Ulupui et al. (2020), and Winarsih & Supandi (2020) ensure that media exposure positively influences carbon emission disclosure. The current digital era makes the media crucial in disclosing carbon emissions. A company's willingness to disclose its voluntary carbon emissions is directly linked to active media exposure. According to this interpretation, the hypothesis that it follows:
H2: Media exposure significantly and positively influences carbon emission disclosure.

Institutional Ownership. Institutional ownership refers to the proportion of shares in the share capital belonging to institutions or other companies (Akbaş & Canikli, 2018). Institutional share ownership is considered a power source rather than individual investors (Bedi & Singh, 2024a). Institutional ownership plays a role in monitoring management effectively and optimally because the supervision of institutional ownership can control management not to be selfish. The higher the presence of institutional shareholdings, the more excellent management supervision to improve company performance (Hermawan et al., 2018; Kiswanto et al., 2023). The proportion of ownership in an institution is determined by dividing the shares held by the institution by the outstanding shares. Legitimacy theory suggests that a more significant portion of institutional ownership can encourage companies to disclose all activities carried out as a positive response to institutional investors that the company cares about the environment, so the company's worth is increased and its credibility is strengthened. In addition, stakeholder theory suggests that disclosing carbon emissions can assist investors in making investment decisions and satisfy institutional investors' needs, which leads business managers to address stakeholders' information requirements. The statement is in agreement with Akbaş & Canikli (2018), Bedi & Singh (2024a), Jaggi et al. (2018), and Pratiwi (2018), ensuring that institutional ownership positively influences carbon emission disclosure. Firms are linked to institutions, so institutional ownership can pressure management to carry out corporate social and environmental responsibilities, especially regarding company disclosure of carbon emissions. A higher level of institutional control is necessary to maintain the reputation and trust of stakeholders by providing transparent disclosure of its activities. According to this interpretation, the hypothesis that it follows:
H3: Institutional ownership is significantly positively influencing carbon emission disclosure.

Figure 1 presents the theoretical frameworks, which are based on the concepts and previous research that have been explained.

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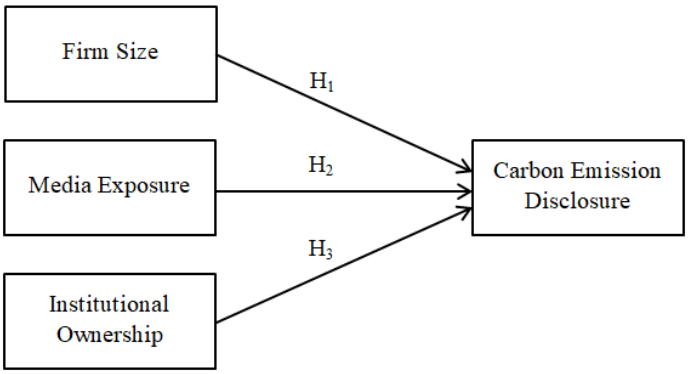

Figure 1. Theoretical Framework

METHODS

The data utilized in this research is sourced from sustainability reports, annual reports, and company websites. A purposive sampling method is used to select a research sample of energy sector companies listed on the Indonesia Stock Exchange (IDX) between 2018 and 2022 periods, which must align with the criteria as a sample (1) consistently listed on the Indonesia Stock Exchange (IDX) during the observation period, (2) consistently reporting sustainability reports during the observation period, and (3) consistently reporting annual reports during the observation period. From 79 energy sector companies, this study includes ten companies in the sample for analysis that meet our criteria.

Table 1. Samples Criteria

No.	Samples Criteria	Total
1.	Energy sector companies of the listed Indonesia Stock Exchange (IDX) during 2018-2022	79
2.	Energy sector companies that are not consistently listed on the Indonesia Stock Exchange (IDX) during 2018-2022	(5)
3.	Energy sector companies that are not consistently reporting sustainability reports during 2018-2022	(55)
4.	Energy sector companies that are not consistently reporting annual reports during 2018-2022	(9)
Number of samples of energy sector companies		10
Number of samples of energy sector companies in 5 years / during 2018-2022		10 x 5 = 55

This research considers independent variables such as firm size, media exposure, and institutional ownership. Firm size was proxied by the natural logarithm of total assets. Media exposure was proxied by a dummy variable with a value of 1, which calculates media exposure for companies that publish information about carbon emissions on their website and other media releases (e.g., annual reports and sustainability reports). At the same time, the company's website and also other media releases that do not publish information about carbon emissions have a value of 0. Institutional ownership was proxied by dividing the shares held by the institution into the outstanding shares. This research analyzes carbon emission disclosure as a dependent variable, determined by 18 checklist items of carbon disclosure developed by Choi et al. (2013). The carbon disclosure checklist consists of 5 categories relevant to climate change (CC), greenhouse gas (GHG), energy consumption (E.C.), reduction and cost of carbon emission (R.C.), as well as accountability

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of carbon emission (ACC) with 18 checklist items to report. Companies that disclose each item are given a value of 1; they give a value of 0, so the score must be at least 0 and not exceed 18 in the maximum score. The carbon emission disclosure was quantified by comparing declared items against the total. The description of variables is presented in Table 2.

Table 2. Operational Variables

Variables	Abbreviations	Description	Reference
Dependent Variable			
Carbon Emission Disclosure	CED	The number of disclosed items divided by the overall number of items	Choi et al. (2013); Manurung et al. (2022)
Independent Variables			
Firm Size	SIZE	Natural logarithm of the company's total assets	Desai (2022)
Media Exposure	ME	1 for companies that publish information about carbon emissions on their website and also other media releases (e.g., annual reports and sustainability reports), while 0 otherwise	Abdullah et al. (2020)
Institutional Ownership	INST	The proportion of institutional shares based on outstanding shares	Akbaş & Canikli (2018)

The statistical analysis was performed using panel data regression in Eviews 12. Because the data is cross-sectional and has a time series, panel data regression was employed. Before conducting panel data regression, this research needs to determine the best estimation method. The estimation method consists of 3 approaches, i.e., Common Effect Model (CEM), Fixed Effect Model (FEM), or Random Effect Model (REM). Several tests are required before the evaluation method can be determined, i.e., the Chow, Hausman, and Lagrange multiplier tests. After determining its best estimation method, this research conducted a classical assumption test. First, this research uses a multicollinearity test by observing the correlation coefficient value between variables. The expected value to be free from multicollinearity is less than 0,90. Second, this research uses a heteroscedasticity test by observing the probability value for every variable. The expected value to be free from heteroscedasticity is more than 0,05. Furthermore, panel data regression is suitable for testing simultaneous and partial hypotheses. The regression equation for the panel data is shown below:

$$CEDit = \alpha + \beta 1SIZEit + \beta 2MEit + \beta 3KIit + \varepsilon$$

RESULT AND DISCUSSION

The first test consists of descriptive statistics to get an overview of the analyzed data and to get information from each variable. The variables in this research have two measuring scales, i.e., ratio and nominal scales. Carbon emission disclosure (CED), firm size (SIZE), and institutional ownership (INST) in this research used a ratio scale with descriptive statistical analysis, including mean, minimum, maximum, and standard deviation values. Meanwhile, this research's media

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exposure (M.E.) used a nominal scale with descriptive statistical analysis, including mode values. Tables 3 and 4 below demonstrate the descriptive statistical analysis results on the ratio scale and dummy variables.

Table 3. Descriptive Statistic on Ratio Scale

	CED	SIZE	INST
Mean	0.518889	25.90072	0.630052
Maximum	0.833333	32.37568	0.897979
Minimum	0.000000	15.54846	0.199868
Std. Dev.	0.242190	5.901622	0.146952

Source: Data Processed 2024

Table 4. Dummy Variable Frequency

Criteria	Value	Frequency	Percentage
Companies publish information about carbon emissions on their websites and other media releases (e.g., annual and sustainability reports).	1	18	36%
The company's website and other media releases do not publish information about carbon emissions.	0	32	64%
Total		50	100%

Source: Data Processed 2024

Table 3 reveals that carbon emission disclosure (CED) has a mean value of 0.518889. This result explains that energy sector companies are more likely to disclose carbon emissions by 51,89% or around 9 to 10 items out of 18 disclosure items. Firm size (SIZE) has a mean value of 25.90072. This result explains that the size of the energy sector companies is balanced; 50% of companies have a large scale, and 50% have a small size scale. Institutional ownership (INST) has a mean value of 0.630052. This result explains that energy sector companies tend to have a high institutional shareholding level of 63,01%, meaning that a high institutional shareholding level has an optimal ability to supervise company management. Table 4 shows media exposure in energy sector companies. As many as 32 observations (64%) do not publish information about carbon emissions on their website or other media releases. These results explain that energy sector companies have yet to fully disclose information voluntarily in the company's media.

This research tested classical assumptions using multicollinearity and heteroscedasticity tests before data regression. Tables 5 and 6 below demonstrate the results of these tests.

Table 5. Multicollinearity Test Results

	SIZE	ME	INST
SIZE	1.000000	-0.112399	-0.091561
ME	-0.112399	1.000000	-0.143106
INST	-0.091561	-0.143106	1.000000

Source: Data Processed 2024

Table 6. Heteroscedasticity Test Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.165891	0.165218	1.004073	0.3206
SIZE	-0.000645	0.004402	-0.146454	0.8842
ME	-0.076951	0.040956	-1.878871	0.0666

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INST	0.066903	0.163693	0.408711	0.6846

Source: Data Processed 2024

The multicollinearity test is done by observing the correlation coefficient value between firm size, media exposure, and institutional ownership variables, which must be < 0,90. Table 5 reveals that the correlation coefficient value between firm size (SIZE), media exposure (M.E.), and institutional ownership (INST) < 0,90, so this research does not have multicollinearity. The heteroscedasticity test is performed by observing the profitability value of every variable, which must be > 0,05. Table 6 reveals that each variable of firm size (SIZE), media exposure (M.E.), and institutional ownership (INST) has a profitability value > 0.05, so this research does not have heteroscedasticity.

The researcher must determine the model approach before implementing panel data regression, i.e., Common Effect Model (CEM), Fixed Effect Model (FEM), or Random Effect Model (REM) will be chosen by doing the Chow test, Hausman test, and Lagrange multiplier test. Table 7 below demonstrates the results of the Chow test, Hausman test, and Lagrange multiplier test.

Table 7. Panel Data Model Test Results

Testing	Conditions	Results
Chow Test	H_0: Probability > 0.05 → CEM	0.0017 < 0.05
	H_1: Probability < 0.05 → FEM	Fixed Effect Model (FEM)
Hausman Test	H_0: Probability > 0.05 → REM	0.5278 > 0.05
	H_1: Probability < 0.05 → FEM	Random Effect Model (REM)
Lagrange Multiplier Test	H_0: Probability > 0.05 → CEM	0.0025 < 0.05
	H_1: Probability < 0.05 → REM	Random Effect Model (REM)

Source: Data Processed 2024

Table 7 reveals that the determination of the Chow test model has a probability of 0.0017 < 0.05. Thus, the most appropriate model in the Chow test is the Fixed Effect Model (FEM). Furthermore, the determination of the Hausman test model has a probability of 0.5278 > 0.05. Thus, the most appropriate model in the Hausman test is the Random Effect Model (REM). Furthermore, the determination of the Lagrange multiplier test model has a probability of 0.0025 < 0.05. Thus, the most appropriate model in the Lagrange multiplier test is the Random Effect Model (REM).

Test outcomes are used to design panel data regression from the Chow, Hausman, and Lagrange multiplier tests, the Random Effect Model (REM). Table 8 below demonstrates the results of panel data regression through the Random Effect Model (REM).

Table 8. Panel Data Regression Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.034307	0.317666	-0.107998	0.9145
SIZE	0.013270	0.009292	1.428078	0.1600
ME	0.239777	0.057707	4.155038	0.0001
INST	0.195485	0.287867	0.679082	0.5005

Source: Data Processed 2024

Table 8 reveals the panel data regression approach used to investigate the effect of firm size, media exposure, and institutional ownership on carbon emission disclosure. The regression equation is shown below:

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$$CED = -0.034307 + 0.013270\ SIZE + 0.239777\ ME + 0.195485\ INST + \varepsilon$$

Carbon emission disclosure is assessed by statistical testing to determine whether it is related to firm size, media exposure, and institutional ownership both simultaneously and partially. Table 9 below demonstrates the results of the F-test.

Table 9. F-test Results

R-squared	0.296372
Adjusted R-squared	0.250483
S.E. of regression	0.171290
F-statistic	6.458491
Prob(F-statistic)	0.000967

Source: Data Processed 2024

Simultaneously, this can be seen in Table 9, which shows a Prob(F-statistic) value of 0.000967 < 0.05, meaning that carbon emission disclosure is simultaneously influenced by firm size, media exposure, and institutional ownership. The adjusted R-squared value shows 0.250483, which means that firm size, media exposure, and institutional ownership can describe carbon emission disclosure by 25,05%, while other non-study variables can describe 74,95%. Table 10 demonstrates the results of hypothesis testing.

Table 10. Summary of Hypothesis Test Results

Hypothesis	Variables	Coefficient	Prob.	Results
H_1	Firm Size	0.013270	0.1600	Rejected
H_2	Media Exposure	0.239777	0.0001	Accepted
H_3	Institutional Ownership	0.195485	0.5005	Rejected

Source: Data Processed 2024

Firm Size Effect on Carbon Emission Disclosure. The hypothesis test in Table 10 reveals that firm size has a probability value of 0.1600 > 0.05 with a coefficient value of 0.013270. The results show that H01 was accepted and H1 was rejected, which means that firm size does not significantly influence carbon emission disclosure. The results of this research are not aligned with the hypothesis stating that firm size significantly influences carbon emission disclosure. Large-scale companies have more excellent resources and can meet the cost of disclosing information. The information provided can create a good reputation among the public and build investor confidence in the company to invest its capital, which can incentivize companies to disclose carbon emissions voluntarily. However, this research proves that companies with large and small scales can adequately contribute to carbon emission disclosure. Companies with above-average firm size tend to conduct carbon emission disclosure; it can be seen in Table 11 that as many as 13 samples (26%) of large firm size apply carbon emission disclosure. Companies with a below-average firm size also tend to disclose carbon emissions. As many as 14 samples (28%) of small companies apply carbon emission disclosure. 54% of the total 50 observations data carry out carbon emission disclosure. Table 11 below demonstrates the relationship between firm size and carbon emission disclosure.

Table 11. Firm Size and Carbon Emission Disclosure

Firm Size	Carbon Emission Disclosure	Total

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	Above Average (>0.518889)	Below Average (<0.518889)	
Above Average (>25.90072)	13 (26%)	12 (24%)	**25 (50%)**
Below Average (<25.90072)	14 (28%)	11 (22%)	**25 (50%)**
Total	**27 (54%)**	**23 (46%)**	**50 (100%)**

Source: Data Processed 2024

The results of this research are aligned with Kholmi et al. (2020), Krisnawanto & Solikhah (2019), Pratiwi (2018), Riantono & Sunarto (2022), Ulupui et al. (2020), and Winarsih & Supandi (2020) suggesting that firm size is not influential on carbon emission disclosure. A firm size with significant total assets can only sometimes be used as a standard for the company's obligation to disclose carbon emissions. Firms with small total assets can also adequately disclose carbon emissions because it is vital to implement social practices and care for the environment. The statement is aligned with (Pratiwi, 2018) that the decree of the President of the Republic of Indonesia No. 61/2011 on the national action plan for reducing GHG emissions does not state that only companies with a large scale size contribute to reducing GHG emissions, but all companies must be able to contribute to reducing GHG emissions.

Media Exposure Effect on Carbon Emission Disclosure. The hypothesis test in Table 10 reveals that media exposure has a probability value of 0.0001 < 0.05 with a coefficient value of 0.239777. The results show that H02 was rejected and H2 was accepted, meaning that media exposure significantly influences carbon emission disclosure. This research's results align with the hypothesis that media exposure significantly positively influences carbon emission disclosure. The media can inform the public about its company's activities. Information published by companies voluntarily to the public can create a positive response, so this can motivate companies to disclose emissions voluntarily. Companies can enhance their carbon emissions through increased company media exposure. Companies with above-average firm size tend to conduct carbon emission disclosure; it can be seen in Table 12 that as many as 15 samples (30%) of companies with media exposure value one or companies that publish information about carbon emissions on their website and also other media releases.

Meanwhile, as many as 20 samples (40%) of media exposure with a value of 0 or the company's website and other media releases that do not publish information about carbon emissions. 54% of the total 50 observations data contain carbon emission disclosure. Table 12 below demonstrates the relationship between media exposure and carbon emission disclosure.

Table 12. Media Exposure and Carbon Emission Disclosure

Media Exposure	Carbon Emission Disclosure		Total
	Above Average (>0.518889)	Below Average (<0.518889)	
Companies publish information about carbon emissions on their websites and other media releases (e.g., annual and sustainability reports). **(Value 1)**	15 (30%)	3 (6%)	**18 (36%)**
The company's website and other media releases do not publish information about carbon emissions. **(Value 0)**	12 (24%)	20 (40%)	**32 (64%)**

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Total	**27 (54%)**	**23 (46%)**	**50 (100%)**

Source: Data Processed 2024

The results of this research are aligned with Darlis et al. (2020), Hidayat et al. (2022), Kiswanto et al. (2023), Ulupui et al. (2020), and Winarsih & Supandi (2020) suggesting that media exposure is influential on carbon emission disclosure. Visibility in media exposure encourages companies to disclose their carbon emissions, as this can continuously raise awareness. Companies are encouraged to increase publicity, mainly when they reveal their carbon emissions voluntarily due to the media's more active role in company monitoring. The statement is aligned with (Kiswanto et al., 2023) the role of the media in monitoring so that it can encourage companies to protect the environment by disclosing carbon emissions more broadly. It is supported by legitimacy theory, which provides evidence that when information about the company's operations in the context of the environment is published in the media, it will become a matter of public consideration in putting pressure on the company to obtain positive responses and legitimacy. In addition, it is supported by stakeholder theory, which provides evidence that companies hold social responsibility to stakeholders, so companies are obligated to share information that is considered essential and relevant to stakeholders.

Institutional Ownership Effect on Carbon Emission Disclosure. The hypothesis test in Table 10 reveals that Institutional ownership has a probability value of 0.5005 > 0.05 with a coefficient value of 0.195485. The results show that H03 was accepted and H3 was rejected, meaning institutional ownership does not significantly influence carbon emission disclosure. The results of this research are not aligned with the hypothesis stating that institutional ownership significantly influences carbon emission disclosure. Institutional ownership makes management under the power of institutions that can encourage companies to disclose all company activities. Incentivized disclosure of carbon emissions can prompt decision-making processes among institutional investors, enabling them to push firms to disclose their carbon footprint voluntarily. However, the findings of this research suggest that companies with high or low institutional shareholdings can be prompted to disclose carbon emissions adequately.

Table 13 reveals that companies with above-average institutional ownership tend to disclose carbon emissions. As many as 16 samples (32%) of high institutional shareholdings conduct carbon emission disclosure. Companies with below-average institutional ownership also tend to disclose carbon emissions. As many as 11 samples (22%) of low institutional shareholdings conduct carbon emission disclosure. 54% of the total 50 observations data carry out carbon emission disclosure. Table 13 below demonstrates the relationship between institutional ownership and carbon emission disclosure.

Table 13. Institutional Ownership and Carbon Emission Disclosure

Institutional Ownership	**Carbon Emission Disclosure**		**Total**
	Above Average (>0.518889)	**Below Average (<0.518889)**	
Above Average (>25.90072)	16 (32%)	15 (30%)	**31 (62%)**
Below Average (<25.90072)	11 (22%)	8 (16%)	**19 (38%)**
Total	**27 (54%)**	**23 (46%)**	**50 (100%)**

Source: Data Processed 2024

The results of this research are aligned with Darlis et al. (2020), Hermawan et al. (2018), and Riantono and Sunarto (2022), suggesting that institutional ownership is not influential on carbon emission disclosure. A significant proportion of institutional shareholding may not be a reliable

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indicator for companies voluntarily disclosing carbon emissions. The management of carbon emission disclosure is monitored more efficiently with low institutional shareholding, as each company's decision to implement them is a part of their management. The statement is aligned with Hermawan et al. (2018) that voluntary disclosure of broader information by companies will be different according to the management policies of each company, so it does not rule out the possibility that companies with low institutional shareholding can carry out carbon emission disclosure properly.

CONCLUSION

This research is intended to observe how energy sector companies listed on the Indonesia Stock Exchange (IDX) voluntarily disclose carbon emissions through factors that can affect them, i.e., firm size, media exposure, and institutional ownership. Simultaneously, firm size, media exposure, and institutional ownership have a 25,05% influence on carbon emission disclosure. Partially, media exposure significantly positively influences carbon emission disclosure. It means that the current media exposure of companies has a role in prompting them to disclose their carbon footprints voluntarily. Meanwhile, firm size and institutional ownership have little influence on carbon emission disclosure. A company with large scale and sizeable institutional shareholding levels only guarantees that companies will partially report carbon emission disclosure.

The research findings are relevant to companies, investors, government, academics, and researchers. First, the present research suggests that energy sector companies be more independent and consistent in reporting carbon emission disclosures to ensure sustainability within the company's business and maintain its environmental obligations. Additionally, companies are expected to consider factors influencing carbon emission disclosure, such as media exposure. Second, this research can help investors to refine their investment strategies. The greater disclosure of carbon emissions indicates management's commitment to environmental concerns and compliance with government regulations. Third, the government can consider the result of this research in providing socialization about the importance of disclosing carbon emissions to realize the 2030 agenda for Sustainable Development Goals (SDGs). Fourth, these findings are expected to add theoretical information for academics, especially the disclosure of carbon emissions. Fifth, to further research, we can expand the research object and add the observation period to get more accurate results and represent the actual conditions.

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