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CARBON EMISSION DISCLOSURE, ECO-EFFICIENCY, AND FIRM VALUE

Ayu Oktaviani*, Muhammad Atho Al Ghozi

Lambung Mangkurat University, Indonesia

E-mail : aoktaviani@ulm.ac.id *

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ABSTRACT

Environmental problems such as global warming that are currently occurring have prompted a shift in business focus that was once profit-oriented, towards a broader orientation by considering environmental aspects as one of the aspects that stakeholders need to pay attention to in making decisions. This study aims to prove that environmental aspects, especially carbon emission disclosure and eco-efficiency practices, can build better firm value. With the population of energy sector companies listed on the Indonesia Stock Exchange in 2019-2023 and multiple linear regression analysis methods, it was found that carbon emission disclosure did not significantly impact the firm value. It shows that the comprehensiveness of carbon emission disclosure has not been a strong signal in changing investors' perception of companies. Inversely proportional to the results of other tests, eco-efficiency, which has a positive and significant influence on the firm value, shows that the company's ability to balance ecological and economic aspects brings a positive and significant signal to the assessment of stakeholders towards a company. The study contributes to the theory and practice of green accounting, namely the disclosure of carbon emissions and eco-efficiency to stakeholders' perception, especially investors in their business decisions.

Keywords: Carbon Emission Disclosure, Eco-efficiency, Firm Value, Carbon Accounting.

INTRODUCTION

Firm value can be interpreted as investors' views on management's success in managing the resources they own, and this value is in line with the condition of the company's share price (Jihadi et al., 2021; Mursyidin et al., 2023). When a company's stock price increases, the market values the company more favorably. Companies that can improve their value can increase the chances of obtaining additional sources of funds through investment by investors (Fadillah et al., 2021), thereby increasing their competitiveness in the face of the industrial world. Management can enhance firm value by reviewing the five aspects of sustainability performance (economic, governance,

social, ethical, and environmental) in every strategic consideration, managerial action, and reporting that aligns with stakeholder needs (Rezaee, 2016).

From the environmental aspect, there is a topic that various stakeholders, such as those related to global warming, often discuss. Global warming is a phenomenon of periodic temperature increases caused by greenhouse gas (GHG) emissions accumulated in the atmosphere, thereby resisting solar heat waves that should be reflected out of space (Anggita et al., 2022; Hadianti & Mulyani, 2023). Industrial activities contribute significantly to the increase in GHG (Hilmi et al., 2020), which can be in the form of burning fossil fuels or deforestation (Redlin & Gries, 2021). The growing phenomenon of climate change has fostered investor attention to the environmental aspects of companies, where companies are encouraged to disclose their carbon information through sustainability reports (Houten & Wedari, 2023). Lee & Cho (2021) also said that the magnitude of the potential for climate change caused by extreme weather changes from this phenomenon causes increasing pressure by stakeholders on company managers to reduce and disclose their carbon emissions.

Carbon emissions disclosure is part of environmental accounting, containing information on calculating and reporting a company's carbon emissions and development models for carbon emission reduction (Kurnia et al., 2020). Environmental information, such as carbon emissions, must be disclosed to foster a good image in society (Kurnia et al., 2020), ultimately fostering stakeholder support in building sustainable businesses (Houten & Wedari, 2023). Positive signals from the company can change investors' perceptions in a more positive direction, encouraging greater investment interest. The investment interest in a company can increase the stock price, where the strengthening stock price reflects the company's better value. Alfayerds & Setiawan (2021) stated that more complete and comprehensive carbon emissions disclosure is directly related to the company's sustainability in the future, which can increase the firm’s value for investors.

A company's concern for the environment is certainly not only about revealing its environmental impacts, but also through concrete efforts to reduce the environmental impacts that arise from its activities. It is a business concept related to efforts to reduce environmental impacts, such as emissions, through improvements in the company's workflow and a reduction in waste products, such as Eco-efficiency. This concept encourages the development of a product that has added value while reducing environmental impact, resource use, and cost (Rahelliamelinda & Handoko, 2024). Pratama & Ainiyah (2023) said that eco-efficiency, directly related to the impact of the economy, resources, and the environment, can be the right tool in measuring a company's sustainable development level. According to Safitri & Nani (2021), signaling that companies care about environmental conservation through efficiency efforts in ecological aspects can build a positive image among stakeholders. Efficiency in the use of resources can maximize the production process, which can have an impact on minimizing operational costs and increasing the company's profitability (Daud et al., 2023). Resource use efficiency can also reduce potential pollution in the form of waste and emissions that pollute the environment. It can prevent companies from negative perceptions for stakeholders related to the problem of sanctions or fines arising from environmental pollution. Dewi & Rahmianingsih (2020) stated that eco-efficient companies have a competitive advantage in terms of efficient use of resources, and this is an added value for stakeholders such as investors who support the company's sustainability.

The results of the literature study above show that environmental disclosure in the form of carbon emissions and the implementation of the eco-efficiency strategies align with the encouragement of stakeholders to build a sustainable business and can also be a

positive signal for investors in valuing a company. It shows that from a conceptual perspective, carbon emission disclosure and eco-efficiency positively impact firm value. A preliminary research was also conducted to find the facts of how the firm's value responds to environmental practices in three energy sector companies in Indonesia:

Table 1. Preliminary Studies

Company	Year	CED	ECO	Tobins Q
Adaro Energy Indonesia Tbk	2019	0,5700	0,0391	0,9400
	2020	0,5700	0,0470	0,8900
	2021	0,5700	0,0299	1,0600
	2022	0,7100	0,0100	1,1000
Perusahaan Gas Negara Tbk	2019	1,0000	0,0012	1,0700
	2020	1,0000	0,0014	0,9900
	2021	1,0000	0,0010	0,8700
	2022	1,0000	0,0010	0,9000
Samindo Resources Tbk	2019	0,0000	-	1,5200
	2020	0,0000	-	1,4900
	2021	0,0000	-	1,7900
	2022	0,0000	0,0002	1,4400

Source: Author, 2025

The results of the preliminary study show that the firm's value does not always go hand in hand with the ability of management to disclose carbon emissions and implement the eco-efficiency concept. In the company Samindo Resources Tbk, although they do not disclose carbon emissions (CED) based on the GRI standard, with an index of 305 in their sustainability report, and do not disclose scope one emissions, which can be an indicator of the company's eco-efficiency (ECO) during 2019-2022. However, the Tobin's Q ratio tends to be stable and even increase. Gas Negara Tbk Company, which has a CED index value of one which shows that the company comprehensively discloses carbon emissions in accordance with the GRI 305 standard and the ECO index value that continues to decline, shows that the intensity of the environmental impact on the company's economic performance continues to improve, actually has a Tobins Q value which tends to decrease from year to year. It shows a gap between what should happen in theory and the facts on the ground, where companies that disclose their carbon emissions in detail can increase their value (Bahriansyah & Ginting, 2022). However, in reality, it does not always work that way. Eco-efficiency practices that positively impact investor perception, as stated by Galindo-Manrique et al. (2021), are also not always in line with the factual conditions in the field.

Further literature studies were also carried out to find the reason for the existence of this phenomenon. Several past studies discussing the effect of carbon emission disclosure on firm value show some inconsistent results. According to Hadianti & Mulyani (2023), Damas et al. (2021), Bahriansyah & Ginting (2022), Rahmanita (2020), Yuliandhari et al. (2023), Hardiyansah et al. (2021), and Lee & Cho (2021), , there is a positive impact of carbon emission disclosure on firm value. Alfayerds & Setiawan (2021) stated that more complete and comprehensive carbon emissions disclosure is directly related to the firm's sustainability in the future, which can increase value for investors. These results are in contrast to the previous research, such as from Muhammad & Aryani (2021), Choi et al. (2021), and Choi & Luo (2021), who stated that carbon emission disclosure actually hurts firm value. Hadiwibowo et al. (2023) said that the more comprehensive a company's carbon emission information is, the more likely it is to show

the magnitude of the carbon emissions produced, which stakeholders could consider negative. The difference in the results of these studies shows a research gap, which also happened in several previous studies that analyzed the influence of eco-efficiency on firm value.

Research gaps were also found in several studies that tested the impact of eco-efficiency on firm value. According to Satrio & Kunto (2020), Dianti & Puspitasari (2024), and Helmina et al. (2022), eco-efficiency has been proven to have a positive influence on firm value. Dewi & Rahmianingsih (2020) said that companies that implement eco-strategies, such as eco-efficiency, have a competitive advantage in efficient use of resources, which can add value for stakeholders who support the firm's sustainability. The results of some of the above studies contrast with the results of the research of Damas et al. (2021) and Septianingrum (2022), which stated that eco-efficiency harms firm value. Implementing eco-efficiency often requires many capital resources, such as research and development of more efficient company activities, resulting in greater costs. According to Rahelliamelinda & Handoko (2024), the cost incurred is considered contrary to the basic purpose of the business, which is to maximize shareholder wealth.

Based on the above background, which shows the existence of environmental phenomena such as global warming, management is encouraged to be responsible and strive to reduce the environmental impact arising from its activities. Then, a research gap is shown by the "conceptual" aspect with the "factual" situation, and the inconsistency of several previous studies prompted this research, which intends to analyze the impact of carbon emission disclosure and eco-efficiency on firm value. This research uses one of the industry sectors listed on the Indonesia Stock Exchange, namely the energy sector, in the 2019-2023 period. This research is increasingly interesting because it brings novelty, especially in using proxies that are relatively rarely used by previous research, namely the environmental intensity approach, especially the emission intensity used as an eco-efficiency proxy. This proxy is said to be one of the latest research developments because previous research, such as Helmina et al. (2022), Rahelliamelinda & Handoko (2024), and other researchers, often use ISO 14001 as an indicator in assessing eco-efficiency. The underlying reason for using the environmental intensity approach as an indicator of eco-efficiency is that it is considered appropriate in assessing the company's success in implementing eco-efficiency practices, as shown by its small environmental impact (emissions) in carrying out its monetary activities (sales). This research proves that environmental accounting practices, such as carbon emission disclosure and eco-efficiency, can increase the value of companies from the perspective of signal theory and stakeholder theory. To achieve this contribution, the development of the hypothesis is described as follows:

The disclosure of environmental information, such as carbon emissions, carried out by companies allows them to show a low risk profile of the company, particularly on environmental risks (Velte et al., 2020). Companies that disclose their carbon emissions show that they apply the principles of transparency and accountability to the environmental impact caused by their business activities (Soleha & Isnalita, 2022). This transparency and accountability build stakeholder trust and foster a positive company perception. Management's efforts to disclose environmental information, particularly regarding carbon emissions, show the company's commitment to building a valuable business over a long period (Houten & Wedari, 2023). Viewed from a signaling theory perspective, a company's efforts to create a conducive environment through environmental disclosures are a positive signal to investors (Hardiyansah et al., 2021)

because this information is important in determining the sustainability aspect of a company (Anggraeni, 2015). Based on stakeholder theory, disclosure of environmental information is one of the company's strategies for projecting management's attention and commitment to reducing environmental impact. This voluntary disclosure also reflects the company's commitment to building a business with good environmental aspects in corporate sustainability, while responding to stakeholder demands for corporate social responsibility (Hardiyansah et al., 2021; Houten & Wedari, 2023). So that the market reaction is in line with the company's efforts to increase the transparency of information related to carbon emissions (Alfayerds & Setiawan, 2021), this suggests that the more comprehensive carbon emissions information a company discloses, the more positive value it will be to the firm's value.

H_1 : Carbon Emission Disclosure has a Positive Effect on Firm Value

The concept of eco-efficiency combines efficiency strategies of two aspects, namely the economic aspect and the ecological aspect (Helmina et al., 2022; Valencia & Sri, 2022). From an economic perspective, this strategy encourages companies to create effective business processes through more efficient use of resources, raw materials, and energy. Dewi & Rahmianingsih (2020) also mentioned that implementing eco-efficiency can help companies be more effective because it saves work time and costs in running their business. Therefore, companies implementing eco-efficiency strategies are more likely to maximize company profits and value than those that do not (Satrio & Kunto, 2020; Yin & Liu, 2023). In the ecological aspect, efficiency in the use of resources can decrease the potential for environmental pollution caused by companies, such as waste and emissions. Thus, companies can also avoid sanctions and fines resulting from environmental pollution that affects the company's image and how investors assess the company (Daud et al., 2023). In the context of stakeholder theory, implementing eco-efficiency can reduce the cost of compliance risk to provide a good image while meeting stakeholder satisfaction (Rais et al., 2020). In the context of signal theory, by sending a signal that the company is implementing good governance practices towards environmental sustainability through eco-efficiency strategies, the company can build a positive image and response in the community (Safitri & Nani, 2021). Companies implementing eco-efficient strategies will have environmental impacts, such as carbon emissions, that are also getting smaller in monetary units (sales). So, the better the output of eco-efficiency implementation is, the more it will improve a firm's value.

H_2 : Eco-Efficiency has a Positive Effect on Firm Value

RESEARCH METHODS

The object of study is a company listed in one of the Indonesia Stock Exchange (ISE) sectors, namely the energy sector, for the 2019-2023 period. The samples in this research were taken using purposive sampling, a sample determination technique that considers specific criteria. The sample selection criteria are outlined in the following table:

Table 2.1. Research Sample

No	Information	Sample
1.	Energy sector companies listed on the ISE from 2019 to 2023	64
2.	Companies that did not publish their annual reports consecutively in 2019-2023	(15)

Table 2.2. Research Sample (Continuation)

No	Information	Sample
3.	Companies that did not publish their sustainability reports consecutively in 2019-2023	(32)
4.	Companies that did not disclose the amount of emissions sourced from activities owned and directly controlled by the company (Scope 1)	(7)
Number of Company Samples		10
Year of Observation		5
Total Sample Data Studied		50

Source: Author, 2025

Secondary data for this study comes from annual reports and sustainability reports that can be reviewed on the official website of the Indonesia Stock Exchange (www.idx.co.id) and the company's official website. In variable measurement, the firm's value is measured using the market value ratio, namely the Tobin's Q ratio, which is calculated by multiplying the share price at closing by the number of shares outstanding, then dividing it by the overall book value of liabilities before dividing by the book value of total assets (Yuliandhari et al., 2023).

Carbon emission disclosures are measured through content analysis by reviewing the GRI standard with an index of 305:2016, which consists of seven specific disclosures about emissions in the company's sustainability report (Houten & Wedari, 2023). Each item disclosed will be given a value of one; if it is not disclosed, it will be given a value of 0. The disclosed items will be accumulated and divided by the maximum number of disclosures (7). The larger the GRI index, the more comprehensive the carbon emission information disclosed by the company. Eco-efficiency is measured by an approach to environmental intensity (eco-intensity), especially the intensity of carbon dioxide equivalent (CO_{2e}) emissions arising from the company's activities, and then divided by total sales. Referring to the study of Yook et al. (2017), the scope of emissions considered in the calculation of emission metrics is emissions that come from activities owned and directly controlled by the company (Scope 1). The smaller the environmental intensity value, the more the company can reduce its environmental impact, especially the emissions caused by the company in each of its monetary units. Therefore, a lower eco-intensity value indicates that the company has successfully implemented a proactive strategy to reduce waste and emissions in line with eco-efficiency practices.

The following is the multiple regression equation used in this study:

$$Y = a + \beta_1 X_1 + \beta_2 X_2 + e$$

Information:

Y : Firm Value

X_1 : Carbon Emissions Disclosure

X_2 : Eco-efficiency

A : Constant

β_1, β_2 : Regression Coefficients

e : Error

RESULTS AND DISCUSSION

Descriptive statistics show that the carbon emission disclosure (CED) variable ranges from 0.430 to 1. These results show that there are companies that only disclose 43% or 3 out of 7 emission disclosure items, and there are also companies that disclose carbon emission information comprehensively, as evidenced by a 100% disclosure ratio. The average value of carbon emission disclosure is 0.744. This figure shows that, on average, energy sector companies disclose 74.44% or about 5 out of 7 disclosure items in the GRI standard on emissions-specific topics, with an index of 350. The standard deviation of the CED variable is 0.172, which is smaller than the average of the CED, which can be interpreted as a variation of the relatively low data. The eco-efficiency (ECO) variable shows an average of 0.626. It indicates that energy sector companies produce 0.063 tons of CO2 per million rupiah in sales. The ECO value ranges from 0.000 to 0.289, showing that in the population of energy sector companies on the Indonesian stock exchange in 2019-2023, there are companies that only produce 0.000 tons of CO2 per million rupiah in sales, and there are also companies that produce 0.289 tons of CO2 per million rupiah in sales. The standard deviation value of ECO is 0.068, which is greater than the average value of ECO. The average value of a company (Tobin's Q) shows a figure of 1.006. It indicates that the market values companies in the energy sector 0.620% higher than the value of their physical assets, which is often considered an indication of good growth prospects. The average number is larger than the standard value of Tobin's Q deviation, which has a value of 0.243, so it can be described that the variation of the data is relatively low. The minimum value of Tobin's Q is 0.510, and its maximum value reaches 1.600, which indicates that some companies are undervalued and overvalued.

In the classical assumption test, the Kolmogorov-Smirnov non-parametric statistical method is used to see the normality of the data used. The normality test showed Asymp results. A larger sig (2-Tailed) compared to 0.050, which is 0.200. These results show that the data used is usually distributed. The results of the multicollinearity test, which showed a tolerance value > 0.1 and a VIF < 10 for each variable, indicate that the data is free from the multicollinearity assumption. The Glejser test used in the heteroscedasticity test showed significant results. Both variables are greater than 0.050, which shows no heteroscedasticity in the data used. The autocorrelation test in this study used the Durbin-Watson test; this result showed that the value dU–d < 4–dU. So it can be interpreted that there is no autocorrelation in the data used. The normality, multicollinearity, heteroskedasticity, and autocorrelation tests showed that the research data met the BLUE (Best, Linear, Unbiased, and Efficient) criteria 3.

Table 3. Model Feasibility Test

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	0.487	2	0.244	4.765	0.013
Residual	2.403	47	0.051		
Total	2.890	49			

Source: Author, 2025

The results of the model feasibility test showed that the value of F Calculation (4.765) was greater than that of Table F (3.195). This indicates that disclosure of carbon emissions and eco-efficiency simultaneously affect firm value the value of sig. Smaller than 0.050 also shows that this study model meets the fit model.

Table 4. Model Feasibility Test

Model	Unstandardized Coefficients		Standardized Coefficient		
	B	**Std.Error**	**Beta**	**T**	**Sig.**
Contant	0.990	0.167		5.935	0.000
CED	0.132	0.201	0.094	0.657	0.514
ECO	-1.310	0.508	-0.367	-2.578	0.013

Source: Author, 2025

The Effect of Carbon Emission Disclosure on Firm Value

Based on Table 4, the above hypothesis test shows the significance. The value of the carbon emission disclosure variable is 0.514 > 0.050, which can be interpreted as the first hypothesis being rejected, or it can also be stated that the disclosure of carbon emissions does not significantly affect the company's value. The results of this study are in contrast to the research results, which state that companies that can disclose their information about carbon emissions comprehensively can improve their firm value (Alfayerds & Setiawan, 2021). This result supports previous research, such as Anggita et al. (2022), who stated that voluntary disclosure by companies, such as carbon emission disclosure, cannot increase firm value. Likewise, the study results from Ticoalu & Agoes (2023) stated that disclosing carbon emissions does not impact company value because investors still do not see carbon emission information as necessary in considering a business decision. Investors pay attention to the environmental aspect only in the results of overall environmental management, not in detail or specifically, such as carbon emissions (Houten & Wedari, 2023).

This study shows that disclosing carbon emissions is not always a positive signal that can increase investors' interest in a company. One underlying reason is that investors do not review the company's environmental aspects in detail, such as carbon emissions information, but only focus on the overall environmental management results. It is also driven by a sample of companies in a study that includes one of the developing countries, namely Indonesia, which shows that the signals conveyed by companies through carbon disclosure cannot yet influence the business decisions of investors in the area. Investors in developing countries will look more at the financial aspect than the details of carbon emissions information, which can be a “boomerang” if the amount of emissions disclosed is so large that it results in a bad stigma against the company. In other words, emissions disclosure without a clear environmental management strategy can worsen investors' perception of the company (Ott & Schiemann, 2023).

Then, the disclosure is still voluntary, which is also the reason why this disclosure is still not a material consideration in determining business decisions (Houten & Wedari, 2023; Kurnia et al., 2020). The nature of disclosure, still classified as voluntary, means that no rules or sanctions bind a company if carbon emission disclosure is not carried out. This statement is also supported by the data collected, where the average carbon emission disclosure is 0.750, or it can be stated that energy sector companies disclose at least five carbon emission disclosure items. Only three companies have an above-average CED index: ABM Investama Tbk, Perusahaan Gas Negara, and Bukit Asam Tbk. In contrast, seven other company samples still reveal carbon emissions below the average. It indicates that environmental disclosures, such as carbon emissions, which are still voluntary, make management reluctant to disclose this information comprehensively. It also applies to stakeholders who still do not consider the comprehensiveness of carbon emissions disclosures to be a consideration when assessing a company.

In the context of stakeholder theory, carbon emissions disclosure has not been able to build a positive perception in influencing stakeholders' views of companies. These results are related to the research period that covers before, during, and after the Covid-19 pandemic, namely 2019-2023, where management is more faced with maintaining company stability than with specific information such as carbon emissions. The change in business dynamics during this pandemic has made stakeholders pay attention to specific non-financial aspects, such as carbon emissions, which are also excluded in assessing company performance. Thus, these results contrast with research by Hardiyansah et al. (2021), who proved that a company's attention to environmental impact by disclosing its carbon emissions can positively impact company value.

The Effect of Eco-efficiency on Firm Value

The sig. The value for eco-efficiency of 0.013 (less than 0.050) shown in Table 4 ab shows that eco-efficiency significantly influences firm value. The negative coefficient is in line with the environmental approach of eco-efficiency to the firm's value, which is inverse, so that eco-efficiency is said to have a significant positive impact on the firm's value, and this result shows that the second hypothesis is accepted. The results of this study support previous studies, such as research conducted by Satrio & Kunto (2020), which stated that eco-efficiency positively impacts the value of manufacturing companies listed on the Indonesia Stock Exchange. The results of this study also provide strong support for the results of the research of Rodríguez-García et al. (2022), which proves that Tobin's Q can be improved through an environmental strategy in the form of production efficiency from the company's greenhouse gas emissions, referred to as eco-efficiency.

Stakeholders, particularly investors, view company efforts to implement pro-environmental strategies, such as eco-efficiency, as positive steps toward maintaining business sustainability and the surrounding environment (Helmina et al., 2022). Companies focused on eco-efficiency can better navigate evolving legislative landscapes concerning environmental regulations. Those proactively embracing sustainable measures often find themselves at a strategic advantage, mitigating compliance risks and enhancing operational efficiencies through resource conservation and waste reduction (Warren-Myers, 2023). Companies that implement eco-efficiency have a competitive advantage in terms of efficient use of resources; this is an added value for stakeholders who support the company's sustainability (Dewi & Rahmianingsih, 2020). Corporate investments in eco-efficiency can catalyze innovation within firms, enabling the development of new, sustainable products or services that meet emerging market demands. By fostering a culture of innovation through eco-focused initiatives, companies can differentiate themselves in competitive markets, unlocking new revenue streams and enhancing market share (Horobet et al., 2025).

This result also show that eco-efficiency practices can be a positive signal that builds a positive image for stakeholders, especially investors, to consider this aspect in making investments, as revealed by Safitri & Nani (2021) that companies can build a positive image and response in society by sending a signal that they are implementing good governance practices towards environmental sustainability such as eco-efficiency efforts. Through an eco-efficiency strategy, companies can realize products with efficient resource inputs while reducing the potential for environmental pollution arising from inefficient business activities. It realizes the satisfaction of stakeholders such as customers who demand that companies create environmentally friendly products to respond to the potential scarcity of energy resources in the future. Stakeholders' demands for maximum profits can also be realized by an eco-efficiency strategy, which minimizes the

inefficiency of the company's activities to reduce operational costs while maximizing the company's profitability (Osazuwa & Che-Ahmad, 2016). Developing a good image will foster investment interest, especially for investors concerned about environmental problems. The growing interest in investing in an eco-efficient company will increase its share price, showing that its value is also increasing. In other words, companies with an eco-efficient strategy in their business environment will have a better market value than companies with a poor environmental strategy. The results of this research contrast with several previous studies, such as those by Damas et al. (2021) and Septianingrum (2022), which state that eco-efficiency harms firm value.

CONCLUSION

This study found that disclosing carbon emissions does not impact the firm's value. It shows that carbon emission disclosure does not provide a strong signal in influencing investor perceptions of the company, which is also related to their investment decisions. The voluntary aspect of carbon emissions disclosure is why it does not affect the investor's business decisions; there are no rules or sanctions accompanying it if the company does not carry out the disclosure. It also shows that investors still do not consider the comprehensiveness of a company's carbon emissions disclosure as an aspect that influences their business considerations or decisions. The change in business dynamics during the pandemic that focuses more on maintaining the company's financial stability rather than paying attention to specific non-financial aspects, such as carbon emissions, also sidelines stakeholders' attention to the comprehensiveness of carbon emission disclosure. The positive influence of eco-efficiency on company value, one of the findings of this study, indicates that companies with sound environmental practices, such as eco-efficiency, will improve their value. These results show that the company's efforts to improve efficiency in the economic and ecological fields to encourage environmental improvement (shown by the reduction of environmental impacts, such as emissions, in its activities) have succeeded in creating a positive perception for stakeholders, especially for investors who are concerned about environmental problems. This positive perception increases investment interest in the market value of a company, which is recorded in the Tobin's Q ratio, which is getting better.

This research has several limitations, including that the energy sector companies included in this research sample are relatively small compared to the population of energy sector companies as a whole, which is caused by the fact that many companies have not yet disclosed their sustainability reports. Small sample sizes can reduce the ability to generalize research results. In addition, the sample used by the research is limited to one sector of companies only, so the research results cannot necessarily be generalized to other company sectors. Thus, future research should consider using a wider range of research objects. Future research also needs to develop this research variable, such as positioning the variable of carbon emission disclosure as an intermediate or intervening variable. There is a gap between the results of this study and the previous research in the form of this research period which includes the period before, during, and after the pandemic where in this period there is a change in business dynamics that make the company's focus on disclosing specific environmental information such as carbon emissions can be the basis for the subsequent research in conducting comparative tests of carbon emission disclosure before and after the COVID-19 pandemic.

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