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Carbon Tax Revenue Allocation for Climate Mitigation and Sustainable Development: Comparative Evidence from 31 Countries and Indonesia

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Abstract:
Carbon taxation is recognized as an economic instrument for internalizing the negative externalities of greenhouse gas emissions while supporting the transition to a low carbon economy. This study examines carbon tax revenue allocation across 31 countries and explores its implementation potential in Indonesia. The countries were purposively selected based on the existence of an operational carbon tax and the availability of verifiable information on revenue allocation as of 2025. The study employs a qualitative approach using descriptive methods and secondary data sourced from academic literature and public policy documents. The findings reveal that among 31 cases allocated at least part of their carbon-tax revenues to climate-related purposes. However, the allocation mechanisms varied considerably across countries. Indonesia has established a legal basis for carbon taxation, but its implementation and revenue allocation arrangements remain under development. The findings indicate that the effectiveness of carbon tax policy depends greatly on the clarity of its design, revenue allocation schemes, and the accompanying social protection mechanisms. Policymakers are encouraged to prioritize the strengthening of earmarking regulations, cross sectoral integration, and institutional capacity building to ensure that carbon tax revenues are effectively utilized for climate mitigation and sustainable development.

Keywords: Carbon Tax, Climate Finance, Environmental Governance, Sustainable Development, Climate Mitigation, Carbon Pricing

INTRODUCTION

The increasing demand for energy, which affects living standards through urbanization and industrialization particularly due to the use of fossil fuels has led to a significant rise in atmospheric CO_2 emissions. The most substantial increases in energy consumption and CO_2 emissions occur in urban areas, especially in regions where growing populations enjoy higher living standards and greater material prosperity. Human activities in cities affect urban ecosystems in several critical ways, including altering landscapes, mobilizing nutrients, diverting water and energy, driving the extinction of certain species while supporting the population growth of others, and even modifying local climates (Parris, 2016). The rise in average air and ocean surface temperatures since the mid-19th century is a hallmark of global warming, which is projected to continue (Aldrian et al., 2011).

One of the key international agendas to address climate change is the Paris Agreement, signed by 190 countries, including Indonesia. The agreement establishes a commitment to limit global warming to below 2°C, with an ultimate target of 1.5°C. It also led to the adoption of the Nationally Determined Contribution (NDC), which outlines targets and projections for reducing greenhouse gas (GHG) emissions (ENDC, 2022).

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Market based instruments have a comparative advantage in reducing GHG emissions. Broadly, there are two types of such instruments: emissions trading schemes (quantity-based) and tax or levy systems (price based), such as carbon taxes (Zhang et al., 2022). In Indonesia, Presidential Regulation No. 98/2021 on the Implementation of Carbon Economic Value (NEK) provides a legal framework supporting Indonesia's emission reduction commitments under the Enhanced Nationally Determined Contribution (ENDC). NEK policy implementation can be achieved through various mechanisms, including carbon trading, results based payments, carbon levies or taxes, and other approaches that leverage technological and scientific advancements.

The Indonesian government may introduce a carbon tax as a policy tool to reduce emissions (Selvi et al., 2020). The coal-fired power plant (PLTU) sector was initially designated as the first to be subjected to a carbon tax on April 1, 2022. The tax was to be implemented using a tax-and-cap mechanism, whereby emissions exceeding the established cap would be taxed at a rate of IDR 30 per kilogram of CO_2 equivalent. However, due to the absence of finalized technical regulations by March 2022, the government postponed its implementation until July 2022 (Suryani, 2022). A carbon tax is a levy imposed on carbon dioxide emissions for the purpose of mitigating global climate change (Tax Foundation, 2020; Q. Zhang et al., 2022). Its main objective is to reduce emissions—particularly carbon—while discouraging fossil fuel consumption associated with human production activities (Yuliasih, 2018). Moreover, the implementation of carbon taxation is expected to initiate a greener economic transformation and accelerate future emission reductions (Sitorus & Pratysto, 2018). Many countries have already adopted carbon taxes, and these policies have proven effective in curbing carbon emissions (Kumala et al., 2021).

Finland, the first country in the world to introduce a carbon tax, successfully reduced its emissions without negatively impacting its economy. Similarly, Sweden, Denmark, Ireland, and Slovenia, where carbon taxation has long been in effect, have demonstrated that energy-sector carbon taxes effectively reduce GHG emissions; tax rate increases have been associated with measurable reductions in emissions (Hájek et al., 2019). Conversely, Zhang (2000) found that the introduction of a carbon tax in the United Kingdom exacerbated economic inequality because it disproportionately burdened lower-income households compared to wealthier groups. Meanwhile, a study by Lee, Pollitt, & Ueta (2012) on Japan's carbon tax revealed minimal impacts on emission reduction and little effect on GDP, largely due to the relatively low tax rate.

Carbon taxes are levied on fossil fuels such as coal, petroleum, and natural gas used to generate energy. The tax is calculated based on the amount of CO_2 released from the combustion of these fuels and is applied to industries that emit GHGs (Pusparini et al., 2023). Carbon taxation is expected to increase the prices of carbon-intensive goods and services, thereby influencing consumer demand (Maghfirani et al., 2022). According to Rahmawati (2019), environmental taxes combine the concepts of taxation and environmental protection and serve as an economic tool for addressing environmental issues. Efforts to reduce emissions through economic instruments are influenced by price and market mechanisms, making them more cost effective compared to command and control mechanisms, which require the government to provide detailed information about production units that generate emissions (Prasojo et al., 2020).

A carbon tax is a form of Pigouvian tax. Pigouvian taxation, introduced by Arthur C. Pigou in 1920 (Selvi et al., 2020), is levied on transactions that generate negative externalities (Barus & Wijaya, 2021). In economics, a carbon tax is considered a Pigouvian tax on negative externalities because it can send the correct price signals to consumers and producers (e.g., aligning prices with the social cost of production, including the damage caused by GHG emissions), stimulate research and development of clean technologies, and avoid the inefficiencies associated with command and

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control policies or subsidies. Perman et al. (2003) in Ayu et al. (2024) note that while command-and-control mechanisms offer certain benefits in reducing pollution, disagreements between policymakers and stakeholders often render them impractical or undesirable.

The implementation of carbon taxes is guided by several principles. First, fairness, which is based on the polluter pays principle. Second, affordability, which considers public purchasing power. Third, gradualism, which accounts for sectoral readiness to avoid excessive burden (Margono et al., 2022). According to Rachmany (2020), carbon taxation generates both social and economic benefits. It can increase revenue without significantly disrupting the economy while simultaneously advancing climate policy objectives by reducing harmful carbon dioxide emissions, thereby mitigating climate change and its adverse effects on human health and the environment.

Carbon taxes, which are not limited to CO_2 emissions, are intended to reduce GHG emissions predominantly caused by fossil fuel combustion (Astuti & Maryono, 2018). The growing demand for fossil fuels and rising carbon emissions globally, driven by rapid industrialization, have exacerbated climate warming, one of the most pressing global challenges today. There is a substantial body of research on both carbon tax and carbon trading policies (Yu, 2020). Economists argue that carbon pricing, particularly in the form of carbon taxes, represents the least-cost climate policy for reducing GHG emissions, although governments often set carbon prices too low to drive substantial emission reductions (Criqui et al., 2019).

Finland was the first country to introduce a carbon tax in 1990, followed by the adoption of various carbon pricing instruments in national, subnational, and regional jurisdictions. Earlier literature reported that 27 countries had implemented carbon tax policies, although this estimate reflected the global policy landscape at the time of publication and did not necessarily include all subnational, regional, or emissions trading instruments (Maghfirani et al., 2022). More recent evidence from the World Bank's *State and Trends of Carbon Pricing 2025* identified 43 carbon taxes and 37 emissions trading systems (ETSs) as of April 1, 2025 (World Bank, 2025). The latest edition reported 87 implemented direct carbon-pricing instruments worldwide as of April 1, 2026, comprising 47 carbon taxes and 40 ETSs, operating across 47 countries and one regional ETS in the European Union (World Bank, 2026). These figures are not directly comparable because they refer to different observation years and policy units. The estimates reported by Maghfirani et al. (2022) refers to countries with carbon tax policies, whereas the World Bank figures refer to policy instruments, including both carbon taxes and ETSs. Accordingly, the 31 cases examined in this study represent a purposively selected subset of country level carbon-tax cases for which verifiable information on revenue allocation was available as of 2025. Despite sharing the objective of reducing greenhouse gas emissions, these countries apply different tax rates, sectoral coverage, revenue allocation arrangements, and complementary policy instruments. In Indonesia, Law No. 7/2021 on the Harmonization of Tax Regulations establishes the legal basis for carbon taxation and specifies a statutory minimum rate of IDR 30 per kilogram of CO_2e. However, the existence of this legal framework should be distinguished from the operational collection of the carbon tax.

Research by Pratama et al. (2022) indicates that carbon tax implementation could potentially increase state revenue by IDR 23.65 trillion in 2025 while significantly reducing carbon emissions. However, other studies highlight several challenges, including the need for a robust Monitoring, Reporting, and Verification (MRV) system and the necessity of harmonizing carbon tax policy with other environmental policies. From a social perspective, Harfiani (2025) emphasizes the importance of equitable policy design to prevent regressive impacts on low-income households. Similarly, Siregar (2025), using the Miyazawa Input-Output model, finds that carbon taxes could

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disproportionately affect lower-income households, underscoring the need for appropriate compensation mechanisms.

The relationship between revenue recycling and public acceptability (Klenert et al., 2018; Maestre-Andrés et al., 2019), and the potential role of earmarking in renewable energy financing (Effendi & Resosudarmo, 2024). Building on these contributions, this study addresses the need to connect documented differences in revenue-allocation arrangements with their institutional relevance for Indonesia. Specifically, it distinguishes formal earmarking, general-budget allocation, social compensation, and mixed arrangements, rather than treating all climate related expenditure as equivalent evidence of earmarking.

The study addresses three research questions: (1) What carbon-tax revenue-allocation arrangements are documented across the 31 selected countries within the 2025 observation period? (2) How do these arrangements differ in their allocation mechanisms and treatment of climate expenditure and social compensation? (3) What context-dependent policy lessons can be drawn for Indonesia's prospective carbon-tax revenue allocation? The intended contribution is a structured comparison using consistent classification criteria, including explicit treatment of mixed allocations. For Indonesia, the analysis connects international allocation practices with the distinction between legal authorization, operational implementation, and prospective revenue use. It thereby identifies policy options and institutional considerations for further assessment, without claiming that the descriptive comparison establishes the causal effectiveness of any allocation model.

METHODS

This study employs a qualitative approach using descriptive analysis methods to examine the implementation characteristics of carbon taxation across countries. The analysis focuses on national-level carbon tax instruments, particularly their implementation year, revenue allocation mechanisms, and policy objectives related to climate mitigation and sustainable development. The initial dataset was obtained from the World Bank Carbon Pricing Dashboard and State and Trends of Carbon Pricing 2025 report, which identifies 43 carbon tax instruments globally. From this database, the study selected national-level carbon tax instruments to ensure comparability across jurisdictions. Subnational carbon taxes and non-tax carbon pricing instruments, such as emissions trading systems (ETS), were excluded from the analysis.

The World Bank's *State and Trends of Carbon Pricing 2025* identified 43 carbon taxes and 37 emissions trading systems (ETSs) as of April 1, 2025 (World Bank, 2025), of which 31 represented national-level carbon tax instruments, while the remaining instruments consisted of subnational carbon taxes implemented in Mexico.

The World Bank's *State and Trends of Carbon Pricing 2025* identified 43 carbon taxes and 37 emissions trading systems (ETSs). Of the 43 carbon tax instruments, 31 were implemented at the national level. This study excludes 11 subnational carbon tax instruments implemented in Mexico, covering Colima, Durango, Guanajuato, Mexico City, Morelos, Querétaro, San Luis Potosí, the State of Mexico, Tamaulipas, Yucatán, and Zacatecas, as the analysis is limited to national-level carbon pricing instruments.

For each selected country, information was extracted regarding (1) country name, (2) carbon tax implementation year, (3) revenue allocation mechanism, and (4) World Bank income classification. Income group classification in was determined based on the World Bank's income classification system. The World Bank categorizes economies into four income groups: low-income, lower-middle-income, upper-middle-income, and high-income economies. This classification is

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based on gross national income (GNI) per capita, measured in current US dollars and converted from local currencies using the World Bank Atlas method, which is applied to reduce the impact of short-term exchange rate fluctuations (World Bank, 2025).

Revenue allocation categories were classified based on their primary policy purpose, including general fiscal revenue, climate-related investment, energy transition support, social compensation, and mixed allocation approaches. The collected data were analyzed using descriptive comparative analysis. Countries were grouped according to their revenue allocation patterns and income classifications to identify similarities and differences in carbon tax policy design. The analysis emphasizes institutional arrangements and policy choices rather than estimating causal relationships between carbon tax implementation and emission outcomes.

RESULT AND DISCUSSION

Evaluation of carbon tax revenue utilization in 31 countries research indicates that the way carbon tax revenues are utilized significantly influences public support for the policy. Carattini et al. (2019) demonstrate that support for carbon taxation increases substantially when the public is informed that the revenue is allocated to purposes perceived as fair or beneficial, such as environmental investments or social compensation. Revenue recycling strategies, including carbon dividends or funding for green projects, are widely considered effective in enhancing public acceptance of the tax (Klenert et al., 2018). Furthermore, perceptions of fairness particularly regarding how tax revenues are used, are a key determinant of public acceptance of carbon tax policies (Maestre-Andrés et al., 2019).

Allocating carbon tax revenues to climate-related projects, such as investments in renewable energy development, consistently emerges as the most preferred and widely accepted approach. This strategy not only enhances the perceived fairness of the policy but also strengthens its effectiveness, particularly when revenue is also used to provide compensation for low income households (Maestre-Andrés et al., 2021). Several countries that have successfully implemented carbon tax policies demonstrate how revenue utilization plays a critical role in achieving policy effectiveness.

In France, the carbon tax was introduced in 2014 through the Contribution Climat-Énergie (CCE) scheme after two previous attempts had failed. By 2019, the allocation of tax revenues included 42% for the general budget, 47% for environmental projects, 5% for tax reductions, and 6% for direct transfers to households or businesses (Lecuyer & Postic, 2020). This policy contributed to a 5% reduction in carbon emissions within five years and supported the nation's 2050 carbon neutrality agenda (Dussaux, 2020). However, the tax faced widespread public resistance, as it was perceived as regressive and environmentally ineffective. The "tax and dividend" scheme intended for income redistribution was largely rejected due to public concerns over reduced purchasing power (Douenne & Fabre, 2022).

Revenue recycling can take different forms, including tax reductions, household compensation, and public expenditure (Marten & van Dender, 2019). This study examines these allocation arrangements without treating them as evidence of realized emission reductions or increased public acceptance.

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Table 1. Allocation of Carbon Tax Revenues in Selected Countries

Country	Year of Implementation	Revenue Allocation	Countries Income Group	Source
Finland	1990	General budget and environmental projects (green tax)	High income	Lilliestam et al. (2025)
Poland	1990	Approx. 50% for climate and energy goals, not project-specific	High income	Lilliestam et al. (2025)
Sweden	1991	Revenues are not earmarked and are incorporated into the general government budget.	High income	Government Offices of Sweden (n.d.); Lilliestam et al. (2025)
Norway	1991	CO_2 tax revenues are incorporated into government fiscal revenues; petroleum-sector CO_2 tax contributes to the Government Pension Fund Global.	High income	Norwegian Ministry of Finance (2025)
Denmark	1992	Revenues are recycled through tax reductions, general budget support, and limited environmental spending.	High Income	Lilliestam et al. (2025)
Estonia	2000	Revenues from CO_2 charges are allocated through public budgets for environmental policy objectives.	High Income	Riigikogu (2024)
Latvia	2004	CO_2 tax revenues are allocated entirely to the state basic budget.	High Income	Ministry of Finance of Latvia (2026)
Liechtenstein	2008	Two-thirds of business CO_2 levy revenues are redistributed to companies through payroll-based compensation.	High income	Office for the Environment Liechtenstein (2026)
Switzerland	2008	Two-thirds returned to public and economy, one-third for CO2 mitigation	High income	Federal Office for the Environment (2026)
Albania	2010	Revenues are incorporated into national tax revenues without verified climate earmarking.	Upper middle income	Ministry of Finance of Albania (2025)
Ireland	2010	Climate investments, energy poverty prevention, just transition,	High income	Government of Ireland (2024)
Iceland	2010	Environmental projects and general budget	High income	Lilliestam et al. (2025)

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Country	Year of Implementation	Revenue Allocation	Countries Income Group	Source
Ukraine	2011	Special fund, min. 39.4% for environmental purposes - the State Fund for Decarbonisation and Energy-Efficient Transformation.	Upper middle income	State Agency on Energy Efficiency and Energy Saving of Ukraine (2024)
Japan	2012	Renewable energy and energy-saving measures, climate mitigation measures.	High income	Ministry of Environment Japan (n.d.); Lilliestam et al. (2025)
United Kingdom	2013	Carbon Price Support revenues flow into the Consolidated Fund as general government revenue.	High income	UK Parliament (2019)
Mexico	2014	General budget, varies by fiscal objective	Upper-middle income	Secretaría de Hacienda y Crédito Público (2026)
France	2014	Environmental projects and direct household transfers, support general fiscal needs, tax reductions	High income	Ministry for Ecological Transition France (2017); Douenne & Fabre (2022)
Spain	2014	Carbon-tax revenues are treated as general indirect-tax revenues.	High Income	Boletín Oficial del Estado (2024)
Portugal	2015	Climate projects and personal income tax reduction	High Income	Fundo Ambiental (2024); Government of Portugal (2025)
Colombia	2017	Environmental projects and emission reduction	Upper-middle income	Congress of Colombia (2022)
Chile	2017	general public expenditure, education and public health initiatives	High income	Lilliestam et al. (2025)
Argentina	2018	Revenues are distributed among national government, provinces, social security, housing, water, and transport infrastructure.	Upper middle income	Government of Argentina (n.d.)
South Africa	2019	National Revenue Fund; efficiency investments and climate projects	Upper-middle income	Lilliestam et al. (2025)
Singapore	2019	Decarbonization, green economy transition, household/business support	High income	Ministry of Sustainability and Environment Singapore (2026)

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Country	Year of Implementation	Revenue Allocation	Countries Income Group	Source
Netherlands	2021	Environmental projects and carbon emission reduction subsidies	High income	Government of the Netherlands (2025)
Luxembourg	2021	Revenues are transferred to the Climate and Energy Fund.	High Income	Government of Luxembourg (2025)
Andora	2022	Revenues finance the Green Fund, renewable energy, efficiency, and sustainable mobility.	High income	Government of Andorra (n.d.)
Uruguay	2022	Carbon-tax revenues are collected, but no verified implementation of a specific revenue-allocation mechanism has been identified	High income	
Hungary	2023	Revenues are recorded as central government budget revenue without dedicated climate allocation.	High income	Government of Hungary (2025)
Slovenia	2023	CO_2 charge revenues are allocated to the state budget.	High Income	Financial Administration of Slovenia (2025)
Israel	2024	Revenues are not directly earmarked; climate and social support are financed separately.	High Income	OECD (2025)

Source: Authors' compilation from World Bank (2025)

In Colombia, carbon tax revenues are used to reduce income taxes, fund climate programs, and provide tax credits for low and middle income households. This policy was designed to be fiscally neutral through a redistribution scheme, however, its complex offset mechanism poses challenges to environmental transparency and accountability (GFI, 2025).

Finland, the first country to implement a carbon tax, integrates its revenues into the general budget without earmarking them for environmental projects (Nurhayati et al., 2024). Although this policy reduced emissions by up to 30% by 2004 compared with a no-tax scenario (Mideksa, 2021), its effectiveness was limited by the initially low tax rate and numerous exemptions, particularly for energy-intensive industries such as metals and pulp & paper (Bruvoll & Larsen, 2002; Clarke, 2023). Conversely, Japan applies its carbon tax revenues more directly to finance clean energy projects and climate mitigation strategies. Although the policy has had limited effects on GDP and unemployment and has not produced substantial long-term emission reductions, it remains a central component of the country's emission control strategy. Japan's continued reliance on fossil fuels following the Fukushima disaster has further constrained the policy's effectiveness (Lewis, 2022). The comparison between the two countries highlights that carbon tax effectiveness depends on policy design, rate structure, and the consistency of regulatory and institutional support.

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Across the 31 countries studied, carbon tax revenues have been utilized in various ways, reflecting each nation's strategies and priorities. Broadly, revenue allocation falls into four main categories. First, funding for climate and clean energy projects, as seen in Poland, Estonia, Singapore, Ukraine, Portugal, Luxembourg, y, the Netherlands, Colombia, , and Japan, demonstrates a strong commitment to energy transition and emission reduction. Second, redistribution to households and social compensation, as practiced in Finland, Denmark, Liechtenstein, Francem, Switzerland, and South Africahelps mitigate the economic burden on vulnerable groups and maintain public support. Third, integration into the general state budget, as in, Norway, Sweden Latvia, Albania, United Kingdom, Spain, Slovenia, Hungary, Iceland, and Mexico, provides fiscal flexibility but has faced criticism regarding transparency and effectiveness. Fourth, support for a just transition, as implemented in Ireland, Singapore, , Chile, Colombia, Argentina, South Africa and Portugal where revenues are used to prevent energy poverty and strengthen the social dimension of climate action.

Under this criterion, had an explicitly documented climate-related allocation, including mixed arrangements with a qualifying climate-related component, as identified in Table 1. Although a portion of the revenue is often directed to the general budget, the majority remains dedicated to green initiatives. Findings also indicate that emission reduction effectiveness is strongly influenced by tax rates: lower rates tend to yield minimal impact, whereas higher rates contribute significantly to carbon emission reductions.

The Use of Carbon Tax in Indonesia

Since the enactment of the Harmonization of Tax Regulations Law (Law No. 7/2021, hereafter "HPP Law"), the carbon tax has emerged as a strategic issue within Indonesia's climate policy. Theoretically, this instrument is considered efficient in internalizing the externalities of emissions and driving the transition toward clean energy (Nurdianto & Resosudarmo, 2016 ; Yusuf & Resosudarmo, 2015). However, its implementation has been delayed and faces several challenges, including unclear emission thresholds, the underdeveloped Monitoring, Reporting, and Verification (MRV) system, and limited law enforcement capacity (Pamungkas & Haptari, 2022).

Ministerial Regulation of Environment and Forestry (Permen LHK) No. 21/2022 stipulates that climate change mitigation may be carried out through the Carbon Economic Value (NEK) framework, which encompasses carbon trading, result-based payments, carbon levies, and other mechanisms supported by advancements in science and technology.

1. Carbon Trading

Carbon trading is a market-based instrument that enables entities to buy or sell carbon units, each representing one ton of verified carbon dioxide within the National Registry System (SRN PPL). This mechanism consists of emissions trading and emissions offsetting. Emissions trading occurs when actual emissions exceed the cap set through the Emission Ceiling Allocation Plan (PTBAE), while offsets involve financing emission reduction projects in other locations to compensate for excess emissions. These mechanisms can be implemented domestically or internationally, either under the direct scheme regulated by Law No. 4/2023 or through market-based agreements requiring carbon units.

2. Result-Based Payment (RBP)

RBP refers to incentives or payments granted for greenhouse gas (GHG) emission reduction outcomes that have been verified, certified, and validated.

3. Carbon Levy

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Carbon levies are imposed based on carbon content, emission potential, total emissions, customs and excise, as well as other state-imposed charges. These levies are regulated under Article 13 of Law No. 7/2021 on the Harmonization of Tax Regulations, which governs carbon taxation.

4. Other Mechanisms in Line with Scientific and Technological Advancements

Under Article 13(5) of the HPP Law, the subjects of carbon tax in Indonesia include individuals and/or entities that purchase carbon-intensive goods or engage in emission-generating activities. The tax object is emissions that negatively impact the environment. In its initial phase (2022–2024), the tax is applied to coal-fired power plants (PLTU) due to their significant contribution to emissions, the availability of infrastructure, and high dependence on fossil fuels (Pamungkas & Haptari, 2022). Indonesia adopts a hybrid scheme combining cap and tax and cap and trade, integrating carbon taxation with emissions trading as outlined in the United Nations model (Ilahi & Kusmono, 2023; Nadine & Yoga, 2021).

Indonesia's carbon tax framework provides a legal basis for linking carbon taxation with emissions trading. Pamungkas and Haptari (2022) describe this approach as a cap, trade, and tax mechanism, under which emissions exceeding an applicable cap and not covered by eligible allowances or emission reduction certificates could become subject to carbon taxation, subject to the relevant implementing regulations. The statutory framework, the operation of emissions trading, and the implementation of carbon tax liabilities should therefore be distinguished. The discussion of carbon tax revenue allocation in Indonesia concerns potential policy arrangements and does not presume that the existence of the legal framework or carbon trading demonstrates actual carbon-tax collection.

Article 13(8) an (9) of Law No. 7/2021 links the carbon-tax rate to the carbon-market price and establishes a statutory floor of IDR 30 per kilogram of CO_2e when that market price falls below this threshold. This provision should not be interpreted as evidence that IDR 30 was being collected on every kilogram emitted by coal-fired power plants. Operational taxation requires the relevant implementing rules. Separately, the Ministry of Energy and Mineral Resources announced emissions-cap allocations for participating coal-fired generating units in 2023 under the power-sector emissions-trading framework (Ministry of Energy and Mineral Resources, 2023). These allocations do not, by themselves, demonstrate the implementation of carbon-tax collection.

Fiscal policies to support sustainable development and climate change mitigation include:

1. Developing a fiscal framework for climate change mitigation;
2. Government spending by ministries/agencies for climate programs (climate budget tagging);
3. Tax and excise facilities, such as incentives for the private sector to develop environmentally friendly products (e.g., renewable energy, electric vehicles);
4. Intergovernmental fiscal transfers to support climate programs, such as physical special allocation funds (DAK) for food, water, health, environment, and forestry; non physical DAK for waste management; regional incentive funds (e.g., for waste management performance); and village funds for alternative low-emission energy and environmental restoration;
5. Climate financing through green bonds/green sukuk;
6. Establishing disaster pooling funds;
7. Sustainable finance platforms such as the Environmental Fund Management Agency (BPDLH) and SDG Indonesia One;
8. Carbon pricing through the carbon tax (Nawawi, 2022).

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Earmarking refers to the practice of allocating tax revenue for specific purposes, which, in the context of carbon tax, is intended to ensure that collected funds directly support environmental initiatives. This approach aligns with the Pigouvian principle, which emphasizes the use of taxes to correct negative externalities. Although Presidential Regulation No. 98/2021 establishes the framework for the carbon economic value to achieve the Nationally Determined Contribution (NDC) targets, it does not explicitly regulate the earmarking of carbon tax revenues (Pattinggi et al., 2021). Earmarking is considered to improve budget efficiency, accountability, and public trust in fiscal policy (Effendi & Resosudarmo, 2024).

Clague and Gordon (1939) define earmarked taxes as the separation of a portion of tax revenue from the general budget for exclusive use in specific government programs. Three main reasons for earmarking include taxpayer interests, distrust of government, and the desire to link taxes to specific purposes (Tambunan, 2022). Bird (2005) distinguishes between two forms of earmarking: substantive, which requires alignment between revenue growth and expenditure for specific purposes, and symbolic, which is more flexible and dependent on government discretion regarding the allocation and magnitude of tax revenue.

In the Indonesian context, earmarked taxes can be observed in Law No. 1/2022 on the Fiscal Relationship between Central and Regional Governments (HKPD Law). Article 86(1) of the HKPD Law identifies four tax revenue categories subject to earmarking: Motor Vehicle Tax (PKB) and PKB Surcharge, Specific Goods and Services Tax on Electricity, Tobacco Tax, and Groundwater Tax. The allocation details are further regulated under Article 25(1)–(5) of Government Regulation No. 35/2023:

1. At least 10% of PKB and PKB Surcharge revenue must be allocated for road construction and maintenance, and improvement of public transportation infrastructure;
2. At least 10% of electricity PBJT revenue must be allocated for public street lighting, including infrastructure provision, maintenance, and electricity costs for street lighting;
3. At least 50% of tobacco tax revenue, both provincial and district/city shares, must be allocated to fund public health services and law enforcement;
4. At least 10% of groundwater tax revenue must be allocated for the prevention, mitigation, and restoration of environmental damage affecting groundwater quality and quantity, including tree planting, infiltration wells, forest conservation, and waste management.

The implementation of earmarking faces several challenges, such as limited budgetary flexibility, weak oversight mechanisms, and insufficient institutional capacity at the regional level. The absence of a robust monitoring and evaluation system from the central government also raises concerns over potential misuse of funds (Tambunan, 2022). Furthermore, budget allocation for climate-related issues remains limited, as national fiscal policy continues to prioritize health, education, infrastructure, and social protection. Although there is no dedicated earmarking mechanism for climate mitigation, climate agendas can be integrated into cross-sectoral programs, such as education and social protection.

Ningsih et al. (2022) find that the Indonesian government is not yet fully prepared to implement earmarking of carbon tax revenues. Key challenges include a lack of clear commitment, insufficient human resources, and the absence of technical procedures and regulations for revenue allocation. Additionally, budget rigidity and the risk of inefficiency if funds remain unutilized are major concerns. From a legal perspective, Pertiwi & Wisaksono (2024) emphasize that allocating carbon tax revenues for climate mitigation is optional and requires further regulation through government decrees consistent with statutory provisions.

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Article 13(12) of Law No. 7/2021 permits carbon tax revenues to support climate change control, while Article 13(15) requires further regulation; neither provision mandates a specific earmarking share nor confirms actual expenditure. International evidence shows varied revenue-use arrangements, including general-budget allocation, tax reductions, compensation, and earmarking (Marten & van Dender, 2019). Earmarking can improve transparency and protect climate programs but may reduce fiscal flexibility, especially when revenues are uncertain, and may replace rather than increase existing climate spending. General-budget allocation offers greater flexibility but may weaken the link between revenues and climate expenditure. We therefore recommend assessing both options based on revenue predictability, distributional effects, additionality, and fiscal flexibility, supported by transparent reporting and periodic evaluation. This is a policy recommendation, not an empirically established optimal approach.

CONCLUSION

This study identifies variation in documented carbon tax revenue allocation arrangements across the selected countries, including climate-related expenditure, compensation, general-budget allocation, tax reductions, and mixed arrangements. These descriptive patterns do not establish the superiority or causal effectiveness of any allocation model. For Indonesia, the findings provide a basis for assessing earmarking and general-budget recycling in relation to fiscal flexibility, distributional objectives, administrative capacity, and expenditure additionality. However, the conclusions are subject to limitations arising from heterogeneous tax designs, reliance on secondary data, changing policy status, non-comparable outcome measures, and potential selection bias. Future research should use longitudinal and comparable data to evaluate actual expenditure, environmental and distributional outcomes, and the relative effects of earmarking and general-budget allocation.

Some countries, such as Finland and Poland, integrate carbon tax revenues into the general budget, providing fiscal flexibility but raising concerns over transparency and policy continuity. Conversely, Ireland and Singapore demonstrate that carbon tax revenues can be effectively directed toward supporting a just energy transition, particularly for vulnerable groups. Furthermore, the level of the carbon tax rate significantly influences its effectiveness; countries with higher rates tend to achieve greater emission reductions. This underscores the importance of a robust policy design, strategic revenue allocation, and equitable distribution as key factors for ensuring the success of carbon taxation in supporting climate and sustainable development agendas.

In Indonesia, the plan for utilizing carbon tax revenues is still under development as the government prepares a comprehensive roadmap. Insights from various studies and international best practices are expected to serve as references for policy formulation. Although the Harmonized Tax Law permits the use of carbon tax revenues for climate control, it does not mandate such allocation. At present, the government intends to integrate carbon tax revenues into the state budget (APBN), whose main priorities include education, health, infrastructure, and national resilience. Consequently, environmental issues have yet to become a primary focus, although their integration into relevant sectoral programs remains feasible.

The Indonesian government may consider earmarking part of future carbon tax revenues for climate change mitigation, subject to an assessment of fiscal flexibility and expenditure additionality. Initial priorities should include establishing the necessary legal and administrative arrangements and ensuring MRV readiness. Revenue allocation should subsequently be supported by clear institutional responsibilities, transparent reporting, and eligibility criteria for any

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accompanying social compensation. Periodic evaluation should assess expenditure delivery, distributional implications, and the need to adjust allocation arrangements. Comparative evidence offers examples of revenue-use options for consideration, rather than demonstrating that earmarking alone delivers renewable-energy development, energy efficiency, or emission reductions.

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