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Eco-Efficiency and Financial Performance: Empirical Evidence of Companies in Indonesia

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Abstract

This study aims to identify and analyze energy consumption and emissions produced by companies listed on the Indonesia Stock Exchange after the Circular Letter of The Financial Services Authority number 16 of 2021 regarding the obligation to prepare Sustainability Reports. In addition, this study tries to provide evidence regarding the relationship between eco-efficiency and company financial performance. The research population is all companies listed on the Indonesia Stock Exchange in 2021 and 2022. The research sample is a company that has prepared separate sustainability reports and has energy consumption and emission data for 185 companies. This study documents that energy and emissions intensity significantly impact ROA in all sectors, including sensitive industries. This research supports the stakeholder theory in that companies responsible for balancing all stakeholders' interests can lead to long-term success and sustainability.

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1. Introduction

One of the goals of sustainable development is clean and affordable energy by 2030. Achieving this goal requires synergy between the government, companies, and the whole community. The importance of the company's role in supporting sustainable development is recognized by many parties (Cordova & Celone, 2019). Companies are pretty significant energy users in Indonesia. Data for 2021 shows that the total energy consumption of the industrial sector ranks second after the transportation sector, which is 39 percent. The industrial sector in 2021 consumes 389.4 million BOE (Barrels of Oil Equivalent) of energy in the form of coal, gas, and electricity, in addition to diesel and fuel oil. The industrial sector's energy demand is projected to increase, with an average growth rate of 3.9% per year to 1,279.5 million BOE in 2050. Managing energy use as well as possible is an important matter that gets the attention of all companies to support sustainable development goals. Energy use is a source of greenhouse gas (GHG) emissions (Clementino & Perkins, 2021). Applying low-carbon technology or decarbonization in companies is an implementation to reduce GHG emissions (Liu et al., 2017). An analysis of how efficiently a company uses energy and reduces emissions is an important thing to do to know the eco-efficiency value achieved by a company in producing the company and its services. Apart from that, to continue to operate, the company must also be financially viable (Fatemi et al., 2018). Energy efficiency and emission reduction are expected to impact the company's financial performance positively. Research on eco-efficiency is mainly carried out in developed countries than in developing countries (Xu et al., 2019; Pereira et al., 2018; Heras-Saizarbitoria et al., 2020; Pang et al., 2016; Onat et al., 2021; Bianchi et al., 2020). Meanwhile, research on eco-efficiency in Indonesia is still minimal. It is noted that there is research (Alviani & Sholihin, 2016; Meutia et al., 2019; Purwaningsih et al., 2021).

In several studies (Suh et al., 2014; Sudha, 2020; Lucato et al., 2017; Rodríguez-García et al., 2022; Matsumura et al., 2014; Joachimiak-Lechman et al., 2019; Koskela & Vehmas, 2012) eco-efficiency is also only understood as a company having ISO 14001 or won an award in the environmental field. This measure does not capture the true meaning of eco-efficiency, as meant by (Glavič & Lukman, 2007), i.e. creating more goods and services while using fewer resources and creating less waste and pollution. This research will contribute to enriching the literature on eco-efficiency, in particular by measuring eco-efficiency based on the concept of energy intensity and emissions and identifying whether eco-efficiency in companies in Indonesia has an impact on company financial performance. Furthermore, this paper will explain the theory and literature review, followed by the research method. The next section discusses the analysis and research findings results, and the final section describes the research conclusions.

2. Literature Review

Eco-efficiency is essential in revealing how efficient economic activities are for natural goods and services (Shakil et al., 2020). Hundreds of companies have embraced eco-efficiency, which has proven to be a practical tool for improving economic and environmental performance (Alareeni & Hamdan, 2020). Efficiency

generally refers to producing the maximum amount of output with the least amount of input. However, eco-efficiency in environmental management has a slightly different meaning. Regarding energy use or carbon emissions, efficiency refers to producing products with the minimum energy use or producing the lowest carbon emissions (World Business Council for Sustainable Development, 2000). The eco-efficiency theory proposed by (Derwall et al., 2005; Xu et al., 2019) states that companies can maximize their efficiency by reducing costs and creating value while minimizing their environmental impact. In the industrial world, the resources' efficiency is known as Corporate Environment Performance (CEP) (Heras-Saizarbitoria et al., 2020; Joachimiak-Lechman et al., 2019). Eco-efficiency, which is a management control process, is considered one of the best measures for measuring CEP because it embraces the concept of a clean enterprise – that is, more efficient use of natural resources such as raw materials, energy, and water with an impact on reducing waste and emissions.

The most common eco-efficiency is defined (Koskela & Vehmas, 2012) as the ratio between environmental impact and economic performance; the balance between economic performance and environmental impact. Implementing eco-efficiency in the business sector is usually based on the ratio of company or service value to environmental impact (Li et al., 2020; Stępień et al., 2021; Sutrisno & Wendy, 2020). Most indicators focus on energy, material, and water consumption and greenhouse gas, wastewater, and pollution emissions. In addition to analyzing energy intensity and emissions, it is essential to ensure that energy efficiency and emission reduction efforts benefit the company. Several studies have examined the company's financial performance. compared to energy efficiency and emission reductions. Among them, research conducted by (Bianchi et al., 2020; Costa & Lucato, 2017; Meutia et al., 2019; Niero et al., 2017; Onat et al., 2021; Purwaningsih et al., 2021; Rodríguez-García et al., 2022; Sudha, 2020). Bianchi et al. (2020) found that energy, water, and materials are strategic environmental sustainability resources; if used efficiently, they can improve a company's financial performance. Research (Niero et al., 2017) in Latin America's canned beverage packaging sector found that companies that implement eco-efficiency will provide maximum benefits for the ecological and economic systems. Similar research in Latin America was conducted by Rodríguez-García et al. (2022), who found a positive relationship between eco-efficiency and financial performance as measured by Tobin's q.

Sudha (2020) found that water, energy, and material efficiency positively impacted the financial performance of companies in India. On a different side, research conducted (Costa & Lucato, 2017) on textile companies in Brazil found that the higher the company's profit, the worse its environmental performance, as indicated by the greater its eco-efficiency ratio. Ahmad and Osazuwa (2015), researching the relationship between eco-efficiency and firm value in companies in Malaysia, found that eco-efficiency is positively related to firm value. However, in this study, eco-efficiency is measured by a dummy, namely companies that are eco-efficient and not. Companies that adopt ISO 14001 are considered eco-efficient companies. Research on eco-efficiency in the Indonesian context is minimal, especially after the obligation for companies listed on the Indonesian Stock Exchange to prepare a

sustainability report. Research (Alviani & Sholihin, 2016) found that implementing eco-efficiency can reduce a company's cost of capital. However, similar to research (Ahmad & Osazuwa, 2015), this study also measures eco-efficiency by adopting ISO 14001. Research (Purwaningsih et al., 2021) found that company actions by investing in renewable energy and reducing emissions benefit stakeholders economically. This research was only conducted at one furniture company in the Jepara area. Research by (Meutia et al., 2019) found that the eco-efficiency of companies listed on the Indonesian Stock Exchange is still low. Research (Meutia et al., 2019) used data for 2012-2016; there were no rules for listed companies to prepare sustainability reports then. In 2021, the Indonesian Financial Services Authority issued a letter (SE OJK) number 16 stipulating that all companies listed on the Stock Exchange must prepare a Sustainability Report. This rule forces companies listed on the Indonesia Stock Exchange to disclose matters related to their sustainability policies. Among the two essential things that must be disclosed are policies related to energy use and emission reduction. Through this regulation, companies are expected to provide information on how much energy, either fuel or electricity, is used and the emissions from using energy. Therefore, this research will identify the eco-efficiency of companies listed on the Indonesia Stock Exchange in 2021 and 2022. This is important to provide an overview of the extent to which companies listed on the IDX have sustainability initiatives in the form of energy use and reduced emissions that impact the company's eco-efficiency. This research will overcome the weaknesses of previous studies that have not used the concept of eco-efficiency properly, namely, using eco-efficiency measures based on energy intensity and emissions. In addition, this research will also provide evidence of the link between eco-efficiency and the company's financial performance. Stakeholder theory, popularised by Freeman introduces a new concept of stakeholders to companies. Freeman (1994) defines stakeholders as "employees, financiers, customers, and society". The theory asserts that the notion of a moral community cannot be separated from business value-creation activities. Stakeholder theory provides a vehicle for linking business ethics and strategy, and companies that diligently seek to serve the interests of broad stakeholder groups will create more value over time (Freeman, 1998; Meutia et al., 2022).

Stakeholder theory is a perspective that considers how a business should operate in a way that benefits all stakeholders who have a stake in the organization (Freeman et al., 2007). These stakeholders include shareholders, employees, customers, suppliers, communities, and the environment. The theory suggests that companies balance all stakeholders' interests rather than just their shareholders, which can lead to long-term success and sustainability. Rather than focusing on economic performance measures, stakeholder-based performance measures challenge managers to examine the value their company creates from a broader stakeholder perspective. Based on this argument, there is a positive relationship between eco-efficiency and the company's financial performance. In line with the above argument, this study hypothesizes:

H1. Energy intensity has a positive effect on the company's financial performance

H2. Emission intensity has a positive effect on the company's financial performance

3. Research Methods

The population of this study is all companies listed on the Indonesia Stock Exchange in 2021 and 2022. There are 728 companies listed on the Indonesia Stock Exchange, consisting of 11 sectors. The companies that will be sampled in this study through a purposive sampling technique with the criteria of companies that compile Sustainability Reports and disclose data on energy use and emissions produced in the Sustainability Reports. Based on the criteria above, the samples in this study based on sectors are as follows:

Table 1. Research Sample

No	Sectors	Company
1	Energy	55
2	Consumer Cyclicals	34
3	Technology	0
4	Basic Materials	62
5	Healthcare	24
6	Infrastructure	34
7	Industrials	20
8	Transportation & Logistics	8
9	Consumer non-Cyclicals	64
10	Property and Real Estate	28
11	Finance	41
	Total	**370**

Source: Data Processed

This study uses content analysis to explore data from sustainability reports and company annual reports. This method aims to understand the patterns, themes, or messages contained in the content. In accounting, content analysis is a widely used analytical technique, primarily when the research seeks to identify the contents of annual reports or other reports (Alves, 2011; Krippendorff, 2013). Analysis of the relationship between eco-efficiency and financial performance uses the following equation:

$$ROA_{it} = \alpha_i + \beta 0 EKO_{it} + \beta 1 EKO2_{it} + \beta 3 SIZE_{it} + \varepsilon_{it}$$

Table 2. Research Variables

Variables	Code	Definition	Measurement
Dependent	ROA_{it}	Return on Asset	Profit before tax divided by total assets
Independent	$EKO1_{it}$	Energy intensity	Total Energy divided by total Sales in year t
	$EKO2_{it}$	Emission Intensity	Total GHG Emissions divided by Total Sales in year t
Control	$SIZE_{it}$	Total Asset	Natural logarithm of Total Assets.
	SEN_IND	Industry Sensitivity	Dummy (1 dan 0)

For Sensitive Industries, code dummy 1 is used if the company belongs to one of the following industries: agriculture, automotive, aviation, chemical, construction,

building materials, energy, energy utilities, forest and paper companies, logistics, metal companies, mining, railroads, management sewage and water utilities and water utilities, and 0 otherwise. Firm size and industry sensitivity are used as control variables because many studies linking company financial performance prove a positive relationship between these two variables (Elsayih et al., 2015; Faisal et al., 2018; Rankin et al., 2011).

4. Results

Table 3 below shows each company sector's average energy consumption in giga joules in 2021. The lowest average energy consumption is in the health sector, which is 124,009.98 giga joules. Meanwhile, the highest average energy consumption is in the basic materials sector, which is 15,143,834.74 gigajoules. When viewed in total, the minimum energy consumption is in the Finance sector at 23 Giga Joules, while the highest is in the basic materials sector at 108,524,033 Giga Joules.

Table 3. Energy Consumption in 2021

N	Sectors	Energy Consumption (Giga Joule)		
		Mean	Min	Max
1	Energy	5.425.440,96	165,91	46.135.655,00
2	Consumer Cyclicals	532.294,31	364,05	6.173.728,00
3	Technology	2.599.221,34	308.505,72	4.889.936,96
4	Basic Materials	15.143.834,74	5.994,00	108.524.033,00
5	Healthcare	124.009,98	8.747,59	399.139,63
6	Infrastructure	2.847.772,40	209,86	41.618.350,00
7	Industrials	14.768.729,05	1.966,55	70.248.013,00
8	Transportation & Logistics	3.328.839,77	238.934,96	10.703.546,90
9	Consumer non-Cyclicals	1.800.992,12	81,01	20.873.007,00
10	Property and Real Estate	571.885,10	74,40	9.222.602,40
11	Finance	238.934,96	23,00	2.911.960,96

Source: Data Processed

Table 4 shows the average energy consumption in gigajoules in each company sector in 2022. In 2022 the average energy consumption will be the least in the healthcare sector (124,167.03) gigajoules. Meanwhile, the average energy consumption is most significant in the industrial sector. The sector with the least energy consumption is the Finance sector (15.98 gigajoules), and the sector with the most is the basic materials sector (94,227,782 gigajoules).

Table 4. Energy Consumption in 2022

N	Sectors	Energy Consumption (Giga Joule)		
		Mean	Min	Max
1	Energy	6.616.945,97	198,06	51.416.903,00
2	Consumer Cyclicals	480.752,92	570,20	6.118.199,00
3	Technology	5.552.626,32	420.386,09	10.684.866,54
4	Basic Materials	14.922.956,45	155,33	94.227.782,00
5	Healthcare	124.167,03	1.455,76	399.015,16

6	Infrastructure	1.305.390,50	189,08	10.799.690,00
7	Industrials	15.461.113,51	2.261,53	69.480.057,00
8	Transportation & Logistics	5.905.187,32	6.034,52	17.333.291,75
9	Consumer non-Cyclicals	1.815.979,78	89,90	22.831.511,00
10	Property and Real Estate	619.640,82	74,18	9.683.730,00
11	Finance	264.601,86	15,98	3.074.957,68

Source: Data Processed

Table 5 shows the average emissions produced by companies per sector in 2021. The sector that makes the most emissions is the infrastructure sector (181,802,915.97) tons of CO2, while the sector that produces the fewest emissions is the property and real estate sector (86,356.13) tons of CO2. Of the total emissions produced, the sector that has the most emissions is the infrastructure sector. At the same time, the sector that has the least emissions is the consumer cyclical sector.

Table 5. Average Emissions Produced per Sector in 2021

N	Sectors	Emission (Ton CO2)		
		Mean	Min	Max
1	Energy	1.949.874,45	3,53	38.565.832,00
2	Consumer Cyclicals	2.397.055,31	3,05*	39.085.900,00
3	Technology*			
4	Basic Materials	2.037.711,55	2.822,95	26.634.394,00
5	Healthcare	36.682.338,53	30,85	438.783.452,14
6	Infrastructure	181.802.915,97	22,61	2.903.261.139,21*
7	Industrials	845.589,23	168,00	4.312.084,00
8	Transportation & Logistics	332.783,53	2.607,00	1.276.192,35
9	Consumer non-Cyclicals	287.811,76	228,00	1.421.568,62
10	Property and Real Estate	86.356,13	59,94	442.180,00
11	Finance	272.360,51	34,56	4.206.860,69

(*) Companies in the Technology sector do not disclose data related to emissions produced for 2021

Source: Data Processed

Table 6 shows the average emissions produced by companies per sector in 2022. The sector that makes the most emissions is the infrastructure sector (42,832,650.11) tons of CO2, while the sector that makes the fewest emissions is the property and real estate sector (102,814.34) tons of CO2. Of the total emissions produced, the sector with the least emissions is the energy sector, while the sector with the most emissions is the infrastructure sector.

Table 6. Emissions per Sector in 2022

N		Emisi (Ton CO2)		
	Sektor	Mean	Min	Max
1	Energy	2.520.704,34	2,07*	30.663.075,00
2	Consumer Cyclicals	2.785.985,53	3,60	45.356.525,00
3	Technology *			

4	Basic Materials	2.408.090,43	2.458,17	23.042.918,00
5	Healthcare	3.532.450,67	8.079,32	34.457.662,09
6	Infrastructure	42.832.650,11	39,74	765.130.142,16*
7	Industrials	1.050.338,35	193,00	4.859.101,00
8	Transportation & Logistics	472.237,37	19.861,12	1.288.590,90
9	Consumer non-Cyclicals	286.432,67	384,00	1.459.885,00
10	Property and Real Estate	102.814,34	65,58	510.853,00
11	Finance	1.236.250,48	28,59	13.691.012,79

* Companies in the Technology sector do not disclose data related to emissions produced for 2021

Source: Data Processed

The data in Table 7 shows that in 2021 the most incredible energy intensity will be in the property and real estate sector (1.2337). At the same time, the smallest energy intensity is in the Finance sector (0.02154). This figure means that for every million rupiah of income generated by companies in the property and real estate sector, they use an average of 1.2337 giga joules of energy. Meanwhile, companies in the financial sector use an average of 0.02154 giga joules of energy to generate every million rupiahs of income.

Table 7. Energy Intensity per Sector in 2021

N	Sector	Energy Intensity		
		Mean	Min	Max
1	Energy	1,05072	0,00017	19,07530
2	Consumer Cyclicals	0,411900687	0,000784795	6,420004289
3	Technology	0,556196967	0,354099583	0,758294352
4	Basic Materials	0,995361639	0,000018071	4,731045078
5	Healthcare	0,038954699	0,000701991	0,089394409
6	Infrastructure	0,255928121	0,000170747	2,743545096
7	Industrials	0,426099644	0,007784285	1,868947742
8	Transportation & Logistics	0,178671194	0,001690064	0,862024033
9	Consumer non-Cyclicals	0,141469132	0,000037684	0,933645262
10	Property and Real Estate	1,233738006*	0,000065922	22,7347913
11	Finance	0,02154308*	0,000007180	0,329499898

Source: Data processed

In 2022, the greatest energy intensity will be in the property and real estate sector (1.54248). At the same time, the smallest energy intensity is in the Finance sector (0.01321). Compared to data for 2021, there has been an increase in energy intensity in the property and real estate sectors. This indicates that the eco-efficiency of companies in the property and real estate sector is becoming increasingly inefficient. In other words, in 2022, more energy will be used for every million revenue generated than in 2021. Meanwhile, eco-efficiency in the finance sector 2022 will be more efficient because the energy intensity number will be smaller (0.01321) compared to 2021 (0.02154).

Table 8. Energy Intensity per Sector in 2022

N	Sectors	Energy intensity		
		Mean	Min	Max
1	Energy	0,852887238	0,000304329	7.119971654
2	Consumer Cyclicals	0,152965295	0,001181917	0.6540457
3	Technology	0,885393369	0,40268603	1.368100709
4	Basic Materials	0,96045805	0,0000000258	4.890265852
5	Healthcare	0,039307941	0.000777405	0.096041023
6	Infrastructure	0,129250276	0.000155642	0.651256609
7	Industrials	0,324906846	0.008754138	1.278284471
8	Transportation & Logistics	0,202813146	0.001237108	0.554493501
9	Consumer non-Cyclicals	0,142405333	0,000019654	1.045925649
10	Property and Real Estate	1,542484446*	0,000081708	28.53717738
11	Finance	0,013210657*	0,000039268	0.131008362

Source: Data Processed

Table 9 shows the average emission intensity per sector in 2021. The infrastructure sector is the highest emitting sector (11,997). The healthcare and consumer cyclical sectors rank second and third. The figure of 11.997 shows that per one million revenue generated, the company produces emissions of 11.997 tons of CO2. At the same time, the sector with the lowest average emission intensity is the transportation and logistics sector, namely 0.0151 Ton CO2 per one million revenue. The company with the lowest emission intensity (0.000000343) is a company from the energy sector, namely Baramulti Suksessarana Tbk. Meanwhile, the company with the highest energy intensity is Jasa Marga (Persero) Tbk (191.3874).

Table 9. Average Emission Intensity per Sector for 2021

N	Sectors	Emission Intensity		
		Mean	Min	Max
1	Energy	0,090119023	0,000000343*	1,247545725
2	Consumer Cyclicals	0,305535107*	0,000025274	3,808656311
3	Technology *			
4	Basic Materials	0,164015428	0,000001792	1,36514984
5	Healthcare	6,242884954*	0,000023376	74,76289864
6	Infrastructure	11,99768802*	0,000037283	191,3874015
7	Industrials	0,025027557	0,000017257	0,109739176
8	Transportation & Logistics	0,015179171**	0.001934665	0,064141682
9	Consumer non-Cyclicals	0,033223013	0.000227664	0,216950671
10	Property and Real Estate	0,047970856	0,000014860	0,42177477
11	Finance	0,01831597	0,000013185	0,239468144

Source: Data Processed

In 2022, the infrastructure sector will still have the highest average emission intensity (2.5961). The healthcare and consumer cyclical sectors also rank second

and third. Meanwhile, the transportation and logistics sector has the lowest average emission intensity (0.0162). The company with the lowest emission intensity (0.000000134) is a company from the energy sector, namely Baramulti Suksessarana Tbk. Meanwhile, the company with the highest emission intensity came from the Infrastructure sector (46.1398), namely Jasa Marga (Persero) Tbk. The following analysis is to identify the relationship between research variables consisting of financial performance, energy intensity, emission intensity, total assets, and industry sensitivity.

Table 10. Average Emission Intensity per Sector in 2022

N	Sectors	Emission Intensity		
		Mean	Min	Max
1	Energy	0,181957426	0,000000134*	3,066877585
2	Consumer Cyclicals	0,331366173*	0,000020835	4,415849978
3	Technology*			
4	Basic Materials	0,172718719	0,000001490	1,250664326
5	Healthcare	0,597232981*	0,000072003	7,030741091
6	Infrastructure	2,596153868*	0,000040380	46,1398486*
7	Industrials	0,023798957	0,000019433	0,093308584
8	Transportation & Logistics	0,016257133*	0.003645047	0,041222134
9	Consumer non-Cyclicals	0,029618617	0.000229989	0,156210259
10	Property and Real Estate	0,04310236	0,000028514	0,233735029
11	Finance	0,018156018	0,000020522	0,245073173

Source: Data Processed

Table 11 presents Pearson's correlation coefficients for all variables (dependent, independent, and control variables) performed in the empirical model. The results show that energy intensity, emission intensity, and total assets have a negative but insignificant relationship with financial performance (ROA). Meanwhile, environmental sensitivity has a positive and significant relationship with financial performance (ROA) ($p < 0.01$, two-tailed).

Table 11. Correlation Analysis

	ROA	EKO_Energy	EKO_Emission	LN_Asset	SENS_LING
ROA	1	-.021	-.010	-.016	.177**
EKO_Energy	-.021	1	.156**	-.008	.201**
EKO_Emission	-.010	.156**	1	.055	.041
LN_Asset	-.016	-.008	.055	1	-.250**
SENS_LING	.177**	.201**	.041	-.250**	1

**. Correlation is significant at the 0.01 level (2-tailed)

The heteroscedasticity test shows that the regression model does not contain heteroscedasticity if no significant relationship exists between the residual absolute values and the independent variables. In this study, the significance level for almost all independent variables was more significant than 0.05. The multicollinearity test results are in Table 12; tolerance values for all variables are greater than 0.10, and

all VIF values are below 10. It is concluded that there is no multicollinearity problem in the regression model.

Table 12. Regression Analysis

Variable	Prediction sign	Coefficient regression	t	p-value	Multicollinearity		Heteroscedasticity	
					Tolerance	VIF	t	p-value
(Constant)		-.021	-.348	.097	-	-	0.832	0.407
EKO_Energy	-	-.011	-1.094	.008**	0.939	1.065	0.470	0.454
EKO_Emission	-	.000	-.208	.001**	0.855	1.170	1.763	0.639
LN_Asset	+	.002	.656	.009**	0.843	1.186	0.261	0.080
Industry Sensitive	-	.067	3.634	.000**	0.925	1.081	1.474	0.143

Note. ***p ≤ 0.01, **p ≤ 0.05, *p ≤ 0.10; R2 = 0.345; adjusted R2 = 0.322; F = 14.956; p value = 0.000; N = 368. Dependent variable: ROA

Table 12 details the multiple regression results. Multiple regression shows that the model fits and is statistically significant: F statistic = 14.956 and p-value = 0.000. Regression has an adjusted R2 of 32.2%. The statistical test results show that energy intensity (EKO_Energy) and Emission Intensity (EKO_Emission) have a negative and significant effect on financial performance (ROA) p-value <0.05. This indicates that the higher the energy intensity number, the lower the financial performance. The high energy intensity suggests that the company is inefficient in using energy. Likewise with emission intensity, the higher the emission intensity will affect the lower financial performance. These follow the research findings (Alviani & Sholihin, 2016; Perez-Calderon et al., 2011; Rodríguez-García et al., 2022c). Industry sensitivity, the control variable in this study, also negatively affects financial performance (ROA). This is possible because the more sensitive a company is to the environment, the more efforts related to the costs needed to reduce the implications of this sensitivity to the environment. This will have an impact on the company's financial performance. These align with research findings (Faisal et al., 2018; Rankin et al., 2011; Waddock & Graves, 1997).

5. Conclusion and Suggestion

This study found several things related to energy consumption and emissions from companies in eleven sectors listed on the Indonesia Stock Exchange. In 2021, the lowest average energy consumption was in the health sector, while the highest was in the basic materials sector. In 2022, the healthcare sector has the lowest average energy consumption, while the industrial sector has the largest average. When viewed in total, the most minor energy consumption in 2021 and 2022 will be in the Finance sector, while the highest energy consumption will be in the basic materials sector. Of the total emissions produced in 2021, the sector with the most minor emissions is the consumer cyclical sector. At the same time, the sector that produces the most emissions is the infrastructure sector. For 2022, the sector that produces the fewest emissions is the energy sector, while the sector that produces the most is the infrastructure sector. In 2021 and 2022, the greatest energy intensity is in the property and real estate sector, while the smallest is in the Finance sector. In 2021, the infrastructure sector has the highest emission intensity, while the sector with the lowest average emission intensity is the transportation and logistics sector. This

study documents that energy efficiency and emissions significantly positively impact ROA in all sectors, including sensitive industries. This research has several limitations, including the variety of data related to energy consumption and the resulting emissions, making this research use economic intensity and emission data based on the company's net sales. The emission data used is based on emission data disclosed by the company; limited company disclosures make researchers use the available emission data regardless of whether it comes from Scopes 1, 2, or 3. Further research is recommended to sort out emission sources for a better picture. However, this research has contributed to mapping the relationship between energy consumption, emissions produced, and the company's financial performance. At least this research proves that the company's initiative to support sustainable development through energy efficiency has positively influenced the company's financial performance. This research supports the stakeholder theory in that companies responsible for balancing all stakeholders' interests can lead to long-term success and sustainability.

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References

Ahmad, A. C., & Osazuwa, N. P. (2015). Eco-efficiency and firm value of Malaysian firms. *International Journal of Managerial and Financial Accounting*, *7*(3/4), 235. https://doi.org/10.1504/IJMFA.2015.074902

Alareeni, B. A., & Hamdan, A. (2020). ESG impact on the performance of US S&P 500-listed firms. *Corporate Governance (Bingley)*, *20*(7), 1409–1428. https://doi.org/10.1108/CG-06-2020-0258

Alves, M. T. V. D. (2011). Content Analysis: Its Use In Accounting Publications. *Revista Universo Contábil*, 146–166. https://doi.org/10.4270/ruc.2011227

Alviani, L., & Sholihin, M. (2016). Does Eco-Efficency Reduce The Cost Of Equity Capital? Empirical Evidence From Indonesia. *Journal of Indonesian Economy and Business*, *29*(3). https://doi.org/10.22146/jieb.9966

Bellantuono, N., Pontrandolfo, P., & Scozzi, B. (2016). Capturing the Stakeholders' View in Sustainability Reporting: A Novel Approach. *Sustainability*, *8*(4), 379. https://doi.org/10.3390/su8040379

Bianchi, M., Valle, I. del, & Tapia, C. (2020). Measuring eco-efficiency in European regions: Evidence from a territorial perspective. *Journal of Cleaner Production*, *276*, 123246. https://doi.org/10.1016/j.jclepro.2020.123246

Clementino, E., & Perkins, R. (2021). How Do Companies Respond to Environmental, Social and Governance (ESG) ratings? Evidence from Italy. *Journal of Business Ethics*, *171*(2), 379–397. https://doi.org/10.1007/s10551-020-04441-4

Cordova, M. F., & Celone, A. (2019). SDGs and innovation in the business context literature review. *Sustainability (Switzerland)*. https://doi.org/10.3390/su11247043

Costa, E. M., & Lucato, W. C. (2017). The environmental and economic-financial performance of SMEs: A survey in the Brazilian textile sector. *Espacios*, *38*(29).

Derwall, J., Guenster, N., Bauer, R., & Koedijk, K. (2005). The Premium Puzzle. *Journal of Financial Analysts*, *61*(2), 51–63. https://doi.org/10.2307/4480656

Faisal, F., Andiningtyas, E. D., Achmad, T., Haryanto, H., & Meiranto, W. (2018). The content and determinants of greenhouse gas emission disclosure: Evidence from Indonesian companies. *Corporate Social Responsibility and Environmental Management*, *25*(6). https://doi.org/10.1002/csr.1660

Fatemi, A., Glaum, M., & Kaiser, S. (2018). ESG performance and firm value: The moderating role of disclosure. *Global Finance Journal*, *38*, 45–64. https://doi.org/10.1016/j.gfj.2017.03.001

Freeman, R. E. (1994). The Politics of Stakeholder Theory: Some Future Directions. *Business Ethics Quarterly*, *4*(4), 409–421. https://doi.org/10.2307/3857340

Freeman, R. E. (1998). A Stakeholder Theory of the Modern Corporation. In M. Clarkson (Ed.), *The Corporation and Its Stakeholders*. University of Toronto Press. https://doi.org/10.3138/9781442673496-009

Freeman, R. E., Harrison, J. S., & Wicks, A. C. (2007). Managing for stakeholders: Survival, reputation, and success. In *Managing for Stakeholders: Survival, Reputation, and Success*.

Gibson, K. (2012). Stakeholders and Sustainability: An Evolving Theory. *Journal of Business Ethics*, *109*(1), 15–25. https://doi.org/10.1007/s10551-012-1376-5

Glavič, P., & Lukman, R. (2007). Review of sustainability terms and their definitions. *Journal of Cleaner Production*, *15*(18). https://doi.org/10.1016/j.jclepro.2006.12.006

Heras-Saizarbitoria, I., García, M., Boiral, O., & Díaz de Junguitu, A. (2020). The use of eco-efficiency indicators by environmental frontrunner companies. *Ecological Indicators*, *115*, 106451. https://doi.org/10.1016/j.ecolind.2020.106451

Jibriel Elsayih, Qingliang Tang, & Yi-Chen Lan. (2015). *Article information : Corporate Governance and Carbon Transparency : Australian Experience*. https://doi.org/10.1108/ARJ-12-2015-0153

Joachimiak-Lechman, K., Selech, J., & Kasprzak, J. (2019). Eco-efficiency analysis of an innovative packaging production: case study. *Clean Technologies and Environmental Policy*, *21*(2), 339–350. https://doi.org/10.1007/s10098-018-1639-7

Koskela, M., & Vehmas, J. (2012). Defining Eco-efficiency: A Case Study on the Finnish Forest Industry. *Business Strategy and the Environment*, *21*(8), 546–566. https://doi.org/10.1002/bse.741

Krippendorff, K. (2013). Content Analysis: An Introduction to Its Methodology. In *Content Analysis: An Introduction to Its Methodology*. Sage Publications. http://www.uk.sagepub.com/textbooks/Book234903

Li, J., Cai, C., & Zhang, F. (2020). Assessment of ecological efficiency and environmental sustainability of the Minjiang-source in China. *Sustainability (Switzerland)*, *12*(11), 1–15. https://doi.org/10.3390/su12114783

Liu, Z., Abhayawansa, S., Jubb, C., & Perera, L. (2017). Regulatory impact on voluntary climate change–related reporting by Australian government-owned corporations. *Financial Accountability and Management*, *33*(3), 264–283. https://doi.org/10.1111/faam.12124

Lucato, W. C., Costa, E. M., & de Oliveira Neto, G. C. (2017). The environmental performance of SMEs in the Brazilian textile industry and the relationship with their financial performance. *Journal of Environmental Management*, *203*, 550–556. https://doi.org/10.1016/j.jenvman.2017.06.028

Matsumura, E. M., Prakash, R., & Vera-Muñoz, S. C. (2014). Firm-Value Effects of Carbon Emissions and Carbon Disclosures. *The Accounting Review*, *89*(2), 695–724. https://doi.org/10.2308/accr-50629

Meutia, I., Kartasari, S. F., & Yaacob, Z. (2022). *Stakeholders or Legitimacy Theory ? The Rationale Behind The Company ' s Materiality Analysis : Evidence from Indonesia*. *9*, 1–18.

Meutia, I., Ramadhani, M., & Adam, M. (2019). Does Eco-Efficiency Improve Financial Performance of Manufacturing Companies in Indonesia? *Jurnal Dinamika Akuntansi Dan Bisnis*, *6*(2), 137–150. https://doi.org/10.24815/jdab.v6i2.13785

Niero, M., Hauschild, M. Z., Hoffmeyer, S. B., & Olsen, S. I. (2017). Combining Eco-Efficiency and Eco-Effectiveness for Continuous Loop Beverage Packaging Systems: Lessons from the Carlsberg Circular Community. *Journal of Industrial Ecology*, *21*(3), 742–753. https://doi.org/10.1111/jiec.12554

Onat, N. C., Abdella, G. M., Kucukvar, M., Kutty, A. A., Al-Nuaimi, M., Kumbaroğlu, G., & Bulu, M. (2021). How eco-efficient are electric vehicles across Europe? A regionalized life cycle assessment-based eco-efficiency analysis. *Sustainable Development*. https://doi.org/10.1002/sd.2186

Pang, J., Chen, X., Zhang, Z., & Li, H. (2016). Measuring Eco-Efficiency of Agriculture in China. *Sustainability*, *8*(4), 398. https://doi.org/10.3390/su8040398

Pereira, C. P., Prata, D. M., Santos, L. S., & Monteiro, L. P. C. (2018). Development of eco-efficiency comparison index through eco-indicators for industrial applications. *Brazilian Journal of Chemical Engineering*, *35*(1), 69–89. https://doi.org/10.1590/0104-6632.20180351s20160370

Perez-Calderon, E., Milanes-Montero, P., Meseguer-Santamaria, M.-L., & Mondejar-Jimenez, J. (2011). Eco-Efficiency: Effects On Economic And Financial Performance. Evidences From Dow Jones Sustainability Europe Index. *Environmental Engineering and Management Journal*, *10*(12), 1801–1808. https://doi.org/10.30638/eemj.2011.243

Purwaningsih, R., Susanto, N., Adiaksa, D. A., & Putri, A. A. A. (2021). Analysis of the eco-efficiency level in the dining table production process using life cycle assessment method to increase industry sustainability. *IOP Conference Series: Materials Science and Engineering*, *1072*(1), 012014. https://doi.org/10.1088/1757-899X/1072/1/012014

Rankin, M., Windsor, C., & Wahyuni, D. (2011). An investigation of voluntary corporate greenhouse gas emissions reporting in a market governance system: Australian evidence. *Accounting, Auditing and Accountability Journal*, *24*(8). https://doi.org/10.1108/09513571111184751

Rodríguez-García, M. del P., Galindo-Manrique, A. F., Cortez-Alejandro, K. A., & Méndez-Sáenz, A. B. (2022a). Eco-efficiency and financial performance in Latin American countries: An environmental intensity approach. *Research in International Business and Finance*, *59*(September 2021). https://doi.org/10.1016/j.ribaf.2021.101547

Rodríguez-García, M. del P., Galindo-Manrique, A. F., Cortez-Alejandro, K. A., & Méndez-Sáenz, A. B. (2022b). Eco-efficiency and financial performance in Latin American countries: An environmental intensity approach. *Research in International Business and Finance*, *59*. https://doi.org/10.1016/j.ribaf.2021.101547

Rodríguez-García, M. del P., Galindo-Manrique, A. F., Cortez-Alejandro, K. A., & Méndez-Sáenz, A. B. (2022c). Eco-efficiency and financial performance in Latin American countries: An environmental intensity approach. *Research in International Business and Finance*, *59*. https://doi.org/10.1016/j.ribaf.2021.101547

Shakil, M. H., Tasnia, M., & Mostafiz, M. I. (2020). Board gender diversity and environmental, social and governance performance of US banks: moderating role of environmental, social and corporate governance controversies. *International Journal of Bank Marketing*, *39*(4), 661–677. https://doi.org/10.1108/IJBM-04-2020-0210

Stępień, S., Czyżewski, B., Sapa, A., Borychowski, M., Poczta, W., & Poczta-Wajda, A. (2021). Eco-efficiency of small-scale farming in Poland and its institutional drivers. *Journal of Cleaner Production*, *279*, 123721. https://doi.org/10.1016/j.jclepro.2020.123721

Sudha, S. (2020). Corporate environmental performance–financial performance relationship in India using eco-efficiency metrics. *Management of Environmental Quality: An International Journal*, *31*(6), 1497–1514. https://doi.org/10.1108/MEQ-01-2020-0011

Suh, Y., Seol, H., Bae, H., & Park, Y. (2014). Eco-efficiency Based on Social Performance and its Relationship with Financial Performance. *Journal of Industrial Ecology*, *18*(6), 909–919. https://doi.org/10.1111/jiec.12167

Sutrisno, B., & Wendy, W. (2020). Profitability and leverage in eco-efficiency and quality management system for increasing the firms' performance. *Journal of Economics, Business, & Accountancy Ventura*, *22*(3). https://doi.org/10.14414/jebav.v22i3.1895

Waddock, S. A., & Graves, S. B. (1997). The corporate social performance-financial performance link. *Strategic Management Journal*, *18*(4). https://doi.org/10.1002/(SICI)1097-0266(199704)18:4<303::AID-SMJ869>3.0.CO;2G

World Business Council for Sustainable Development. (2000). Eco-efficiency. Creating more value with less impact. In *World Business Council for Sustainable Development*.

Xu, K., Geng, C., & Wei, X. (2019). Research On Financing Ecology And Financing Efficiency Of Strategic Emerging Industries In China. *Journal of Business Economics and Management*, *20*(2), 311–329. https://doi.org/10.3846/jbem.2019.9592.