

The Impact of Tax Holiday, Tax Allowance, and Effective Tax Rate on Green Investment in Indonesian Geothermal Companies

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Keywords

Green Investment, Tax holiday, Tax allowance, Effective Tax Rate, Geothermal.

Abstract

The development of green investment is a key aspect in supporting a sustainable energy transition in Indonesia, particularly in the geothermal sector. This research analyzes the effects of tax holiday, tax allowance, and effective tax rate on green investment using a quantitative approach, drawing on secondary data from annual reports, sustainability reports, financial statements, official company websites, and publications from IDX. The analysis was conducted using panel data regression with a random effects model. Results reveal tax holiday and tax allowance have advantageous outcome on green investment, whereas the effective tax rate adverse impact. These results implies fiscal incentives can drive an increase in green investment, while a high tax burden has the potential to reduce a company's capacity to develop sustainable investment activities. This study suggests that tax policy can be utilized as an instrument to strengthen the development of green investment in Indonesia's geothermal sector.

INTRODUCTION

National energy sustained demand to rise in tandem with industrialization and economic activity in Indonesia. The high reliance on fossil fuels in national energy consumption has led to increased carbon emissions and poses a growing threat of environmental damage. These conditions have prompted the government to accelerate the clean energy development as part of the national energy transition. One sector with significant potential is geothermal energy. Law No. 21 of 2014 defines the heat contained within hot water, vapor, and rocks, along with their inherent minerals and gases in a geothermal system, constitutes geothermal energy. The utilization of geothermal resources begins with the exploitation of reservoirs (subsurface rock layers that store geothermal fluids) through drilling activities. The hot fluid contained in the reservoir is then brought to the surface and for producing electrical power or other thermal energy needs. In geothermal power generation systems, the thermal energy contained in the fluids is drives turbines to produce electricity. Subsequently, the produced fluids are reverted to container via injection wells to preserve the sustainability of reserves and the stability of subsurface pressure (Mohammadzadeh Bina et al., 2018). Sustainability encompasses net growth, social responsibility, and environmental safety (Srikalimah et al., 2025). These three elements are applied at every stage of geothermal investment to ensure that economic, environmental, and social benefits are achieved in eco-friendly manner.

Progress of the geothermal sector requires significant investment, specialized technology, and a relatively long payback period. Therefore, companies need adequate financial and policy support to increase green investment (Anderson & Rezaie, 2019). The abundance of geothermal resources places Indonesia among world's leading countries in terms of geothermal energy potential. However, the utilization rate remains underperforming. As reported by ESDM, Indonesia's installed geothermal power generation capacity is projected to reach only about 2.6 GW by 2024. The geothermal sector faces a variety of risks, ranging from resource-related issues, such as funding and rising project costs, to social, policy, and regulatory factors (Pambudi & Ulfa, 2024). These conditions mean that geothermal companies require policy support capable of enhancing their investment capacity.

The Indonesian government continues to strive to rise venture in the renewable energy sector through various fiscal policies. One such initiative involves providing tax incentives such as tax holidays and tax allowances for companies in priority sectors and selected industries that support sustainable energy development. According to Kusumastuti and Fatin (2023) A tax holiday refers to a temporary reduction or exemption of corporate income tax granted to newly established companies for a specified period. Meanwhile, a tax allowance is a fiscal incentive policy aimed at taxpayers who make capital investments. Through these facilities, companies receive a reduction in net income that can lower their tax burden and support broader investment activities (Matondang, 2024). The implementation of these two policy instruments as tax incentives is expected to provide relief or ease for companies aiming to increase profits, lower costs, and reduce business risks, thereby encouraging investment in priority sectors as well as in the strategic and sustainable renewable energy sector (Abidin et al., 2020).

In addition to tax incentives, a company's decision to invest is also influenced by the magnitude of its tax burden. The level of this burden is reflected in the Effective Tax Rate, A metric that measures the extent of a firm's tax burden in relation to its profits. The ETR value is the actual tax rate based on financial statements and may differ from the tax rate required in tax regulations (Husni & Wahyudi, 2022). The ETR indicates the proportion of profits that must be allocated to tax payments, thereby affecting the amount of net income available to fund investments. Consequently, companies with a lower ETR tend to have greater capacity to support long-term investments, including green investments, compared to companies with a higher ETR (Yanto, 2022). The allocation of investment funds is one of a company's strategic financial decisions aimed at supporting corporate growth through the utilization of long-term investment opportunities (Niam, 2025). Green investment refers to investments focused on creating greener

technologies and infrastructure. These investments aim to sustain the energy evolution and the achievement of climate targets in a sustainable manner (Belaïd et al., 2023).

A multitude of investigations have explored corporate tax policy and investment. Many studies have examined the association among corporate tax policy and investment. Research findings indicate tax holiday incentives can enhance investment attractiveness by reducing corporate tax burdens (Pohan et al., 2021). The implementation of tax allowance also improves funding efficiency, thereby encouraging investment in priority sectors (Lusiana et al., 2021). ETR is factors influencing investment decisions. A higher tax burden can reduce a company's allocation of funds for long-term investment (Pratiwi & Khoirunurrofik, 2023). Most prior research concentrated on manufacturing and broader industrial areas.

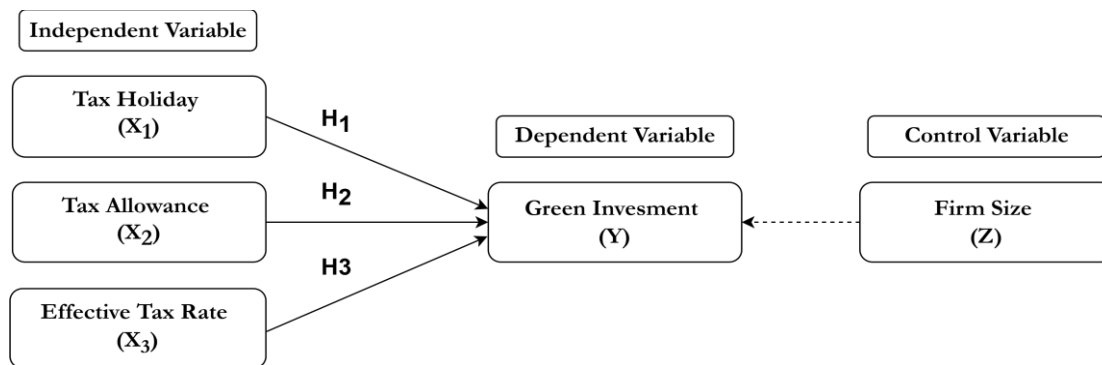
Previous research has also yielded inconsistent findings. Some studies have found that tax incentives affect corporate investment, while others have shown only a weak or insignificant effect. These differing results suggest that the impact of fiscal policy may vary across business sectors. Studies on geothermal companies in Indonesia remain in short supply, even though categorized by high capital requirements, long development periods, and high investment risk. These characteristics underscore the position of appropriate economic policy sustenance for the development of the geothermal area (Harefa & Harmoko, 2021).

Limitations of previous research are also evident in the minimal use of firm-level control variables. This study uses firm size as a control variable because it represents the scale of a firms operations, as evidenced by its resource capacity and ability to finance operational activities both of which effectively support the company's investment activities (Dang et al., 2018). To address empirical gaps in previous studies, this research examines how tax holidays, tax allowances, and the effective tax rate influence green investment in geothermal companies operating in Indonesia while controlling for firm size.

This research is grounded in signaling, legitimacy, and agency theories to provide a comprehensive foundation for analyzing the relationships among the research variables. Signaling theory helps explain how companies communicate favorable information to their stakeholders by making specific investment choices. Legitimacy theory helps explain how companies try to gain and keep public approval by engaging in activities that match what society expects of them. Agency theory is used to explain how management plays a role in handling corporate resources, which serves as the foundation for making investment decisions. These three theories form the basis for examining how tax holiday, tax allowance, and effective tax rate influence green investments.

Conceptual Framework

Figure 1. Conceptual Framework



H1: Tax holiday influences green innovation.

H2: Tax allowance influences green innovation.

H3: The effective tax rate influences green innovation.

METHODS

A quantitative approach combined with an associative research method was employed to assess the effects of tax holidays, tax allowances, and the effective tax rate on green investment in Indonesian geothermal companies, with firm size serving as the control variable. The population comprises of firms in the geothermal and renewable energy areas throughout 2019-2024. Participants were chosen intentionally, requiring firms to regularly issue annual or sustainability reports, possess data related to the research variables, and provide complete research information. Based on the selection process, 78 research observations were obtained.

Research data was gained after annual reports, sustainability reports, financial statements, official company websites, and publications from IDX, which were composed through documentation techniques. Green investment (GI) was treated as the dependent variable and measured using the Green Investment Index. The measurement was based on an analysis of information disclosed in companies' annual reports, sustainability reports, and other sustainability-related disclosures. The index was compiled based on ten indicators developed using the green investment literature and the 2021 GRI Standards and then adapted to the characteristics of the geothermal sector. Indicators are scored as 1 when disclosed and 0 when undisclosed, the index score was determined by comparing the number of disclosed indicators with the total number of indicators applied in the study. (Tran et al., 2026). The independent variables consist of Tax Holiday (TH), Tax Allowance (TA), and Effective Tax Rate (ETR). Tax Holiday and Tax Allowance are measured using dummy variables based on information regarding recipients of tax incentives in government regulations and the characteristics of priority sectors, such as geothermal,

renewable energy, green industries, electric vehicles, and national strategic projects, with a value of 1 assigned to companies that meet the criteria and 0 to all others (Siregar & Patunru, 2021). The ETR is measured using the ratio of tax burden to pre-tax profit, whereas firm size (SIZE) is included as a control variable and measured using the natural logarithm of total assets. (Widarwati et al., 2024).

Data processing was analyzed utilizing Python through panel data regression analysis. The analysis stages included descriptive statistics, a multicollinearity test using VIF, and determining the appropriate panel regression model using the Chow test, Hausman test, and Lagrange Multiplier (LM) test. Hypothesis validation involved the R^2 , alongside F-tests and t-tests for simultaneous and partial significance, respectively to analyze the influence of tax holidays, tax allowances, and ETR on green investment in Indonesian geothermal companies.

RESULTS AND DISCUSSION

Results of Descriptive Statistical Analysis

Data characteristics of the study were presented using descriptive statistical analysis, which consisted of 78 observations from 13 geothermal companies during the 2019-2024 period. Each research variable is summarized through statistical measures including mean, standard deviation, minimum, and maximum values. These measurements provide an initial understanding of the data characteristics. Detailed descriptive statistical results are presented in Table 1.

Table 1. Results of Descriptive Statistical Analysis

<i>Variable</i>	<i>N</i>	<i>Min</i>	<i>Max</i>	<i>Mean</i>	<i>Std. Dev.</i>
<i>TH</i>	78	0.0000	1.0000	0.4103	0.4951
<i>TA</i>	78	0.0000	1.0000	0.6154	0.4897
<i>ETR</i>	78	-0.0033	1.3170	0.3180	0.1725
<i>GI</i>	78	0.2624	0.6419	0.5155	0.0977
<i>SIZE</i>	78	21.1067	32.7638	27.694	3.6355

Based on the calculation results, all research variables have a total of 78 observations. The Tax Holiday (TH) variable has a mean 0.4103, standard deviation of 0.4951. The Tax Allowance (TA) has a mean 0.6154, standard deviation 0.4897. The higher mean value of TA compared to TH shows companies that receive or meet the criteria for tax allowance are more prevalent in the research sample.

ETR has a mean 0.3180 with a standard deviation 0.1725. The minimum -0.0033 and the maximum 1.3170 indicate variation in effective tax rate across companies. Green Investment (GI) has a mean 0.5155 standard deviation 0.0977. The firm size (SIZE) has a mean 27.694 followed

by a standard deviation of 3.6355, indicating that firm sizes in the sample were relatively homogeneous during the observation period.

Multicollinearity Test Results

Table 2. Multicollinearity Test Results

<i>Variable</i>	<i>VIF</i>
<i>TH</i>	1.8276
<i>TA</i>	1.8200
<i>ETR</i>	1.1963
<i>SIZE</i>	1.1730

A multicollinearity examination was carried out to assess the relationship patterns among independent variables within the proposed research model. Multicollinearity was assessed using the Variance Inflation Factor (VIF), with a value < 10 indicating that the model does not suffer from multicollinearity. Based on Table 2, all independent variables have $VIF < 10$. The TH variable has a VIF value of 1.8276, TA of 1.8200, ETR of 1.1963, and SIZE of 1.1730. These findings suggest the research model does not exhibit multicollinearity. Accordingly, all independent variables can be included in the subsequent testing phase.

Selection of the Panel Data Regression Model

Panel data regression model selection was performed to identify the estimation model that best matches the characteristics of the research data. The model selection procedure involved the Chow test, Hausman test, and Lagrange Multiplier (LM) test to identify the most appropriate regression model among the Common Effect Model (CEM), Fixed Effect Model (FEM), and Random Effect Model (REM).

Chow Test Results

Table 1. Chow Test Results

<i>Test</i>	<i>Probability</i>
<i>Chow Test</i>	0.0000

Chow test was applied to compare Common Effect Model (CEM) and Fixed Effect Model (FEM) in order to determine the most appropriate estimation approach. Model selection was based on probability value comparison using a 5% significance threshold. A probability value below 0.05 suggests that FEM is preferable to CEM. In this study, Chow test generated a probability value of 0.000, indicating that FEM was selected as a more suitable model for examining research data. Following this result, Hausman test was subsequently performed to

determine the appropriate regression model for further analysis.

Hausman Test Results

Table 4. Hausman Test Results

<i>Test</i>	<i>Probability</i>
<i>Hausman Test</i>	0.3828

After completing Chow test, Hausman test was performed to determine the most suitable regression model for further analysis. The decision is established by comparing the probability value with the 5% significance level. A probability value under the 5% significance level supports the use of FEM, while a probability value above this threshold favors REM. Hausman Test produced a probability value of 0.3828 which is greater than 0.05. The findings indicate that REM fits the research data better than FEM. Therefore, REM was selected as the estimate model and employed in the next regression analysis.

Results of the Lagrange Multiplier Test

Table 5. Results of LM Test

<i>Test</i>	<i>Probability</i>
<i>LM Test</i>	0.0317

Lagrange Multiplier (LM) test was applied to determine whether the chosen regression model provides an appropriate estimation for the research data. The test is significant at the 5% level of probability. Probability of <0.05 indicates support for random effects as compared to the alternative model. The result of Lagrange Multiplier is 0.0317 which is <0.05. These results indicate that REM provides a better fit for the dataset and can be used as an appropriate model for regression analysis. Based on the outcomes of Chow test, Hausman test, and Lagrange Multiplier test, REM was selected as the final estimation model.

Results of REM

Table 2. Results of REM

<i>Variable</i>	<i>Coefficient</i>	<i>T-statistic</i>	<i>Probability</i>
<i>Constant</i>	0.6712	4.5546	0.0000
<i>TH</i>	0.0699	5.6615	0.0000
<i>TA</i>	0.0624	4.9404	0.0000
<i>ETR</i>	-0.0709	-2.0887	0.0402
<i>SIZE</i>	-0.0072	-1.3754	0.1732

$$GI = 0.6712 + 0.0699TH + 0.0624TA - 0.0709ETR - 0.0072SIZE + e$$

Discoveries of REM estimation were used to test the effects of tax holiday, tax allowance, and effective tax rate on green investment in geothermal companies in Indonesia. See Table 6 for the estimation outcomes. The coefficients for TH and TA are positive, while those for ETR and SIZE are negative. These results indicate that an increase in tax incentives tends yielding a boost in green investment. Boost in the effective tax burden dominish a decrease in green investment. Regarding the control variable, firm size (SIZE) obtained a negative coefficient of -0.0072 and a p-value of 0.1732. This result indicates that firm size has no significant relationship with green investment at the 5% significance level.

Hypothesis Test Results

Hypothesis evaluation involved utilizing the R^2 value, an F-test for overall significance, and a t-test for individual parameter assessment, all within a 5% significance threshold ($\alpha = 0.05$).

Coefficient of Determination Results (R^2)

Table 7. R^2 Results

<i>Description</i>	<i>Value</i>
R^2	0.7011

Independent variables explanatory power over green investment variation is measured by the R^2 with 0.7011 (70.11%) of the variation in green investment interpretable by tax holiday, tax allowance, ETR, and firm size. The remaining 29.89% interpretable by extraneous variables.

Partial Results of F-Test Analysis

Table 8. F-Test Results

<i>Description</i>	<i>Value</i>
<i>F-Statistic</i>	0.0000

The F-test evaluated the simultaneous influence of all independent variables on green investment. The obtained p-value was 0.000, which is lower than the 5% significance level. This outcome confirms that the regression model is statistically valid and indicates that the independent variables jointly affect green investment. These results indicate that tax holiday, tax allowance, the effective tax rate, and firm size simultaneously influence green investment.

Partial Test Results (t-Test)

Table 3. t-Test Results

<i>Variable</i>	<i>Coefficient</i>	<i>T-Statistic</i>	<i>Probability</i>
<i>TH</i>	0.0699	5.6615	0.0000
<i>TA</i>	0.0624	4.9404	0.0000
<i>ETR</i>	-0.0709	-2.0887	0.0402
<i>SIZE</i>	-0.0072	-1.3754	0.1732

The t-test was used to check how each separate factor affects green investment. The estimated p-value for the tax holiday variable is 0.000, which falls below the 5% significance threshold. Analysis shows that tax holidays help increase green investments, which means the first hypothesis is proven correct. The tax allowance also has a probability value of 0.000, indicating that there is a strong and positive connection with green investment, which backs up the second hypothesis. Meanwhile, the effective tax rate has a probability value of 0.0402, which is less than 0.05, while the estimated coefficient is negative. Analysis indicates that the effective tax rate has a significant negative effect on green investment and supports the third hypothesis. Meanwhile, firm size as the control variable records a p-value of 0.1732 above the 5% significance level. This suggests that firm size does not significantly affect green investment during the observation period.

DISCUSSION

The Effect of Tax Holiday on Green Investment

Tax Holiday has a coefficient 0.0699 and significance 0.000. Statistical analysis confirms that tax holiday exerts a positive and significant effect on green investment. The positive correlation between tax holiday and green investment suggests that providing fiscal incentives through corporate income tax exemptions or reductions contributes to increasing the financing capacity of geothermal companies to carry out sustainable investments (Susmanto et al., 2026). The high capital requirements for geothermal project development make the availability of funding sources one of the primary considerations for companies when making investment decisions (Yudha et al., 2022). Reducing the tax burden allows companies to retain a portion of profits that were previously allocated to tax obligations, and then reinvest them in renewable energy projects, technology development, or production capacity expansion that support green investment activities.

This finding aligns with signaling theory which explains that government policies can provide positive signals to companies when making investment decisions. Offering tax holidays shows support for growth in renewable energy, which makes companies more confident about investing in projects that are green. These investments reflect the company's commitment to

sustainable development and sustained growth (Bafera & Kleinert, 2023). The provision of tax incentives lessen a firms tax burden, thereby enhance a project's economic viability and encouraging investment realization (Bella & Yudianto, 2021). Accomplishment of implementing a tax holiday is influenced by supportive regulations and economic conditions. This policy cannot be the sole instrument for increasing investment (Aribowo & Irawan, 2021). These results demonstrate that tax policy serves a broader function than merely as a source of government revenue because it acts as an instrument that promotes sustainable energy development and supports the country's energy transition goals.

The Effect of Tax Allowance on Green Investment

Tax Allowance has a coefficient 0.0624 and significance 0.000. Regression analysis demonstrates that tax allowance positively and significantly affects green investment. The positive effect of tax allowance suggests that tax incentives in the form of reductions in taxable income can drive an increase in green investment among geothermal companies. Unlike tax holiday, which provide tax exemptions for a specific period, tax allowance focus more on the physical investments actually made by companies. The provision of this incentive can reduce investment costs, thereby making capital utilization more efficient (Maffini et al., 2019). For geothermal companies, cost efficiency plays a crucial role because the majority of investment needs are allocated to infrastructure development, well drilling, equipment procurement, and power plant development, all of which require substantial capital. Reducing these investment costs can lower barriers to project implementation and enhance desirability in the renewable energy. The provision of such incentives supports more efficient capital utilization in clean energy development (Polzin et al., 2019).

The study supports legitimacy theory by showing that organizations strive to maintain legitimacy through actions that are accepted by the government and the wider community. Companies are using tax allowances to back green investments, showing they are following government policies by offering financial benefits that align with sustainability goals. This also helps them build credibility as organizations that support long-term environmental progress (Hamm et al., 2022). From a corporate economic perspective, the tax allowance signals that the government supports investments that generate added value and environmental benefits (Marlina et al., 2023). These incentives can improve project viability and increase the potential return on investment expected by companies. Companies that receive tax allowance incentives tend to implement green investments at a higher rate than companies that do not receive similar incentives (Sri Yaumi et al., 2026). Moderate suggestion indicate fiscal policies based on real investment

remain an effective instrument for stimulate the growth of clean energy and accelerating the achievement of sustainable development goals.

The Effect of the Effective Tax Rate on Green Investment

Hypothesis testing yielded a coefficient -0.0709 and significance 0.0402 for ETR. The results suggest that the effect on green investment in Indonesian geothermal companies is negative and statistically significant. Inverse correlation among ETR and green investment suggests that an boost in the effective tax burden may reduce a company's capacity to undertake green investments. ETR reflects the actual amount of tax a company pays relative to its profits, thereby indicating the proportion of profits used to meet tax obligations (Gloria & Apriwenni, 2020). An increase in the ETR leads to a reduction in internal funds available to finance investment activities. For geothermal companies, this funding constraint is a major concern because project development requires sustained long-term investment and faces relatively higher exploration risks compared to other energy sectors (Adam et al., 2025).

This study aligns with agency theory which explains that managers are responsible for managing company resources effectively to achieve organizational objectives. A higher effective tax rate increases the tax burden which limits the internal financial resources available for green investment. However, a lower tax rate also allows management to allocate resources more efficiently for long-term investments that help maintain sustainability (Panda & Leepsa, 2017). From an investment decision perspective, an increase in the tax burden can limit a company's flexibility in allocating resources to projects that support sustainability (De Vito et al., 2025). A decline in after-tax profits prompts companies to be more selective in making investment expansion decisions. Moderate suggestion tax policies not only affect a company's financial condition but also determine the direction and capacity of the company to carry out investments. Therefore, a tax structure that balances government revenue generation with the provision of investment incentives fundamental in supporting increased green investment in the geothermal sector.

The Effect of Firm Size on Green Investment

The coefficient estimated for firm size is -0.0072 while its significance value reaches 0.1732 which is higher than 0.05. Moderate suggestion firm size produced no significant difference on green investment among geothermal companies in Indonesia. This suggests that a larger firm size does not necessarily lead to increased investment in environmentally oriented activities. In the geothermal industry, a company's total assets are generally dominated by fixed assets such as power

plants, infrastructure, and operational facilities that require long-term investment. This implies that an increase in firm size is more related to operational expansion than efforts to enhance green investment.

A Firms decision to make green investments is influenced by various factors, such as access to financing, regulatory certainty, government incentives, and renewable energy project development strategies. Companies also consider climate change risks and pressure from various stakeholders before allocating funds to green investments (Kalantzis & Dominguez, 2023). Companies with larger assets do not necessarily allocate higher amounts to green investments, as their resources may be prioritized to support operational efficiency, asset maintenance, or the development of ongoing projects. Moderate suggestion company size isn't the primary factor determining green investment among geothermal companies in Indonesia.

Research Implications

In general, The analysis indicates that financial instruments significantly influence geothermal companies' investment decisions regarding green projects. From a theoretical perspective, these results support the relevance of signaling theory, legitimacy theory, and agency theory in explaining the connection between tax policies and corporate investment in environmental initiatives. Tax holiday and tax allowance contribute to an increase in green investment, while an boost in the ETR is reduction in size in green investment. These relationships indicate that companies adjust their resource allocation and investment strategies in response to fiscal policies. The implementation of green investment resolved by technical and operational aspects and impacted by tax incentives and the magnitude of the tax burden borne by companies. Meanwhile, firm size, as a control variable, inconsequential on green investment. This insinuates company scale isn't a crucial aspect in determining green investment in geothermal companies.

From a public policy perspective, the research findings suggest that optimizing fiscal incentives can suffice as a tool to accelerate the Indonesia's progress in clean energy. The sustained realization of TH and TA has the potential to enhance the investment appeal of the geothermal sector, necessitating considerable financial resources and a lengthy gestation. Proportional management of the Effective Tax Rate (ETR) also requires attention to ensure the tax burden doesn't limit firms ability to allocate funds for green investment. The government needs to strengthen green financing instruments and formulate policies capable of addressing funding constraints, as the availability of financing sources is a critical factor in supporting increased green investment (Bouchmel et al., 2024). The implementation of market-based environmental policies can reduce barriers to green investment while increasing incentives for companies to develop renewable energy projects (Costa et al., 2024). These efforts support the achievement of national

energy transition targets, increased utilization of renewable energy, and more sustainable economic development.

CONCLUSION

This study shows tax holiday and tax allowance have constructive influence on green investment, and ETR has adverse effect on green investment among geothermal firms in Indonesia between 2019 and 2024. Meanwhile, firm size (SIZE) was not found to significantly influence green investment. Sequel indicate fiscal incentives was integral to in driving green investment, whereas a higher tax burden tends to reduce a company's investment capacity. This study strengthens the experimental evidence regarding capacity of tax policy in supporting the development of renewable energy. The study's limitations include the relatively small number of geothermal companies and the fact that information regarding the receipt of tax incentives is not fully disclosed in company reports. Subsequent research is advocated extended research timeframe and broaden the scope of the study by including companies from various renewable energy sectors beyond geothermal. This approach is expected to allocate a more extensive understanding of repercussion of tax policies on green investment in Indonesia

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