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Carbon Tax Implementation and Its Impact On Economic Growth and Green Investment in Indonesia

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ABSTRACT

A carbon tax is a market-based fiscal instrument designed to internalize the negative externality generated by greenhouse gas (GHG) emissions. Beyond its function as a climate-mitigation tool, carbon tax also has the potential to become a source of financing for the transition toward a green economy. This study comprehensively analyzes the design and implementation of a carbon tax, particularly in the Indonesian context, and its impact on economic growth and green investment. Using a descriptive-analytical approach supported by international empirical literature, national policy documents, and a simple revenue-projection exercise, the study finds that carbon tax does not necessarily generate a trade-off between environmental protection and economic growth. At Indonesia's minimum statutory rate of IDR 30,000 per ton of CO2 equivalent, the national revenue potential from the energy sector alone is estimated to rise from approximately IDR 19.16 trillion in 2019 to IDR 23.65 trillion in 2025, while a moderate international benchmark rate of USD 5 per tCO2e would raise this potential to roughly IDR 76.36 trillion per year. With an appropriate design, particularly through revenue-recycling mechanisms, protection for vulnerable groups, and a credible and predictable price signal, a carbon tax can generate a double dividend, delivering environmental benefits alongside economic and green-investment gains.

KEYWORDS: *Carbon Tax; Green Economy; Economic Growth; Green Investment; Fiscal Policy; Climate Change*

Introduction

Climate change has become one of the most fundamental challenges facing global economic development in the twenty-first century. Global mean temperature has already risen by approximately 1.1°C above pre-industrial levels, with further increases projected in the absence of decisive policy intervention. The consequences of climate change are not confined to the ecological domain; they are systemic to the economy, manifesting through heightened disaster risk, food-price volatility, supply-chain disruption, and declining labor productivity.

From an economic perspective, climate change can be understood as a global-scale market failure characterized by negative externalities that cross generations. Greenhouse gas (GHG) emissions released today impose social costs that will be borne by future generations, and in the absence of policy intervention, the market mechanism has no built-in incentive to internalize these costs.

Carbon Pricing as a Policy Instrument

One of the most widely discussed approaches in the environmental-economics literature for correcting this failure is carbon pricing, implemented either through a carbon tax or an emissions-trading system. A carbon tax assigns an explicit price to every unit of emissions, so that economic agents must factor environmental cost into their production and consumption decisions. Compared with direct command-and-control regulation, a carbon tax offers advantages in both static and dynamic efficiency: statically, it allows emission reductions to be undertaken by the parties with the lowest abatement cost, and dynamically, it provides a continuous incentive for technological innovation.

The Indonesian Context

Indonesia is among the world's largest emitters, particularly from the energy, forestry, and land-use-change sectors. As a developing country with high growth ambitions, Indonesia faces the classic dilemma of how to sustain economic growth while meeting its climate commitments. Law No. 7 of 2021 on the Harmonization of Tax Regulations marked an important milestone in integrating fiscal and environmental policy in Indonesia. Under this law, carbon tax is positioned not only as an instrument for controlling emissions but also as part of a longer-term fiscal reform agenda. Implementation has proceeded in a phased manner, beginning with sectors that are relatively easy to measure, such as coal-fired power plants (PLTU); although the initial rate is low by international standards, this represents an important step toward a national carbon-pricing system (Pratama et al., 2022; Siregar et al., 2025).

Several recent studies have examined the Indonesian carbon-tax agenda from complementary angles. Azis et al. (2023) documented the contribution of carbon taxation to Indonesia's economic progress, while Hardini and Rosdiana (2025) situated carbon tax within a climate-justice framework as a fiscal instrument for supporting the green economy. Halizah and Furqon (2024) outlined a transformation strategy for carbon tax within Indonesia's sustainable-development agenda, and Judijanto (2025) examined its implications for the competitiveness of the manufacturing sector. Prameswari et al. (2025) highlighted the role of carbon tax in encouraging green investment; Musthafa (2025) analyzed capital-market reactions to carbon-tax policy on the Indonesia Stock Exchange; and Sitinjak and Sari (2025), as well as Wardani et al. (2025), discussed its potential to raise state revenue while improving environmental quality. Intan Fajarisa and Pratama (2024) further examined the speculative potential of carbon tax as a domestic financing instrument. Using a more disaggregated approach, Siregar et al. (2025) combined Indonesia's 2016 input-output table with a CO2 satellite account and double exponential smoothing to forecast sector-specific carbon-tax revenue and emission reduction through

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2030, finding that the manufacturing sector alone accounts for close to 90 percent of both projected emissions and projected carbon-tax revenue.

Despite this growing body of work, relatively few studies integrate the environmental, macroeconomic, and green-investment dimensions of Indonesia's carbon tax within a single analytical framework that also incorporates concrete revenue projections. This represents a research gap: the design features of carbon tax, its growth implications, and its role in mobilizing green investment have mostly been examined separately rather than as parts of an integrated policy chain, and sector-level evidence such as that of Siregar et al. (2025) has not yet been connected to the broader green-investment literature. The novelty of this study lies in synthesizing theoretical foundations, international empirical evidence, and Indonesia-specific policy data, including projected revenue potential, sector-level emission estimates, and IDX Carbon transaction data, into a single, holistic assessment of how carbon tax design shapes the balance between environmental, economic, and green-investment outcomes.

Accordingly, this study aims to (1) analyze the design of carbon tax policy in Indonesia relative to international practice, (2) assess its short-run and long-run impact on economic growth, and (3) examine its role in encouraging green investment, with a view to providing both an academic reference and practical policy input.

Materials and Methods

This study adopts a descriptive-analytical approach, combining a review of theoretical and empirical literature, an examination of national policy documents, and a simple quantitative projection of carbon tax revenue potential. The analytical framework integrates three dimensions: (1) the environmental dimension, covering trends in GHG emissions and carbon intensity; (2) the economic dimension, covering GDP growth, sectoral structure, and productivity; and (3) the green-investment dimension, covering capital flows into renewable energy, clean technology, and sustainable industry. The relationship among these three dimensions is interpreted through the lens of the double-dividend hypothesis, which holds that an environmental tax can simultaneously reduce pollution and improve economic efficiency when its revenue is used productively.

Data were drawn from secondary sources, comprising macroeconomic indicators (GDP, inflation, investment) from the National Statistics Agency (BPS), the World Bank, and the IMF; environmental data (CO2 emissions, sectoral carbon intensity, fossil and renewable energy consumption) from the International Energy Agency (IEA), Indonesia's Ministry of Environment and Forestry (KLHK), and the UNFCCC; fiscal and policy data on the statutory carbon-tax rate and the IDX Carbon trading mechanism; and green-investment data on renewable-energy financing and green-bond issuance. Data were examined descriptively as a time series to observe patterns before and after the introduction of the carbon tax in Indonesia.

To illustrate the fiscal magnitude of the carbon tax, national revenue potential for the energy sector was projected using the identity Revenue_t = Emissions_t × Tariff, applying Indonesia's statutory minimum rate of IDR 30 per kg CO2e to reported energy-sector emissions for 2019–2025. This accounting-based projection was supplemented with alternative scenarios using an international benchmark rate of USD 5 per tCO2e, to place Indonesia's current tariff in a comparative perspective. In addition, the broader relationship between carbon-tax intensity and economic or green-investment outcomes documented in the literature is represented by the general reduced-form relationship

$$Yt = \alpha + \beta 1 \cdot CTt + \beta 2 \cdot Xt + \varepsilon t$$

where Yt denotes economic growth or green investment, CTt denotes the carbon-tax rate or revenue, Xt denotes a vector of control variables (inflation, foreign direct investment, energy prices), and εt is the error term. This specification is used to organize and interpret the cross-country empirical evidence reviewed in this study rather than to estimate new coefficients, since panel data of sufficient length following Indonesia's carbon-tax implementation are not yet available; it is presented here as the analytical framework that motivates the projection exercise and the synthesis of prior empirical findings reported in the Results section. Policy evaluation was conducted qualitatively against four criteria: effectiveness (whether emissions decline materially), efficiency (whether implementation costs are proportionate to benefits), equity (whether the tax burden is fairly distributed), and policy coherence (alignment with energy and industrial policy).

Results

Table 1 summarizes key empirical findings on the relationship between carbon tax, economic growth, and green investment drawn from the international and Indonesian literature.

Table 1: Summary of Selected Empirical Studies on Carbon Tax

Study	Region	Method	Key Finding
World Bank (2024)	Global	Meta-analysis	Carbon pricing raises renewable-energy investment by 15–25 percent.
IMF (2024)	Global	CGE modelling	Short-run effect on output is small and negative; long-run effect is broadly neutral.
Andersson (2019)	Sweden	Difference-in-differences	Carbon tax reduces emissions without impeding economic growth.
Metcalf & Stock (2020)	United States	Panel data	Carbon tax encourages clean-technology innovation.
Hartono et al. (2023)	Indonesia	Dynamic CGE	Short-run negative effect is small; long-run effect on output is positive.

Source: compiled by the authors from the reviewed literature

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Table 2 presents the projected national revenue potential of the carbon tax for the energy sector at Indonesia's statutory minimum rate of IDR 30 per kg CO2e.

Table 2: Projected Carbon Tax Revenue Potential, Energy Sector, 2019–2025

Year	Emissions (Gg CO2e)	Tariff (IDR/kg CO2e)	Revenue Potential (IDR million)
2019	638,808	30	19,164,240
2020	661,603	30	19,848,088
2021	685,211	30	20,556,338
2022	709,622	30	21,289,861
2023	734,985	30	22,049,559
2024	761,212	30	22,836,366
2025	788,375	30	23,651,249

Source: authors' calculation based on national energy-sector emissions data and Indonesia's statutory minimum carbon-tax rate.

As shown in Table 2, projected national revenue potential from the energy sector rises steadily from approximately IDR 19.16 trillion in 2019 to IDR 23.65 trillion in 2025, tracking the growth in energy-sector emissions over the period. Under a moderate international benchmark rate of USD 5 per tCO2e (approximately IDR 82,000 per tCO2e), the corresponding revenue potential rises substantially to approximately IDR 76.36 trillion per year; earlier estimates using an assumed rate of USD 5–10 per tCO2e placed first-year revenue potential in the range of IDR 29–57 trillion, or roughly 0.2–0.3 percent of Indonesia's GDP (Pratama et al., 2022). These figures indicate that the realized revenue potential is highly sensitive to the tariff design chosen, and that Indonesia's current statutory rate captures only a fraction of the fiscal potential implied by international benchmarks.

A more disaggregated, economy-wide estimate using a 2016 input-output table enriched with a CO2 satellite account and double exponential smoothing forecasts annual carbon-tax revenue of between IDR 25.195 trillion and IDR 25.21 trillion for each year of the 2025–2030 period, totaling approximately IDR 151.19 trillion, at the same statutory rate of IDR 30,000 per ton (Siregar et al., 2025). This figure is modestly higher than the accounting-based projection of IDR 23.65 trillion for 2025 reported by Pratama et al. (2022) and reproduced in Table 2, reflecting differences in the underlying emissions base and the inclusion of inter-sectoral effects. Siregar et al. (2025) further show that the manufacturing sector alone accounts for approximately 90 percent of both projected carbon-tax revenue and projected emissions, underscoring that the incidence of carbon tax in Indonesia is likely to be highly concentrated by sector rather than spread evenly across the economy. Importantly, even at this higher estimate, projected carbon-tax revenue for 2025–2030 covers only about 4.00 percent of Indonesia's total estimated climate-financing need and 4.32 percent of the financing need for the energy and transportation sectors specifically (Siregar et al., 2025), indicating that carbon tax alone cannot be expected to close Indonesia's climate-financing gap.

With respect to actual implementation, Indonesia's carbon tax has been set at a minimum rate of IDR 30,000 per ton CO2e, and a hybrid cap-and-tax mechanism has begun operating through the IDX Carbon exchange, which recorded a cumulative trading volume of approximately 908 thousand tons of CO2e by the end of 2024, with a transaction value of approximately IDR 50.64 billion at a carbon price of at least IDR 55,000 per ton CO2e (Musthafa, 2025). Although the tariff remains low relative to the global average, this signals the emergence of a functioning domestic carbon-price mechanism and a potential catalyst for shifting capital toward green sectors.

International evidence corroborates the emission-reduction potential of carbon pricing: a panel study covering 121 countries estimated that a USD 10 per ton increase in the carbon tax rate is associated with an emission reduction of approximately 1.3 percent in the short run and 4.6 percent in the long run, while evidence from several OECD countries indicates that carbon tax has consistently reduced emissions without a dominant negative effect on medium-term economic growth. For Indonesia specifically, Siregar et al. (2025) project that national emissions under a carbon tax would reach 839.93 million tons of CO2e by 2030, 49.68 percent below a business-as-usual trajectory, 35.94 percent below the country's first counter-measure (CM1) target, 31.33 percent below its second counter-measure (CM2) target, and 17.28 percent below a no-tax scenario, implying that Indonesia's projected emissions trajectory would already fall below its Enhanced NDC counter-measure targets even without the tax, with the carbon tax delivering a further, incremental reduction. Taken together, the empirical results in Table 1 and Table 2 indicate that carbon tax in Indonesia carries meaningful fiscal potential and is consistent with the broader international finding that carbon pricing need not come at the expense of economic growth.

Discussion

The finding that carbon tax can generate substantial fiscal revenue while remaining consistent with continued economic growth is in line with the theoretical prediction of the double-dividend hypothesis, under which an environmental tax delivers both an environmental dividend, in the form of reduced emissions, and an economic dividend, in the form of revenue that can be used productively (Azis et al., 2023; Hardini & Rosdiana, 2025). The evidence from Hartono et al. (2023), showing a small short-run negative effect but a positive long-run effect for Indonesia specifically, together with the IMF's (2024) finding of a broadly neutral long-run macroeconomic effect, suggests that the short-run adjustment cost of carbon tax in Indonesia is likely to be manageable if accompanied by an appropriate transition strategy for energy-intensive sectors.

The gap between Indonesia's current statutory rate of IDR 30,000 per ton CO2e and the substantially larger revenue potential

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implied by international benchmark rates, as shown in the comparison underlying Table 2, illustrates a central policy trade-off. A low initial tariff reduces the risk of short-run economic disruption and eases political acceptance, consistent with Indonesia's phased implementation strategy beginning with the power sector (Pratama et al., 2022), but it also limits the fiscal space available for financing the energy transition. This trade-off supports the case for a pre-announced, gradually rising tariff path: a credible trajectory of future price increases can encourage forward-looking investment in green technology without imposing an immediate shock on energy-intensive industries.

The role of carbon tax in mobilizing green investment, highlighted by Prameswari et al. (2025), is reinforced by the emergence of the IDX Carbon market, whose current trading volume and value remain modest relative to global carbon markets but demonstrate that a domestic price signal is beginning to function. Musthafa's (2025) finding that carbon-tax policy generates a measurable capital-market reaction in Indonesia further suggests that investors are already incorporating carbon-price expectations into their decisions, which is consistent with the theoretical channel through which carbon pricing redirects capital toward low-emission sectors.

At the same time, without a well-designed compensation mechanism, carbon tax risks being regressive, since lower-income households allocate a larger share of their spending to energy; this concern, raised in the literature on carbon tax and social equity (Sitinjak & Sari, 2025; Wardani et al., 2025), points to the importance of revenue recycling toward clean-energy subsidies, direct transfers to vulnerable households, and support for micro, small, and medium enterprises (MSMEs) undergoing the energy transition. A further risk is carbon leakage, whereby energy-intensive production relocates to jurisdictions with laxer carbon regulation; this risk can be mitigated through instruments such as border carbon adjustment or targeted transitional support for domestic industry, an issue closely tied to the competitiveness concerns documented for Indonesia's manufacturing sector by Judijanto (2025).

A further nuance emerges from Siregar et al.'s (2025) finding that Indonesia's projected emissions trajectory would fall below its Enhanced NDC counter-measure targets even in the absence of a carbon tax, with the tax contributing only an incremental additional reduction, and that projected carbon-tax revenue covers just 4.00 percent of the country's total climate-financing need. Read alongside this study's own revenue projections, this suggests two complementary policy implications. First, the current statutory rate of IDR 30,000 per ton CO2e appears to be calibrated more for political and administrative feasibility during the early rollout than for maximizing either emission reduction or revenue mobilization, which is consistent with the case for a pre-announced, gradually rising tariff path discussed above. Second, because the manufacturing sector accounts for the large majority of both projected emissions and projected carbon-tax revenue (Siregar et al., 2025), sector-specific transition support and monitoring are likely to matter more for the policy's overall effectiveness than economy-wide measures alone. Overall, the discussion suggests that the direction of Indonesia's carbon-tax outcomes the health of growth, the extent of green investment, and distributional fairness is not predetermined by the existence of the tax itself but is shaped decisively by its design: the pace of tariff increases, the allocation of revenue, and the degree of integration with energy, industrial, and social protection policy.

Conclusions

This study concludes that carbon tax is a strategic fiscal instrument for advancing Indonesia's transition toward a low-carbon economy without necessarily compromising long-run economic stability. The projected revenue potential from the energy sector alone, rising from approximately IDR 19.16 trillion in 2019 to IDR 23.65 trillion in 2025 under the current statutory rate, and considerably higher under internationally benchmarked rates, demonstrates that carbon tax can become a meaningful and growing source of financing for the energy transition and sustainable development.

International and Indonesia-specific empirical evidence consistently indicates that any short-run negative effect of carbon tax on output is small, while the long-run effect tends to be neutral or positive as firms adjust through efficiency gains, technological innovation, and structural change toward higher-value-added, lower-emission sectors. The emergence of the IDX Carbon market and evidence of capital-market responsiveness to carbon-tax policy further indicate that carbon pricing is beginning to function as a catalyst for green investment in Indonesia, though at a scale that remains modest relative to the country's overall investment needs.

For carbon tax to deliver these benefits equitably, policy design should prioritize five elements: a gradual and adaptive tariff schedule that avoids economic shocks while signaling credible future price increases; productive revenue recycling toward clean-energy subsidies and reductions in other distortive taxes; integration with industrial and energy policy to support green industrialization; targeted social protection and financing support for vulnerable households and MSMEs; and strengthened governance and transparency, including a robust monitoring, reporting, and verification (MRV) system. Future research incorporating post-2025 data as Indonesia's carbon market matures would help confirm whether the fiscal and environmental gains projected in this study are being realized in practice, and would support more precise, evidence-based calibration of the tariff path going forward.

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