

CORPORATE ENVIRONMENTAL RESPONSIBILITY, GREEN INNOVATION, AND FINANCIAL PERFORMANCE: EVIDENCE FROM INDONESIAN ENERGY SECTOR FIRMS

Ismi Nur Hidayah^{1*)}, Civi Erikawati¹⁾, Fadila Ridho Mardiyah¹⁾, Nesia Amaradanti Putri¹⁾, Aprilia Putri Marheni¹⁾, Asy-Syifa Nur Muslihah¹⁾

isminurh@unisa-surakarta.ac.id, civierika02@gmail.com, fadilamardiyah01@gmail.com, nesiaamaraputrie@gmail.com, apriliamarheni9@gmail.com, syifanurmuslihah@gmail.com

¹⁾ Universitas 'Aisyiyah Surakarta, Indonesia

ABSTRACT

Environmental issues such as excessive energy production and consumption can impact environmental sustainability. Public companies are responsible for reporting their economic, social, and environmental performance to the public. Environmental responsibility is linked to pollution management and clean production. Green innovation relates to the development of processes, product, and technologies to reduce negative impacts on the environment. This study examines the effect of corporate environmental responsibility and green innovation on corporate financial performance.

This is a quantitative explanatory study of 43 companies listed in the energy sector of the Indonesia Stock Exchange from 2021 to 2025. The analysis used random-effect panel regression with STATA. The result of this study indicates that corporate environmental responsibility significant positive, but green innovation insignificant on financial performance. These findings provide new insight for optimizing environmental responsibility and green innovation to support corporate sustainability programs.

Keywords: *contains keywords that reflect the title of the research, maximum 8 words*

INTRODUCTION

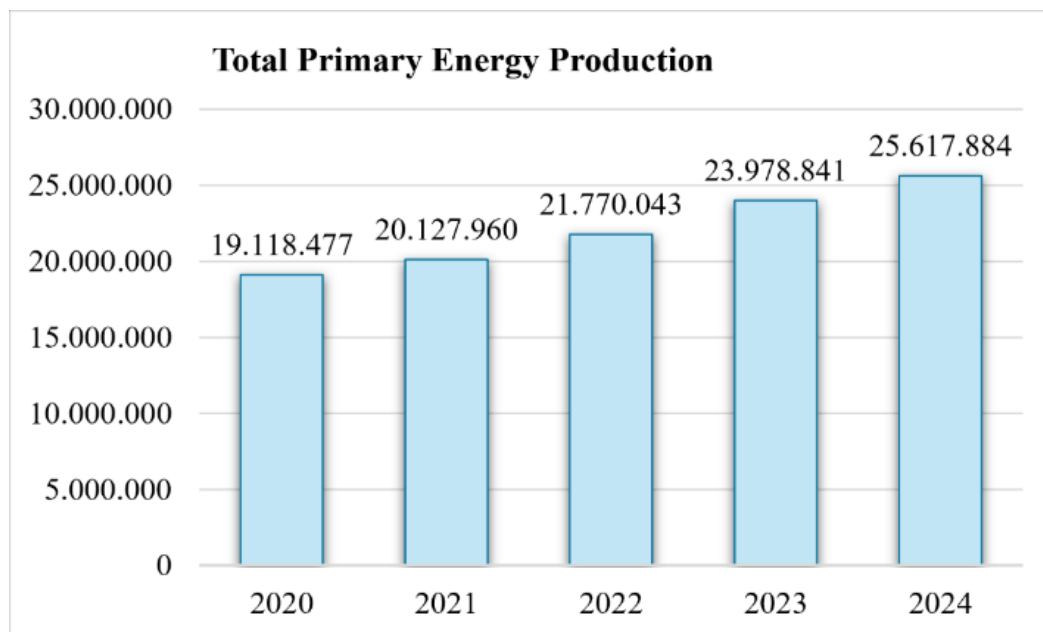
Climate change had a significant impact on various sectors worldwide. Indonesia is among the countries experiencing the effects of climate change, which can lead to environmental problems. One of the issues is energy use that significantly contributes to environmental pollutions, especially from the industrial energy sector (Ibrahim et al., 2022).

According to data from Indonesia's Central Statistics Bureau (BPS) on Energy Balances report, on primary energy

production includes coal, crude oil, natural gas, biomass energy, and electricity (BPS Statistic Indonesia, 2025). Total primary energy production in 2020 was 19.118.477 terajoule, in 2021 was 20.127.960 terajoule, in 2022 it was 21.770.043 terajoule, in 2023 it was 23.978.841 terajoule, and in 2024 was 25.617.884 terajoule (BPS Statistic Indonesia, 2025) Although the development of various energy sources has grown essential to the country's needs and support economic growth, the amount of primary

energy produced has been rising annually (BPS Statistic Indonesia, 2025).

Figure 1. Total Primary Energy Production



Sources: BPS, 2024

In addition to the increase in the production of primary energy sources, there is another issue us an ongoing increase in energy consumption issue of final energy consumption which can decrease in environmental quality. According based on data from Central Statistics Bureau in 2020-2024, total final energy consumption in the construction and non-oil and gas mining sector, in 2020 was 2.370.464 terajoule, in 2021 it was 2.687.411 terajoule, in 2022 it was 3.841.469 terajoule, in 2023 it was 4.163.151 terajoule, and in 2024 it was 4.515.252 terajoule (BPS Statistic Indonesia, 2025). The environment around the business may suffer as a result of this complicated problem (BPS Statistic Indonesia, 2025).

Companies with strong environmental responsibility initiatives help businesses operate better financially, as seen by their earnings. Businesses that integrate green technologies innovation into their operations are expected to effectively improve their financial performance by making the most of their existing resources (Fosu et al., 2024a).

The scope of a company's responsibility covers a wide range of topics, including social, economic, health, and environmental issues (Al Masud et al., 2025a). This study focuses on discuss in corporate responsibility in environmental aspect and green innovation as part of the company's efforts to increase long-term profits. Based on the background re regarding the

importance of integrating environmental performance to maximize the corporate financial performance.

There have been numerous studies on CSR, however this study focuses on CER, which is unique from CSR and explicitly targets the natural environment and natural resources, as well as the nature of corporate responsibility in business operations. Although prior studies have not generated clear result, some indicate positive, negative, or minor effect. That result in depends on the sector and country under study, the duration of the research, and the parameter or metrics employed to measure the observed variable (Al Masud et al., 2025b; D. Li et al., 2017a; Wong et al., 2018a).

While for the green innovation, several studies have found that green innovation can bring positive effect to company. A substantial prior study indicates of green innovation improved corporate performance. Y. Li (2014) research about green innovation positively influences indirectly enhances financial performance in manufacturing firm in China. Similarly,

Lee & Min (2015) find that investment in green innovation can reduced carbon emissions while improving financial performance in manufacturing companies in Japan.

Studies about environmental and green innovation on financial performance yield inconsistent result. Some previous studies

have found that environmental responsibility can make positive impact on financial performance, like study from (Jo et al., 2013; D. Li et al., 2017a; Ullah, 2025; H. Zhang et al., 2025)

Also, studies about green innovation in previous studies discuss about the type of innovation, involves the development of green innovation dorm the technologies, product, or process Xie et al., (2019) . The argument for green innovation as an independent variable in this study is also supported by several previous studies that show green innovation has a positive effect on firm performance (Agustin & Basuki, 2025; Xie et al., 2019).

Although previous study has consistently about relationship between environmental responsibility, green innovation, and financial performance, several gaps remain. There is limited to industry-specific characteristic, particularly in environmentally sensitive sectors like energy, with numerous anomalies related to regulations, legal compliance, public company obligations, environmental strategies, and other issues. Therefore, this research analyzed the impact of CER and green innovation on financial performance within the Indonesian sector energy from 2021 to 2025.

This study aims to investigate the direct effect of corporate environmental responsibility and green innovation on

financial performance. In Indonesia context is particularly interesting and suitable to research this topic for several reason. First, the growth trends of companies in the energy sector listed on IDXENERGY covers 90 companies including the main listing board, development board, and special monitoring board with sub-sector such as oil, gas, coal, and alternative energy (Indonesia Stock Exchange, 2025). Second, the environmental impact of the energy sector, particularly coal-fired power companies, contributes to environmental impacts such as waste disposal, air pollution, land degradation, and carbon emission. This can be environmental issue for companies that operate alongside with nature (Oktaviani et al., 2026). Third, public companies listed on the IDX are requires to prepare and submit sustainability reports based on Peraturan Otoritas Jasa Keuangan No. 51/POJK.03/2017 and Surat Edaran Otoritas Jasa Keuangan No. 156/SEOJK.04/2021. IDX also emphasizes that sustainability reports are not merely accountability reports to comply with regulations, but also integrate ESG for competitive advantage (SAL POJK 51 - Penerapan Keuangan Berkelanjutan, 2017; SEOJK - Bentuk dan Isi Laporan Tahunan, 2021).

The research question for this study is the relationship between corporate environmental responsibility and green innovation as elements impacting to

financial performance in terms of profitability. The purpose of this study is analyzed corporate environmental responsibility and the green innovation affect to corporate financial performance. To determine this impact with specific measurement indicators such as an assessment of environmental responsibility using relevant metrics, and evaluation of information about green innovation from annual report and sustainability report.

THEORETICAL REVIEW

1. Corporate Environmental Performance and Financial Performance

According to signaling theory, companies that demonstrate environmental responsibility send a signal to build a positive reputation among the general public and stakeholders (Dang et al., 2019). Implementing corporate environmental responsibility can improve operational performance (D. Li et al., 2017b; Wong et al., 2018b). Companies are consistently report on their environmental responsibility see a significant increase in their stock prices, whereas companies that are not responsible experience a decline in their stock prices, which leads to a decline in the firm performance (Flammer, 2013; D. Li et al., 2017b).

Corporate environmental responsibility (CER) plays a significant role in enhancing transparency of information to minimize resources consumption, thereby improving operational efficiency. Implement CER are contribute to improved financial performance and the development of sustainable performance in the future (D. Li et al., 2017a)

We argue that, firms commit themselves to environmental protection with pollution control or reduce energy consumption while operational industries, which will one of the factors to improve financial performance. Accordingly, the following hypothesis is proposed:

Hypothesis 1. Corporate environmental responsibility has a positive impact on financial performance in energy sector companies in Indonesia

2. Green Innovation and Financial Performance

Green innovation is a crucial determinant of a company's overall performance (Qiu et al., 2019). Zhou, Zhang, & Zhang (2019) considerable attention from professionals and scholars towards environmental strategies. Green innovation is a crucial strategy all sectors can implementation,

as it leads to green company trend in the industrial domain (Kraus et al., 2020).

The implementation of green innovations can improve transparency overs its environmental responsibilities. This functions as a mechanism for accountability to stakeholders and helps achieve company's reputation and financial performance. Effective implementation of green innovations can enhance a corporate environmental, which is turn will improve financial success in operations (Ma et al., 2021). Xie et al. (2019) green process and product innovations improve financial performance in Chinese manufacturing industry (Aastvedt et al., 2021; Xie et al., 2019).

Study from Lin et al. (2019), find that implementation of green innovation strategy has a positive effect in financial performance in automotive sector, which helps better reputation and the market investors offered a higher premium to the firms with a good image find that green innovation has a positive effect on financial performance in automotive sector (Aastvedt et al., 2021; Lin et al., 2019). Also, from Agustin & Basuki (2025), discovered that green innovation improving financial performance, where companies can implement green innovation practice to

improve their performance (Agustin & Basuki, 2025).

In this study, the effect of green innovation on financial performance is positively and we develop the second hypothesis:

Hypothesis 2. Green innovation has a positive effect on corporate financial performance in in energy sector companies in Indonesia

RESEARCH METHOD

Data and Sample

Our sample consisted of companies listed on the IDX Energy from Indonesian Stock Exchange from 2021 to 2025. We chose data from the IDX Energy based on data from the Indonesian Central Bureau of Statistics which states that the phenomenon of energy production and consumption has increased so that potential adverse effects on the environment, including both natural ecosystems (BPS Statistic Indonesia, 2025). The population used in this research was all companies listed on the Indonesia Stock Exchange. The sample screening method used purposive sampling, with several criteria. The criteria used in determining the sample are: 1) Companies listed in the Energy Sector (IDXENERGY) between 2021 until 2025, 2) Companies listed in the Energy Sector (IDXENERGY) that regularly submit annual reports and/or

sustainability reports between 2021 until 2025, 3) Companies not on special monitoring board of the Indonesia Stock Exchange that were listed in the Energy Sector (IDXENERGY) between 2021 until 2025.

Based on the sample criteria, this study involved 43 firm samples with 215 observations. Data regarding the independent variable and dependent variable, we collecting data using a content analysis form the annual report and sustainability report are publicly available.

Definition and Measurement of Variable

This study adopted the measurements for independent and dependent variable form previous studies (Aastvedt et al., 2021; Agustin & Basuki, 2025; D. Li et al., 2017a). Following (D. Li et al., 2017a), Corporate Environmental Responsibility (CER) is defined as a company's mindset and dedication to reducing adverse effects on the environment by operating procedures, policies, operational practices, and compliance with relevant environmental regulations (D. Li et al., 2017a). CER as independent variable measured by content analysis, using environmental practice indicators D. Li et al. (2017a) using 38 items as the basis for assessment. All information from the 38 indicators that will be rated on a scale of 0 to 4 according to specific scoring system, the score is totaled to determine the

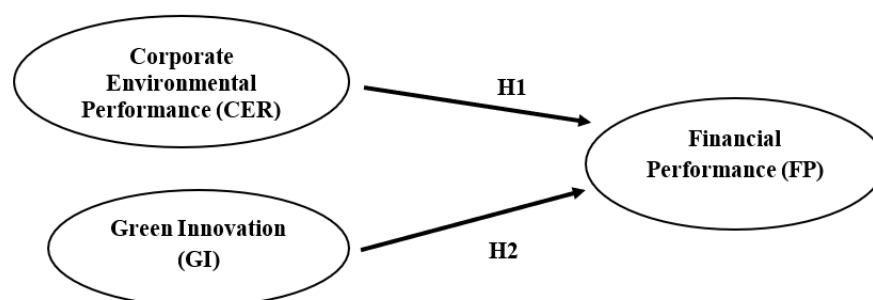
environmental responsibility score (D. Li et al., 2017b). Referring to Agustin & Basuki (2025), green innovation (GI) is defined as a company's initiatives to create processes, products, and practices aimed to mitigate negative impacts on the natural environment and enhancing efficiency in the consumption of energy and resources (Agustin & Basuki, 2025). Green innovation measured by content analysis, using 4 items indicators that will be rated on a scale of 0 to 4

The data collected from the sample companies was subsequently analyzed using data analysis software STATA. This study used panel data and utilized inferential statistical and multiple linear

according to specific scoring system (Agustin & Basuki, 2025). Financial performance as dependent variable defined as the firm's ability to generate profits as an indicator of economic result to create financial value (Aastvedt et al., 2021; D. Li et al., 2017a; Lin et al., 2019). Measurement financial performance is using return on assets using a formula $ROA = \frac{Net\ Income}{Total\ Assets}$ (Aastvedt et al., 2021; D. Li et al., 2017a)

regression analysis as the analysis methods. Data collection was performed through literature and documentation

Figure 2. The conceptual model



Source: Author's own work, 2026

RESULTS AND DISCUSSION

Result

Table 1. present the descriptive statistical result of each variable used in this study. The total data observed were 215 observations. It shows

that the maximum value of ROA measurement from CFP is 61.76, the minimum value is -33.28. The maximum value of CER is 83, and the minimum value is 27. The maximum of GI is 11, the minimum value is 0.

Table 1.
Descriptive statistics

Variable	Obs	Mean	Std. Dev	Min	Max
ROA	215	9.011767	14.24031	-33.28	61.76
CER	215	65.13953	13.30059	27	83
GI	215	7.027907	1.519088	0	11
CER	215	65.13953	13.30059	27	83
GI	215	7.027907	1.519088	0	11

Source: Processed data, 2026

Table 2. is spearman correlation matrix of each variable tested in this study. The correlation between ROA and CER is 0.1709, while correlation between ROA and GI is 0.0879, the last correlation between

CER and GI is 0.6053. From the table, it can be concluded that CER and GI have a strong positive correlation (0.6053) with each other.

Table 2.
Spearman correlation matrix

	ROA	CER	CFP
ROA	1.0000		
CER	0.1709	1.0000	
GI	0.0879	0.6053	1.0000

Source: Processed data, 2026

This study using the regression for panel data. Regression panel data models that may be consist of Pooled Least Square (PLS), the Fixed Effect Model (FEM), and the Random Effect Model (REM). To determine the best panel data regression

model for this study, the test is caried out using the STATA software with three stages of testing. The result is Prob > chibar2 = 0.0000 which is less than 0.05 then the REM is selected based on these three testing steps

Table 3.
Regression Model Selection

Test steps	Test	Indicators	Decision
1	Chow Test	Prob > F = 0.0000, it means less than 0.05	H0: PLS (rejected) H1: FE (accepted)
2	Hausman Test	Prob>chi2 = 0.7448, it means 0.7448 > 0.05	H0: RE (accepted) H1: FE (rejected)

3	Breusch and Pagan Prob > chibar2 = 0.0000, it H0: PLS (rejected)
	Lagrangian Multiplier means less than 0.05 H1: RE (accepted)
	Test

Source: Processed data, 2026

To determine the result of the hypothesis testing formulated at the outset, a random effect model regression analysis was conducted. Table 4 shows the results of data processing for the variables corporate environmental responsibility, green innovation, and financial performance with ROA measurement.

Table 4. Regression Random Effect Result	
Variables	Random Effect ROA
CER	0.260* (1.731)
GI	-1.288 (-1.265)
N	215

t statistics in parentheses
p<0.10, **p<0.05, *p<0.01*
Source: Processed data, 2026

Discussion

This study uses a multiple regression data panel to test the proposed hypothesis. Table 5. shows the result of the regression analysis of the Random Effect regression test of data processing using STATA with a random effect model show CER has a significant positive correlation with ROA ($\beta = 0.260$, $p < 0.10$), so H1 is supported. While, the GI results have a negative correlation with ROA ($\beta = -1,288$, $p < 0.10$), so H2 is rejected.

This research, corporate environmental responsibility was positively significantly on corporate financial performance with ROA as measurement. This result following the study from Fosu et al.,

(2024b); D. Li et al., (2017a); Xu et al. (2021). Hypothesis 1 of this study is accepted.

This research using content analysis, which examined all energy-related policies, strategies, and result that might have an adverse effect on the environment. The notably favorable outcomes show that energy sector companies in Indonesia are truly responsible and accountable. This consistent with studies by (D. Li et al., 2017a) a study examining CER with 451 firms for 3 years in China found a positive effect on financial performance, as measured by ROA (D. Li et al., 2017a). The aligns with research from D. Li et al. (2017b); Wong et al. (2018b), shows the

positive effect on Chinas firms. The result supported the study Wahdan Arum Inawati & Rahmawati, (2023) environmental factors, especially environmental disclosure, can influence a company's financial performance sector companies listed on the IDX (Wahdan Arum Inawati & Rahmawati, 2023). These encouraging outcomes show that business can improve their financial performance by protecting the environment and being responsible for all of their actions in compliance with relevant government legislation. This enhanced accountability can also enhance the company's brand image among the public and stakeholders.

This research, green innovation was not significantly referred to study from Aastvedt et al., (2021); Fitriyati Arlyta & Titik (2025); Utami & Budiadnyani (2025); C. Zhang et al., (2025), Hypothesis 2 of this study is rejected. The green innovation variable did not have a positive effect on improving company financial performance because it failed to attract stakeholder's attention to the implementation of green company trends, as studied by Zhou, Zhang, & Zhang (2019).

This negative finding also impacts the research subjects in energy sector companies, which have not implemented many of the latest innovations related to production systems or operational management, even in relation to

regulations. This is in line with the findings from Utami & Budiadnyani (2025), green innovation has a negative significant effect on financial performance with corporate objectives in the energy sector, implementing green innovation is considered to be burdensome to financial performance, requiring significant initial investments such as developing technology, environmentally friendly management systems, and other innovation (Meng et al., 2024). This green innovation is possible for a longer period of time to grow in the long term, so that its impact on financial performance can be seen. (C. Zhang et al., 2025).

CONCLUSION

Conclusion

The main objective of this study was to investigate the effect of corporate environmental responsibility and green innovation on financial performance. For this, we used random effect panel regression to analyze data 215 Energy Sectors companies listed on the Indonesia Stock Exchange during 2020-2025. The main finding was the confirmation of hypothesis 1, corporate financial performance is positive significant, indicating that companies are genuinely implementing environmental responsibility not only to comply with regulations but also to enhance their firm's value or financial

performance. This positive aspect is expected to attract more investors to invest in companies that are willing to take responsibility and disclose their environmental performance. Meanwhile, in hypothesis 2, green innovation has no positive effect on the financial performance of companies in the energy sector. Although there is no direct positive effect, green innovation can be optimized to its fullest potential to create a competitive advantage over other companies and raises the standards for more dignified green companies.

Furthermore, this study could make significant contribution to the literature since it applied the concept of corporate environmental responsibility and green innovation in Indonesia. Indonesia is a country with vast natural resources, but also high levels of energy production and consumption. This serves as a lesson for all of us to continue protecting the environment and to be accountable for all environment regulations. These findings confirms that public disclosure of environmental responsibility and green innovation can create new dynamics in future business activities. In the future, companies particularly in the energy sector will be able to actively invest in environmental sustainability.

Implications

The practical implication of this research is that management in the energy sector needs to improve the quality and detailed of environmental performance disclosures in sustainability report. Environmental performance disclosure can serve as a selling point and even help build a green brand image for company, thereby enhancing its legitimacy and financial performance. As for the implications for the government and policymakers, the result of this study is expected to inform decisions regarding the allocations subsidies or assistance to companies implementing green innovations. Additionally, could lead to reduced corporate tax payments for companies that are fully responsible for environment and successfully implement green innovation, which ultimately make a significant contribution to the surrounding environment.

Limitation

Limitation of this study is that it examines only one direct relationship between CER and GI variables and financial performance. This could be improved in the future by adding moderating variables such as green image and green subsidies, as in the study by (Xie et al., 2019). This study using ROA as the sole financial performance, future research may consider market measure such as Tobin's Q (Fitriyati Arlyta & Titik, 2025),

or other profitability ratios such as ROE and ROS (Lin et al., 2019). Future research is also recommended to examine a broader range of research objects, such as sectors other than the energy sector that have significant environmental impact, including mining, raw materials, plantations and food crops, among others. Future research may also consider extending the observation period to more than five years to determine, over a longer timeframe, whether or not there is an impact on financial performance.

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