

Fiscal Policy for Sustainable Finance: The Effectiveness of Green Subsidies and Tax Incentives in Spurring Sustainable Investment in the Clean Energy Sector

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ABSTRACT

This study examines the effectiveness of fiscal policies, specifically green subsidies and tax incentives, in promoting sustainable investments in Indonesia's clean energy sector. Utilizing a quantitative approach, data were collected from 70 respondents comprising policymakers, renewable energy developers, and investors. The study employed a structured questionnaire using a 1–5 Likert scale, and the data were analyzed using SPSS version 26. The findings indicate that both green subsidies and tax incentives have significant positive effects on sustainable investment, with tax incentives showing a stronger impact. These fiscal tools collectively explain 65% of the variance in sustainable investment levels. The study underscores the importance of integrating fiscal policies to overcome barriers and foster a robust investment ecosystem. Recommendations include streamlining subsidy disbursement processes, enhancing tax policy clarity, and developing a coordinated fiscal strategy to accelerate Indonesia's clean energy transition.

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1. INTRODUCTION

The transition toward sustainable development in Indonesia, particularly through the promotion of clean energy, is a multifaceted challenge that involves balancing economic growth, environmental preservation, and social well-being. Indonesia's abundant renewable energy resources, such as geothermal, hydroelectric, and solar power, present significant opportunities to reduce dependency on fossil fuels and meet international commitments to

greenhouse gas emission reductions under the Paris Agreement. Renewable energy plays a pivotal role in achieving Sustainable Development Goals (SDGs), particularly SDG 7 (Affordable and Clean Energy) and SDG 13 (Climate Action), as it contributes to economic growth, poverty alleviation, and improved health outcomes by providing clean energy access and creating jobs [1]. However, Indonesia faces several challenges in promoting investment in clean energy, which are crucial for achieving these goals. Infrastructure and energy accessibility remain

significant hurdles, especially in remote areas lacking electricity [2], while high initial investment costs, technological limitations, and regulatory challenges hinder the widespread adoption of renewable energy [1]. Additionally, the lack of a long-term relationship between green economy policies and carbon emissions reduction suggests the need for consistent policy implementation [3]. Government intervention is crucial in steering the transition through strict policies, fiscal incentives, and regulations [2], while public-private partnerships and international cooperation are essential to overcome barriers and promote investment in renewable energy [1]. In this context, PLN, Indonesia's main electricity provider, is developing a sustainable business model to meet market needs for renewable energy [4].

Green fiscal policies, such as subsidies and tax incentives, are essential for promoting sustainable investment in clean energy by addressing market failures and reducing high capital costs that hinder private sector involvement. These instruments improve the financial viability of renewable projects and create favorable conditions for investment. In China, the Energy Conservation and Emission Reduction Fiscal Policy (ECER) boosts urban green total factor productivity through green innovation and industrial restructuring, especially in regions with strong governance and digitalization [5]. Likewise, the Energy Saving and Emission Reduction Fiscal Policy (ESERFP) has significantly reduced industrial pollutants—15.5% in wastewater and 19.5% in sulfur dioxide—while supporting economic growth [6]. Globally, tools like subsidies and green bonds are vital in overcoming renewable energy adoption barriers, with Europe and North America leading efforts, while developing countries require tailored solutions such as concessional loans due to financial and policy limitations [7]. In Germany, fiscal spending on environmental protection supports sustainable development more effectively than tax-based measures, highlighting the importance of targeted ecological expenditures [8].

Despite the potential of green subsidies and tax incentives, questions remain regarding their effectiveness in spurring sustainable investment in Indonesia. Studies conducted in other regions highlight mixed results, with variations in effectiveness influenced by policy design, implementation mechanisms, and market conditions. However, empirical evidence on the effectiveness of these fiscal tools in Indonesia's clean energy sector remains limited, creating a knowledge gap that this study seeks to address. This research employs a quantitative analysis approach to evaluate the impact of green subsidies and tax incentives on sustainable investment in Indonesia's clean energy sector.

2. LITERATURE REVIEW

2.1 *Fiscal Policy and Sustainable Finance*

Fiscal policy is a crucial tool for influencing economic activity and achieving societal goals, particularly in the clean energy sector, as it reduces financial barriers for investors and signals the government's commitment to sustainability. Its effectiveness depends on proper design and alignment with broader development objectives, including the use of fiscal instruments to address market failures by internalizing environmental costs and incentivizing private sector participation [7], [9]. Tax instruments such as energy, fuel, transport, and emissions taxes aim to internalize environmental degradation costs [9], while subsidies for renewable energy and green facilities reduce financial barriers and stimulate investment [7]. Additionally, green bonds and climate bonds mobilize private capital and lower investment risks in clean

energy projects [7]. Fiscal policy also promotes technological innovation by incentivizing research and development in green technologies [10], and supports sustainable economic growth by aligning environmental regulations with fiscal incentives [11]. However, its success relies heavily on tailored policy design and implementation that considers the unique socio-economic context of each country [12], and incorporates region-specific measures to address cross-regional environmental impacts [10].

2.2 *Green Subsidies and Their Impact on Clean Energy Investment*

Green subsidies play a key role in lowering the initial costs of sustainable technologies, making renewable energy projects—such as solar, wind, and geothermal—more appealing to investors, including in countries like Indonesia. However, their impact is often limited by funding shortages, bureaucratic hurdles, and inconsistent policies, highlighting the need for strong governance. In China, subsidies have advanced photovoltaic technology and expanded the market, making it a global leader [13]. Taiwan's optimized subsidies support renewable targets despite falling installation costs [14], [15]. While fiscal incentives in other regions spur green innovation, with varying effectiveness India, however, shows how lack of transparency can weaken subsidy outcomes [16], and success also depends on accurate modeling of factors like weather

and market risks [14]. Strengthening policy systems, improving oversight, and integrating renewable energy with climate adaptation are crucial for long-term sustainability [13], [17].

2.3 *Tax Incentives as Catalysts for Renewable Energy Development*

Tax incentives are crucial for promoting private investment in the clean energy sector by reducing capital costs and making renewable energy projects more financially attractive. These incentives, when well-structured, can significantly influence investment flows, as demonstrated by various studies. For instance, in Canada, clean energy investment tax credits support capital costs for qualifying projects, underscoring the importance of clear terms for effectiveness [18]. In Indonesia, tax incentives have been used to promote geothermal energy and biofuel production, supporting national renewable energy goals [19]. However, the effectiveness of these incentives depends on factors such as policy stability, coherence, and the economic environment. Stable and consistent policies are essential for success, as inconsistency can deter investors [19], while in developed countries, tax incentives work more effectively due to robust market infrastructure and supportive policies. In contrast, developing countries like Indonesia face challenges like low investor awareness and administrative inefficiencies that hinder the implementation of incentives [20], [21]. Properly designed

incentives, such as those in Canada, can significantly boost private investment by providing clear guidelines and reducing financial risks [18].

2.4 Gaps in the Literature

While the existing literature provides valuable insights into the role of fiscal policy in promoting clean energy, empirical studies specific to Indonesia remain limited. Most studies focus on the design and implementation of fiscal instruments without adequately addressing their impact on investor behavior and sustainable investment outcomes. Additionally, there is a lack of research using quantitative methods to evaluate the effectiveness of green subsidies and tax incentives in Indonesia's clean energy sector. Drawing from the reviewed literature, this study conceptualizes the effectiveness of green subsidies and tax incentives as key determinants of sustainable investment in the clean energy sector. The research hypothesizes that green subsidies have a positive and significant impact on clean energy investment, and that tax incentives also have a positive and significant impact on clean energy investment. These hypotheses are tested using a quantitative approach, providing empirical evidence to address the identified gaps and inform policymaking in Indonesia. The study tested the following hypotheses:

H1: Green subsidies have a positive and significant impact on sustainable investment in the clean energy sector.

H2: Tax incentives have a positive and significant impact on sustainable investment in the clean energy sector.

3. METHODS

3.1 Research Design

This study adopts a quantitative research design to empirically assess the impact of fiscal policy instruments on sustainable investment. The approach is appropriate for analyzing relationships between variables and testing the hypotheses established in the conceptual framework. A structured questionnaire was used to collect primary data from relevant stakeholders, including policymakers, clean energy investors, and industry experts.

3.2 Population and Sample

The population of this study consists of individuals and organizations involved in Indonesia's clean energy sector, including government officials, renewable energy developers, financial institutions, and academic researchers. From this population, a purposive sampling method was applied to select 70 respondents who possess relevant knowledge and experience regarding fiscal policies and clean energy investments. The sample size is deemed adequate for exploratory analysis and aligns with previous studies using similar quantitative methodologies.

3.3 Data Collection Methods

Primary data were collected through a structured questionnaire designed to measure respondents' perceptions of the effectiveness of green subsidies and tax incentives. The questionnaire consisted of two main sections: (1) Demographic Information, which captured respondents' background, including their role in the clean energy sector and experience with fiscal policy instruments, and (2) Effectiveness of Fiscal Instruments, using a 1–5 Likert scale (1 = strongly disagree, 5 = strongly agree) to assess the perceived impact of green subsidies and tax incentives on encouraging clean energy investment. The

questionnaire was distributed electronically to ensure accessibility and efficiency, with respondents assured of confidentiality and anonymity to encourage honest and unbiased responses.

3.4 Variables and Indicators

The study focused on two independent variables—green subsidies and tax incentives—and one dependent variable—sustainable investment in the clean energy sector. Key indicators for each variable include: for green subsidies, financial support for clean energy projects, ease of access to subsidies, and adequacy of subsidy amounts; for tax incentives, availability of tax exemptions/credits, clarity of tax policies, and effectiveness in reducing project costs; and for sustainable investment, the level of private sector participation, the number of clean energy projects initiated, and investment growth in renewable energy.

3.5 Data Analysis Techniques

The data were analyzed using SPSS version 26, a statistical software widely used for quantitative research. The analysis involved several steps: first, descriptive statistics were used to summarize the demographic characteristics of respondents and key variables, providing an overview of the dataset. Next, reliability analysis was conducted using Cronbach's Alpha to assess the internal consistency of the questionnaire items, ensuring reliability and validity. Correlation analysis was then performed to evaluate the relationships between green subsidies, tax incentives, and sustainable investment, testing the strength and direction of associations. Finally, multiple linear regression was conducted to quantify the impact of green subsidies and tax incentives on sustainable investment, enabling hypothesis testing.

4. RESULTS AND DISCUSSION

4.1 Descriptive Statistics

Descriptive statistics were computed to summarize the demographic characteristics of the respondents and their overall

perceptions of green subsidies, tax incentives, and sustainable investment. In terms of demographics, 40% of respondents were policymakers, 30% were renewable energy developers, 20% were financial stakeholders, and 10% were academic experts. Additionally, 65% of respondents had over five years of experience in clean energy projects.

Regarding perceptions, the mean score for green subsidies was 4.12, indicating agreement on their effectiveness. The mean score for tax incentives was 4.33, showing a higher level of agreement on their effectiveness. The mean score for sustainable investment was 4.28, reflecting general positivity about the growth of the clean energy sector.

4.2 Reliability Testing

Cronbach's Alpha values for the variables were as follows: 0.841 for green subsidies, 0.863 for tax incentives, and 0.891 for sustainable investment. These values confirm that the questionnaire items are reliable and internally consistent.

4.3 Correlation Analysis

Correlation analysis revealed significant positive relationships among the variables, with a correlation of $r = 0.726$ ($p < 0.01$) between green subsidies and sustainable investment, and $r = 0.751$ ($p < 0.01$) between tax incentives and sustainable investment. These results suggest that both fiscal instruments are strongly associated with increased investment in clean energy projects.

4.4 Regression Analysis

A multiple linear regression analysis was conducted to assess the predictive power of green subsidies and tax incentives on sustainable investment.

The multiple linear regression analysis indicates that green subsidies and tax incentives are significant predictors of sustainable investment in the clean energy sector. The adjusted R^2 value of 0.652 suggests that approximately 65.2% of the variation in sustainable investment can be explained by these two variables, which demonstrates a

strong explanatory power of the model. The F-statistic of 62.451 ($p < 0.001$) further confirms the overall significance of the model,

indicating that the predictors are collectively significant.

Regression Coefficients:

Variable	Coefficient (β)	t-Value	Significance (p)
Green Subsidies	0.412	5.323	<0.001
Tax Incentives	0.486	6.181	<0.001

Looking at the regression coefficients, both green subsidies ($\beta = 0.412$, $p < 0.001$) and tax incentives ($\beta = 0.486$, $p < 0.001$) have positive and statistically significant impacts on sustainable investment. The higher coefficient for tax incentives (0.486) suggests that they have a slightly stronger influence on sustainable investment compared to green subsidies (0.412), but both fiscal instruments are important drivers of investment in clean energy projects. Both green subsidies and tax incentives have significant positive impacts on sustainable investment, with tax incentives showing a slightly stronger effect.

Discussion

The findings confirm that green subsidies are a vital driver of sustainable investment in Indonesia's clean energy sector. Respondents indicated that subsidies reduce financial barriers and make clean energy projects more viable. The significant positive relationship aligns with previous studies that highlight the role of subsidies in lowering upfront costs and incentivizing private sector participation [15], [22]. However, respondents also noted challenges such as delays in subsidy disbursement and bureaucratic complexities. Streamlining the subsidy application process and ensuring timely distribution could further enhance their effectiveness.

Tax incentives emerged as the stronger predictor of sustainable investment. These incentives, such as tax credits and exemptions, significantly reduce operational costs, encouraging long-term investments in renewable energy technologies. This result is consistent with global research that identifies tax incentives as a key policy tool for promoting clean energy adoption [23], [24].

To maximize their impact, policymakers should focus on improving the clarity and accessibility of tax policies, as some respondents reported challenges in understanding eligibility criteria.

The combined R^2 value of 0.65 indicates that green subsidies and tax incentives jointly explain 65% of the variance in sustainable investment. This underscores the importance of using a combination of fiscal tools to address diverse barriers in the clean energy sector.

Policy Implications

The findings provide actionable insights for Indonesian policymakers:

1. Strengthen Green Subsidies: Simplify application processes and increase allocation for high-impact projects.
2. Enhance Tax Incentives: Improve communication and support mechanisms to ensure widespread utilization.
3. Integrate Fiscal Policies: Develop a coordinated strategy that combines subsidies and tax incentives with other regulatory measures to create a robust investment ecosystem.

Contribution to the Literature

This study contributes to the existing literature by providing empirical evidence on the effectiveness of fiscal policies in emerging economies like Indonesia. It bridges the gap between theoretical frameworks and practical implementation, offering a nuanced understanding of how green subsidies and tax incentives influence clean energy investments.

Limitations and Future Research

While this study offers valuable insights, it is not without limitations. The sample size of 70, while sufficient for exploratory analysis, may limit the generalizability of the findings, and the cross-sectional design captures perceptions at a single point in time, which may not reflect long-term policy impacts. Future research could address these limitations by employing longitudinal designs and expanding the sample to include more diverse stakeholder groups. Additionally, examining other policy instruments, such as renewable energy quotas and carbon pricing, could offer a more comprehensive understanding of fiscal strategies for promoting sustainable finance.

5. CONCLUSION

The study provides empirical evidence that fiscal policies, specifically green subsidies and tax incentives, are instrumental in driving sustainable investments in Indonesia's clean energy sector. Green subsidies help reduce financial barriers, enabling the initiation of renewable energy

projects, while tax incentives significantly lower operational costs and encourage long-term investment. The findings reveal that tax incentives have a slightly greater impact than green subsidies, highlighting their importance in policy formulation.

The results emphasize the need for a combined fiscal strategy to maximize the impact of these instruments, addressing both immediate financial barriers and long-term investment challenges. Policymakers should focus on streamlining subsidy application processes, ensuring timely disbursements, and improving the accessibility of tax incentives. By leveraging these findings, Indonesia can create a favorable environment for clean energy investments, contributing to sustainable development goals and the global transition to renewable energy.

Future research should explore additional fiscal tools and adopt longitudinal designs to evaluate the long-term impacts of fiscal policies on sustainable investment. Expanding the sample size and including diverse stakeholders could further enrich the understanding of fiscal policy effectiveness in emerging economies.

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