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Effect of Greenhouse Gas Emissions, Renewable Energy Utilization, CSR Expenditures, and Green Finance on Financial Performance in the Energy Sector for the Period 2021–2023

Anfila Catur Berliana*, Ridarmelli
Institute Keuangan Perbankan dan Informatika Asia, Indonesia
Email: anfilaekstensi@gmail.com*, ridarmelli@perbanas.id

Keywords
Renewable Energy, Greenhouse Gas Emission Intensity, Corporate Social Responsibility, Green Finance, Financial Performance, Energy Industry.

Abstract
This study examines the impact of greenhouse gas emissions, renewable energy usage, Corporate Social Responsibility (CSR) expenditure, and green finance on the financial performance of energy companies in Indonesia. Using multiple regression analysis, this research employs secondary data extracted from the annual reports of energy companies listed on the Indonesia Stock Exchange for the period 2021–2023. The findings reveal that greenhouse gas emissions and renewable energy usage have a significant negative effect on financial performance, indicating that higher emissions and increased reliance on renewable energy are associated with lower profitability. Conversely, CSR expenditure exhibits a significant positive effect, suggesting that greater investment in social responsibility enhances financial performance. Meanwhile, green finance does not demonstrate a significant influence on financial performance. These results provide valuable insights for mining companies in formulating sustainable and responsible business strategies while contributing to the broader discourse on the nexus between sustainability and corporate financial performance.

INTRODUCTION

The industrialization process has made a significant contribution to improving the standard of living of the global community, especially through enhancing health quality, welfare, and accelerating cross-border economic growth (Tambo et al., 2019). In this dynamic, the business sector plays a key catalytic role in product innovation and the provision of services that support socio-economic development (Habiyaremye, King, & Tregenna, 2022). However, behind these advances, there is an exploitative tendency toward natural resources based on short-term profit orientation, without considering long-term ecological implications (Türker, 2015). Such practice has disrupted the balance of ecosystems and exacerbated the sustainability challenges we are now facing globally. Recent reports indicate that humanity's consumption of resources has exceeded 1.6 times the earth's regenerative capacity, a trend that, if not immediately controlled, has the potential to worsen the environmental crisis systemically (Szekely & Dossa, 2017).

Awareness of the importance of sustainability and environmental responsibility in the business world is increasing (Khan, Yu, & Umar, 2021). The issue of the global environmental crisis has prompted many countries, including Indonesia, to adopt policies and practices that support the reduction of carbon emissions and the use of renewable energy (Idroes et al., 2024). As part of the global commitment in the Paris Agreement, Indonesia has set an emission reduction target of 31.89% in 2022. Furthermore, Indonesia is committed to achieving net zero emissions targeted by 2060.

As shown in the table above, the energy sector recorded the highest level of greenhouse gas (GHG) emissions in 2010, at 453.2 million tons of CO_2-eq, much larger than other sectors such as waste (88 million tons) and agriculture (110.5 million tons). By 2030, without policy intervention or Business as Usual, emissions from the energy sector are projected to increase

to 1,669 million tons of CO_2-eq. This shows that the energy sector is the largest contributor to Indonesia's total carbon emissions (Siagian et al., 2017).

On the other hand, the energy sector, especially oil, gas, and coal, has a very important role for the national economy. Its contribution to Gross Domestic Product (GDP) in 2024 will reach 12% (Deny, 2024), which further emphasizes the vitality of this industry in supporting economic growth. However, the dominance of this sector in the economic structure also brings serious consequences for the environment, ultimately leading to a crisis of civilization (Zakharov et al., 2022). Therefore, the energy sector was chosen as the object of research because of its large contribution to national emissions and its strategic role in the economy, making it a key sector in the transition to sustainable development (Liu, Khan, Zakari, & Alharthi, 2022). Focusing on this sector is expected to provide a deeper understanding of the dynamics between sustainability initiatives and corporate financial performance in the face of global policy pressures and demands.

The transition to clean energy is a major challenge, as on one hand the energy industry is still the backbone of the economy (Pahlevi et al., 2024), while on the other hand global pressure to reduce emissions is increasing (Zhang et al., 2023). Indonesia has committed to achieving net zero emissions by 2060 through the Enhanced Nationally Determined Contribution released in 2022, but the implementation of the energy transition strategy still faces obstacles, including industrial dependence on fossil fuels (IESR, 2024), high subsidy costs for biofuels that are expensive and risky to state financial practices (Saputra et al., 2022), and other policies that have not been fully effective in reducing sector emissions. Therefore, understanding the relationship between sustainability in the energy sector and its impact on a company's financial performance is crucial, especially in assessing the extent to which the energy sector can adapt to changing global policies and demands.

However, the impact of this mitigation strategy on the company's financial performance is still a matter of debate. Regarding the use of renewable energy, this energy has the potential to improve business performance, including financial aspects, profitability, logistics, sustainability, and overall company performance (Sitompul et al., 2024). Another study found that the use of renewable energy has a positive relationship with financial performance (Issa & Hanaysha, 2023). However, the development of renewable energies such as geothermal still faces major challenges, especially in the early stages of projects, due to high investment costs and high exploration risks (Guan et al., 2021). In addition, research by Nuha & Nastiti (2020) found that the use of renewable energy does not have a significant impact on companies' financial statements in the energy sector, indicating that other factors can moderate the relationship between the energy transition and financial performance.

In terms of reducing carbon emissions, in the Enhanced Nationally Determined Contribution (ENDC) document, the transformation from the use of non-renewable energy to renewable energy is one of the main mitigation actions in reducing greenhouse gas emissions and providing sustainable sources of clean energy. However, the impact of this mitigation on the company's financial performance is still a matter of debate. Companies that actively reduce CO_2 emissions while having a high emission intensity tend to show better financial performance (Ibishova et al., 2024). Conversely, Busch et al. (2022) found that higher carbon emissions are positively correlated with financial performance, suggesting that higher emissions are related to better short-term and long-term financial results. However, Makan &

Kabra (2021) support the win-win literature, which states that good environmental practices can go hand in hand with improving company performance. In addition, green finance projects chosen by companies tend to reduce emissions while providing measurable financial benefits, as reflected in the increase in Tobin's Q or company value (He et al., 2016).

Regarding investment and financial operations, sustainability practices are accommodated through sustainable investment trends, green finance, and corporate initiatives oriented toward environmental, social, and governance (ESG) aspects (Dmuchowski, Dmuchowski, Baczewska-Dąbrowska, & Gworek, 2023). Not only government policies but investor preferences also show an increase in portfolio allocation to sustainable investments. A survey conducted by Morgan Stanley Firms (2024) revealed that more than three-quarters (77%) of individual investors globally are interested in investing in companies or funds that not only aim to achieve competitive market returns, but also consider positive social and environmental impacts.

Moreover, investors tend to be willing to sacrifice part of their financial gains in favor of social interests (Hirst et al., 2023). This raises the question of whether social programs and green investments affect the company's financial performance. Another study found that companies actively involved in sustainability reporting, green finance, CSR initiatives, and environmental audits tend to experience improved financial performance and are more effective in managing risks associated with their operations (Purwanti, 2024). The integration of sustainability in operations and Corporate Social Responsibility (CSR) programs improves the company's reputation and attracts investors, reinforcing signalling theory (Jao et al., 2023). Syiami & Muflih (2024) found that CSR has a significant effect on financial performance in Islamic banking companies in Indonesia and Malaysia. Additionally, research on mining companies listed on the Indonesia Stock Exchange (IDX) revealed that CSR has a positive and significant effect on financial performance (Khodijah & Huda, 2024). However, previous research found that CSR spending had no significant impact on financial performance, ROA, or ROE for banking companies in Nigeria (Ibrahim & Umeano, 2019). The relationship between financial performance and CSR may thus vary by industry and market.

In addition to CSR activities, efforts to support the transition to a greener and more sustainable economy, the concept of green finance is becoming increasingly relevant in the global financial ecosystem. Green finance refers to a variety of financial instruments, including green bonds, green loans, and sustainable investments, which aim to finance environmentally friendly projects and reduce the impact of climate change (Fu, Lu, & Pirabi, 2023). Research by Ibrahim & Umeano (2019) shows that green finance contributes to company value, indicating that investors pay attention to long-term interests, including environmental sustainability. Green finance significantly drives research and development (R&D) activities, which in turn improve innovation capabilities as well as corporate financial results (Li & Lin, 2024). However, Harliani (2024) revealed that green finance has a negative and insignificant influence.

This research is important because it highlights the energy sector as the largest contributor to emissions as well as a strategic sector in the national economy. Unlike previous studies that tend to be fragmented, this study simultaneously examines four aspects of sustainability to understand their impact on financial performance, expected to make a more comprehensive and contextual contribution. Various studies show that sustainability initiatives,

such as reducing carbon emissions, transitioning to renewable energy, as well as CSR and green finance policies, can impact company profitability. This complexity underscores the need for further research to understand these relationships in more depth and provide a foundation for more effective strategic decision-making for companies in optimizing financial performance while contributing to environmental sustainability.

The purpose of this study is to analyze the influence of each of these variables on *Financial Performance*, to provide a better understanding of how sustainability aspects affect financial performance. The benefits of this study include assessing the impact of renewable energy use, GHG emissions, CSR, and green finance on a company's financial performance, which is expected to inform investment decisions in green energy and sustainability programs. Additionally, this study aims to provide an overview of the effectiveness of green finance in encouraging financial performance and serve as a reference for formulating policies related to sustainability and incentives for companies that adopt green energy.

RESEARCH METHOD

This research employed a quantitative method to test the hypotheses developed. The method section followed a formal structure including: (a) description of the research population and sample characteristics, (b) research procedures and variables, (c) instruments used, and (d) data analysis plan (Creswell & Creswell, 2023).

The population consisted of all companies listed on the Indonesia Stock Exchange (IDX) in the energy sector, specifically the oil, gas, and coal subsectors, during 2021–2023. The sample included companies that (1) operated in these subsectors and were listed on IDX during the study period, (2) published complete sustainability reports accessible via official websites, and (3) reported data on renewable energy use, carbon emissions, and Corporate Social Responsibility (CSR) expenditures. Selected companies also had to present reports with uniform units and standards.

A non-probability sampling technique was applied, selecting samples that met the data requirements. Secondary panel data, combining time series and cross-sectional data, were collected from annual and sustainability reports available on company websites and IDX.

Data collection relied on documentation of financial statements and sustainability reports focusing on environmental aspects. Variables included Greenhouse Gas (GHG) Emissions represented by GHG Intensity, Renewable Energy Usage (REU), CSR Expenditure, and Green Finance (GF). GHG Intensity, REU, CSR, and GF data were calculated using predefined formulas, while Earnings Before Interest and Taxes (EBIT) was taken directly from financial statements. All financial data were standardized into rupiah or US dollars according to company reporting.

Descriptive statistics were used to summarize the data without inference, presenting tables, graphs, and measures of central tendency and distribution. Panel data regression was performed using EViews 12, applying Common Effect Model (CEM), Fixed Effect Model (FEM), and Random Effect Model (REM). The appropriate model was selected using the Chow test (CEM vs. FEM), Hausman test (FEM vs. REM), and Lagrange Multiplier test (CEM vs. REM).

Classical assumption tests—normality, multicollinearity, heteroscedasticity, and autocorrelation—were conducted to ensure valid regression results. Normality tested residual

distribution, multicollinearity checked correlations among independent variables, heteroscedasticity assessed constant variance of residuals, and autocorrelation detected residual dependencies.

Hypothesis testing employed multiple panel regression analyses. The F-test evaluated overall model significance, the t-test assessed the effect of each independent variable, and the adjusted coefficient of determination (Adjusted R^2) measured the model's explanatory power with correction for independent variables.

RESULTS AND DISCUSSION

Hypothesis Test

The level of compatibility of the regression model in estimating the actual value can be assessed using the goodness of fit (Ghozali, 2017). Statistically, the measurement is carried out through the F test, the t test, and the determination coefficient.

Model Feasibility Test (F Test)

The F-test was used to evaluate the feasibility of the constructed regression model (Ghozali & Ratmono, 2017).

Table 1. F Test Results

Dependent Variable: EBIT				
Method: Panel EGLS (Cross-section random effects)				
Date: 03/07/25 Time: 09:25				
Sample: 2021 2023				
Periods included: 3				
Cross-sections included: 14				
Total panel (balanced) observations: 42				
Swamy and Arora estimator of component variances				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	6.006150	3.242747	1.852180	0.0720
GHGI	-108.9472	19.88015	-5.480201	0.0000
REU	-3.115493	1.024190	-3.041909	0.0043
CSR	0.583064	0.139918	4.167172	0.0002
GF	0.305708	0.513668	0.595147	0.5554
Effects Specification				
			S.D.	Rho
Cross-section random			0.994397	0.9093
Idiosyncratic random			0.314069	0.0907
Weighted Statistics				
Root MSE	0.313811	R-squared		0.581695
Mean dependent var	3.410641	Adjusted R-squared		0.536473
S.D. dependent var	0.491083	S.E. of regression		0.334343
Sum squared resid	4.136059	F-statistic		12.86308
Durbin-Watson stat	1.970927	**Prob(F-statistic)**		**0.000001**
Unweighted Statistics				
R-squared	0.661337	Mean dependent var		19.01228
Sum squared resid	48.52244	Durbin-Watson stat		0.168002

Source: Data processed.

From the results of the REM regression, an F-statistic value of 12.86308 was obtained with a Prob(F-statistic) of 0.000001, which is much smaller than the significance level of 0.05. Therefore, the model is worth using for further analysis.

T test

The t-statistical test serves to evaluate the impact of each independent variable separately in influencing the variation of the dependent variable (Ghozali & Ratmono, 2017).

Table 2. Results of the t-test

Dependent Variable: EBIT				
Method: Panel EGLS (Cross-section random effects)				
Date: 03/07/25 Time: 09:25				
Sample: 2021 2023				
Periods included: 3				
Cross-sections included: 14				
Total panel (balanced) observations: 42				
Swamy and Arora estimator of component variances				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	6.006150	3.242747	1.852180	0.0720
GHGI	-108.9472	19.88015	**-5.480201**	0.0000
REU	-3.115493	1.024190	**-3.041909**	0.0043
CSR	0.583064	0.139918	**4.167172**	0.0002
GF	0.305708	0.513668	**0.595147**	0.5554
Effects Specification				
			S.D.	Rho
Cross-section random			0.994397	0.9093
Idiosyncratic random			0.314069	0.0907
Weighted Statistics				
Root MSE	0.313811	R-squared		0.581695
Mean dependent var	3.410641	Adjusted R-squared		0.536473
S.D. dependent var	0.491083	S.E. of regression		0.334343
Sum squared resid	4.136059	F-statistic		12.86308
Durbin-Watson stat	1.970927	Prob(F-statistic)		0.000001
Unweighted Statistics				
R-squared	0.661337	Mean dependent var		19.01228
Sum squared resid	48.52244	Durbin-Watson stat		0.168002

Source: Data processed.

Based on the results of the t-test in the model selection test between Fixed Effect and Random Effect, Greenhouse Gas Emissions (GHG Intensity / GHGI) and Renewable Energy Use (REU) are proven to have a negative and significant impact on financial performance. In contrast, CSR expenditure shows a positive and significant influence, while green finance does not have a significant influence on financial performance.

1) Coefficient of Determination (Adjusted R^2)

The determination coefficient basically tests the extent to which the model can explain variations in dependent variables (Ghozali, 2017). This test uses the adjusted R^2 value as a reference in assessing the most suitable regression model.

Table 3. Determination Coefficient Results

Dependent Variable: EBIT
Method: Panel EGLS (Cross-section random effects)
Date: 03/07/25 Time: 09:25
Sample: 2021 2023
Periods included: 3
Cross-sections included: 14

Total panel (balanced) observations: 42				
Swamy and Arora estimator of component variances				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	6.006150	3.242747	1.852180	0.0720
GHGI	-108.9472	19.88015	-5.480201	0.0000
REU	-3.115493	1.024190	-3.041909	0.0043
CSR	0.583064	0.139918	4.167172	0.0002
GF	0.305708	0.513668	0.595147	0.5554
Effects Specification				
			S.D.	Rho
Cross-section random			0.994397	0.9093
Idiosyncratic random			0.314069	0.0907
Weighted Statistics				
Root MSE	0.313811	R-squared		0.581695
Mean dependent var	3.410641	**Adjusted R-squared**		**0.536473**
S.D. dependent var	0.491083	S.E. of regression		0.334343
Sum squared resid	4.136059	F-statistic		12.86308
Durbin-Watson stat	1.970927	Prob(F-statistic)		0.000001
Unweighted Statistics				
R-squared	0.661337	Mean dependent var		19.01228
Sum squared resid	48.52244	Durbin-Watson stat		0.168002

Source: Data processed

In this regression model, the Adjusted R-Squared value of 0.536473 shows that about 53.65% of these variables, in financial performance can be explained by the independent variables used in the model, namely Greenhouse Gas Emissions (GHG Intensity / GHGI) and Renewable Energy Use (REU), CSR Expenditure, and Green Finance. Meanwhile, the remaining 46.35% were influenced by other variables outside of this regression model.

Interpretation of Research Results

Based on the model selection test, the panel regression model used is REM. The following is a table of the results of the panel data regression with the Random Effect Model (REM).

Table 4. Random Effect Model (REM) Panel Data Regression Results

Dependent Variable: EBIT				
Method: Panel EGLS (Cross-section random effects)				
Date: 03/07/25 Time: 09:25				
Sample: 2021 2023				
Periods included: 3				
Cross-sections included: 14				
Total panel (balanced) observations: 42				
Swamy and Arora estimator of component variances				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	6.006150	3.242747	1.852180	0.0720
GHGI	-108.9472	19.88015	-5.480201	0.0000
REU	-3.115493	1.024190	-3.041909	0.0043
CSR	0.583064	0.139918	4.167172	0.0002
GF	0.305708	0.513668	0.595147	0.5554
Effects Specification				
			S.D.	Rho
Cross-section random			0.994397	0.9093
Idiosyncratic random			0.314069	0.0907
Weighted Statistics				
Root MSE	0.313811	R-squared		0.581695

Mean dependent var	3.410641	Adjusted R-squared	0.536473
S.D. dependent var	0.491083	S.E. of regression	0.334343
Sum squared resid	4.136059	F-statistic	12.86308
Durbin-Watson stat	1.970927	Prob(F-statistic)	0.000001
Unweighted Statistics			
R-squared	0.661337	Mean dependent var	19.01228
Sum squared resid	48.52244	Durbin-Watson stat	0.168002

Source: Data processed

From the regression results table, the mathematical equations are as follows:

$$\text{Financial Performance (EBIT)} = 6.006150 - 108.9472\text{GHGI} - 3.115493\text{XREU} + 0.583064\text{CSR} + 0.305708\text{GF}$$

1. If all the independent variables GHGI, REU, CSR, and GF are zero, then the company's financial performance (EBIT) is predicted to be 6.006150. However, in a real context, this constant is rarely interpreted directly because usually independent variables always have a value.
2. If the GHGI (X_1) increases by 1 unit, then the Financial Performance (EBIT) will decrease by 108.9472, assuming the other variables remain.
3. If the REU (X_2) increases by 1 unit, then the Financial Performance (EBIT) will decrease by 3.115493.
4. If CSR (X_3) increases by 1 unit, then Financial Performance (EBIT) will increase by 0.583064.
5. If GF (X_4) increases by 1 unit, then Financial Performance (EBIT) will increase by 0.305708, but not statistically significant.

Discussion

From the regression results using the Random Effect Model (REM), several important findings were obtained regarding the relationship between the free variable and the bound variable, namely financial performance (EBIT). The t-test is used to see the significance of each independent variable, while the F-test is used to see the feasibility of the model, and the determination coefficient (Adjusted R-Squared) shows the overall strength of the model.

The Effect of Greenhouse Gas Emissions on Financial Performance

Based on the test results in table 20, it can be concluded that the independent variable GHG Intensity (GHGI) has a negative effect on financial performance. This can be seen from the value of the t-test result, where the t-statistical probability value is 0.0000, which indicates significance below the significance level of 5% (0.05). Then, the t-calculated value of -5.480201, and the GHGI coefficient value of -108.9472 revealed a negative relationship between GHGI variables on financial performance.

The results of this t-test are in accordance with the hypothesis, which states that greenhouse gas emissions have a negative effect on the company's financial performance. These findings also show that every single unit decrease in greenhouse gas emission intensity contributes to a significant improvement in financial performance. This indicates that the

company's strategy in reducing carbon emissions not only aims to meet environmental regulations, but also has a real financial impact in increasing profitability.

One factor that could explain these findings is that high-emission industrial sectors, such as energy, tend to have a wide scale of operations and high levels of profitability. Even after being subject to a carbon tax and implementing climate change mitigation measures, companies in this sector are still able to maintain large profit margins (Naef, 2024). In addition, companies that have not yet fully invested in green technologies may still rely on conventional production processes that are cheaper compared to green technologies.

The transition to low-emission technologies requires large investments in the short term, which can depress profitability in the short term. Therefore, companies that stick with fossil fuel-based technologies may have lower cost structures in the short term, thus indicating stronger financial performance. These results are in line with Delmas et al. (2015) who stated that although emission reductions can put pressure on short-term profitability, in the long run they actually contribute to an increase in company value.

From an investor's perspective, some high-emission companies remain attractive because they operate in industries that are in high demand, such as the fossil fuel industry. Despite global trends pointing towards sustainability, there are still investors who prioritize short-term financial gains and remain supportive of high-emissions companies as long as they deliver high returns. This is in line with research by Oestreich & Tsiakas (2024) showing that companies with aggressive emission reduction strategies are still able to maintain or even improve their financial performance.

However, these results could also signal to companies and policymakers that reliance on high-carbon-based production processes could be a challenge in the future. With increasingly stringent environmental regulations and shifting investor preferences towards sustainable businesses, high-emission companies may face financial risks in the long run. Therefore, while currently high emissions correlate with better financial performance, in the long term companies need to adapt to more sustainable strategies to remain competitive.

The Effect of Renewable Energy Use on Financial Performance

Based on the test results in table 20, it can be concluded that the independent variable of Renewable Energy Usage (REU) has a negative effect on financial performance. This can be seen from the value of the t-test results, where the t-statistical probability value is 0.0043, which indicates significance below the significance level of 5% (0.05). Then, the t-calculated value of -3.041909, and the value of the REU coefficient of -3.115493 revealed a negative relationship between the REU variable on financial performance.

The results of this t-test do not match the hypothesis, which states that the use of renewable energy has a positive effect on financial performance. On the contrary, the regression results show that the increase in the use of renewable energy is actually related to the decline in the company's financial performance. This could indicate that the transition to green energy still faces cost challenges or inefficiencies in its implementation, which may negatively impact a company's short-term profitability.

The high initial cost of investing in renewable energy infrastructure, such as solar panels and wind turbines, is one of the main obstacles in its implementation. This technology is capital-intensive and very sensitive to financing costs. Therefore, in a convergence scenario of

funding costs, renewables have the potential to become more competitive than fossil fuels, as capital cost pressures on green projects decrease (Calcaterra et al., 2024).

In addition, renewable energy efficiency in the heavy industry sector is still a challenge. Many companies, especially in the mining and manufacturing sectors, rely heavily on energy sources with stable supplies such as coal and natural gas (Newman et al., 2017). Renewable energy sources such as solar and wind still have constraints in terms of availability and intermittency (supply uncertainty), which can affect operational efficiency (Notton et al., 2018). If a company does not have an adequate energy storage system or still relies on blended energy, then the transition to renewable energy can lead to instability in the production process, ultimately lowering financial performance.

On the other hand, although biofuels and biodiesel are one of the more stable renewable energy alternatives to solar and wind power, government support in the form of subsidies still faces major challenges (Rhamadanty, 2025). If government subsidies for biofuels are still limited, and shipping is difficult, companies that switch to these energy sources may experience a greater increase in operational costs (Marufuzzaman & Ekşioğlu, 2017). As a result, the shift to green energy, particularly biofuels, can be a financial burden for companies in the short term, affecting their profitability.

From an economic perspective, renewable energy production is still in the developing stage and has not yet reached optimal economic scale (Alalwan et al., 2019). The price of renewable energy can be higher than conventional energy in some countries or regions, especially if government subsidies for green energy are still limited. Thus, even if the use of renewable energy is in line with the sustainability agenda, companies that adopt it early may face a greater financial burden than competitors that still use fossil energy.

The Influence of CSR Expenditure on Financial Performance

Based on the test results in the table, it can be concluded that the independent variable of Corporate Social Responsibility (CSR) has a positive effect on financial performance. This can be seen from the value of the t-test result, where the t-statistical probability value is 0.0002, which indicates significance below the significance level of 5% (0.05). Then, the t-calculated value of 4.167172, and the value of the CSR coefficient of 0.583064 revealed a positive relationship between CSR variables and financial performance.

The results of this t-test are in accordance with the hypothesis, which states that CSR expenditure has a positive effect on the company's financial performance. One of the main factors explaining this relationship is the increased reputation and trust of stakeholders. Companies that consistently allocate funds for CSR programs build a positive image in the eyes of the public, investors, and consumers. This is in line with the findings of Yoon & Chung (2018) which show that internal CSR is effective in increasing short-term profitability, while external CSR provides benefits for long-term market value.

In addition, CSR can increase customer loyalty and the competitiveness of the company. In addition, global consumers are increasingly critical in assessing corporate responsibility efforts, thus encouraging companies to realize the strategic value of integrating CSR practices into their operations to remain competitive (Flammer, 2018). This can increase market share and strengthen the company's competitive position, which ultimately affects financial performance (Oware & Mallikarjunappa, 2022).

In its implementation, a well-designed CSR program can improve the company's relationship with stakeholders, including local communities, regulators, and business partners, thereby creating a more conducive business climate. For example, companies that contribute to the development of social infrastructure, education, or health services in their operational areas tend to receive greater support from stakeholders, especially the public and regulators. This support can help reduce licensing barriers and operational risks. In addition, modern consumer trends show that customers have a tendency to choose products and services from companies with a commitment to social and environmental responsibility, which ultimately positively impacts revenue and market share.

From an internal perspective, involvement in CSR can also increase employee engagement and productivity. Companies with good CSR policies are often able to create a more positive work environment, increase employee retention, and attract quality talent who want to work in organizations that have clear social goals. Thus, although CSR is often considered a mandatory expenditure regulated by regulations, the results of this study show that investing in strategically managed CSR is not only a form of corporate social responsibility, but can also be a key factor in improving financial performance.

The Influence of Green Finance on Financial Performance

Based on the test results in the table, it can be concluded that the independent variable Green Finance (GF) does not have a significant effect on financial performance. This can be seen from the value of the t-test result, where the t-statistic probability value is 0.5554, which is greater than the significance level of 5% (0.05). Then, the t-calculated value with the result of 0.595147, and the value of the GF coefficient of 0.305708 revealed a positive, but not significant, relationship between the GF variables on financial performance.

The regression results showed that Green Finance (GF), measured using the Green Coin Rating Indicator, had no significant influence on financial performance (EBIT), with a coefficient of 0.305708 and a p-value of 0.5554. Since the p-value is greater than 0.05, statistically the relationship between green finance and financial performance is not strong enough to be considered meaningful in this model.

The results of the study show that green finance does not have a significant influence on financial performance. Research by Yusnia et al. (2024) shows that there is no significant influence between green investment and company value, because green investment reflected in the PROPER assessment does not directly impact the increase in company value. Other causes may be due to the lack of comprehensive data related to the implementation of green financing in the mining sector or the limitations of the Green Coin Rating (GCR) indicator used in this study.

The insignificance of the influence of Green Finance on financial performance may indicate that during the study period, green investment schemes have not had a direct impact on the company's profitability. This can be due to the lack of optimal implementation of green finance in the energy, oil and gas and coal sectors, or the financial benefits of green investment schemes that still take longer to realize. In addition, regulations and incentives from governments related to green finance may not be strong enough to encourage wider adoption in the industry.

In addition, the absence of significant influences between green finance and financial performance may also reflect that the goals of green investment are more long-term and oriented towards environmental sustainability rather than increasing financial profits in the near term (Ye & Dela, 2023). Many companies are still in the early stages of green project development or are just starting to integrate sustainability principles into their business practices. This makes the impact on profitability not noticeable during the observation period.

In addition, the uneven green financial literacy and lack of company readiness in compiling standardized sustainability reports can also be obstacles in optimizing the potential of green finance. In this context, a long-term strategic approach, as well as synergy between the private sector and public policy, is needed so that green investments not only have an impact on environmental sustainability, but can also improve the competitiveness and financial performance of companies in a sustainable manner.

CONCLUSION

The study using the Random Effect Model (REM) found that higher greenhouse gas (GHG) emissions significantly reduced financial performance (EBIT) of Indonesian energy companies, while the use of renewable energy also negatively impacted profitability in the short term due to high initial costs and technical challenges, despite its long-term potential benefits. Corporate Social Responsibility (CSR) expenditure positively and significantly enhanced financial performance, indicating its value in strengthening reputation, customer loyalty, and stakeholder relations. However, green finance showed no significant effect on profitability during the study period, possibly due to its limited implementation or delayed financial returns. Future research should explore the long-term impacts of green finance and renewable energy adoption on financial performance, incorporating evolving technologies and policy developments.

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