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Economic Legal Instruments for Indonesia's Green Economy Transition: Carbon Taxes, Energy Subsidies, and Green Investment Incentives

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ABSTRACT

Climate change and environmental degradation have prompted Indonesia's green economy transition. This study evaluates carbon taxation, energy subsidy reform, and green investment incentives through a structured qualitative narrative-conceptual review of scholarly publications, policy reports, and institutional documents. Carbon taxation can support emissions control and clean-technology innovation, depending on policy design, institutional coordination, and emissions-reporting capacity. Energy subsidy reform can correct price distortions and create fiscal space for cleaner energy, provided distributional impacts are addressed through social protection. Green investment incentives may support low-carbon investment, although effectiveness depends on regulatory certainty, transparent governance, additionality, and measurable environmental outcomes. Aviation implications include sustainable aviation fuel, airport renewable energy and efficiency investments, and coordination with the International Civil Aviation Organization's Carbon Offsetting and Reduction Scheme for International Aviation. These are policy implications, not measured sectoral effects. Stronger legal frameworks, coherent green fiscal policies, and institutional capacity are needed to support an equitable transition.

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1. INTRODUCTION

The global environmental crisis, characterized by accelerating climate change, biodiversity loss and natural resource degradation, has put the world's countries at a critical juncture in choosing a sustainable development path. In this context, the transition to a green economy has become a strategy that is not only relevant, but also urgent. A green economy conceptually refers to a development model that is low in carbon emissions, efficient in resource use, and socially inclusive (UNEP, 2011). Indonesia faces significant challenges in transitioning towards a greener and more sustainable economy, given the substantial scale of its greenhouse gas (GHG) emissions and its continued dependence on fossil fuels. The official BPS statistical table on greenhouse-gas emissions by sector type reports total emissions of approximately 1,360.35 million tonnes of CO_2 equivalent in 2023 (BPS, 2003).

Economic law acts as a normative and structural instrument in directing economic behavior towards sustainable development goals. In the law and economics paradigm, public policies can be designed by considering the efficiency of resource allocation and internalization of negative externalities through price and incentive mechanisms (Cooter R & Ulen, 2016). In this context, economic legal instruments such as carbon taxes, energy subsidy reforms, and fiscal incentives for green investments are key components in shaping a policy ecosystem that supports the energy transition and decarbonization of economic sectors (Tietenberg & Lewis, 2019).

Indonesia's implementation of a carbon tax through the Harmonization of Tax Regulations Law (UU HPP) in 2021 marks the first step towards a carbon pricing mechanism that reflects the external cost of GHG emissions. Studies show that the implementation of a carbon tax can encourage energy efficiency, clean technology innovation, and increase state revenue if well designed and managed (Meila et al., 2024). However, the success of this policy is highly dependent on technocratic aspects such as tariff design, sector coverage, and fund use mechanism, as well as institutional aspects such as inter-agency coordination and emissions reporting capacity (Haptari & Widiastuti, 2023; Prasetyo, 2023).

On the other hand, energy subsidies in Indonesia are still dominated by support for fossil fuels, which not only creates price distortions but also reinforces dependence on carbon-intensive energy. Energy subsidy reform is a form of market correction that is in line with the polluter pays principle and can create fiscal space to fund green initiatives such as renewable energy and clean transportation (Hidayat & Amalia, 2023; R. J. A. Wibowo & Rasji., 2023). However, these reforms must be carefully designed so as not to impose a disproportionate burden on vulnerable groups, requiring a hybrid approach between fiscal policy and social protection (Gobel et al., 2024; Yudhana & Madalina, 2022).

These policy questions are particularly relevant to aviation and transport, where decarbonization requires coordinated action on fuel, infrastructure, and emissions accounting. The International Civil Aviation Organization’s Indonesia action plan identifies sustainable aviation fuels (SAF), fleet modernization, operational improvements, and emissions-inventory enhancement as mitigation measures (ICAO, 2025). Green investment incentives can help mobilize capital for SAF supply chains, airport renewable-energy systems, energy-efficient terminals, and lower-emission ground-support equipment. For accuracy, the regulatory timeline distinguishes Indonesia Green Taxonomy Edition 1.0 (2022) from the Indonesia Taxonomy for Sustainable Finance (TKBI), which transformed and updated that framework in 2024; TKBI Second Edition followed in 2025 and

expanded coverage to Transportation and Storage, including SAF (OJK, 2022, 2024, 2025). These classifications can inform sustainable-finance eligibility but do not, by themselves, establish a project's financial viability or additional emissions reductions. Domestic aviation policy should also be distinguished from international operations covered by CORSIA; carbon-pricing and reporting arrangements need to be coordinated to avoid inconsistent or duplicative obligations. These sectoral considerations demonstrate why the effectiveness of economic legal instruments should be assessed not only at the economy-wide level but also in relation to aviation's regulatory and investment conditions.

In addition, fiscal incentives for green investments are also an important pillar in encouraging the private sector to shift from carbon-intensive to environmentally friendly projects. Schemes such as tax holidays, tax allowances, and green taxonomy-based financing are expected to lower the market risk and initial cost of green investments, as well as create economic multiplier effects through green job creation (Evitasari & Komarulzaman, 2023; Purwanto, 2022). However, the effectiveness of fiscal incentives in Indonesia remains weak due to a lack of cross-sector policy integration, weak governance, and a lack of measurable impact indicators (Aprillia et al., 2025; Radhiana D. N. & Amanda, 2023). Despite the growing literature on carbon taxation, energy subsidy reform, and green investment incentives, these instruments are often discussed in relation to their respective fiscal, economic, or environmental functions. A key analytical issue is how the three instruments can be assessed together within an economic law framework, particularly in relation to the institutional and regulatory conditions that influence their effectiveness in Indonesia. Unlike existing reviews that primarily examine carbon pricing or individual fiscal instruments, this review brings together three complementary economic policy instruments—carbon taxation, energy subsidy reform, and green investment incentives—to assess their respective mechanisms, outcomes, and trade-offs in Indonesia's green economy transition. Its contribution lies in distinguishing observed outcomes from model-based projections and policy arguments, while examining environmental effectiveness alongside fiscal efficiency, distributional justice, and legal-institutional feasibility. This integrated perspective provides a basis for identifying policy complementarities and evidence gaps without assuming that the three instruments necessarily produce mutually reinforcing outcomes. Accordingly, this study aims to evaluate the effectiveness of carbon taxation, energy subsidy reform, and green investment incentives in Indonesia, with particular attention to their implementation challenges, interrelationships, and implications for the development of a coherent, equitable, and sustainable economic law framework.

2. METHODS

Research Design

This article adopts a structured qualitative narrative-conceptual literature review to examine how economic and legal instruments may support Indonesia's transition towards a green economy. It focuses on three policy instruments—carbon taxation, energy subsidy reform, and green investment incentives—and synthesizes literature on their environmental, economic, fiscal, distributional, legal, and institutional implications. The purpose is interpretive and policy-oriented: to compare mechanisms, identify tensions and complementarities, and derive implications for Indonesia, including aviation and transport, rather than to estimate a pooled effect or claim exhaustive coverage of all available studies.

The review is not presented as a systematic review and does not claim compliance with PRISMA 2020 (Page et al., 2021). PRISMA 2020 is referenced as a transparency and reporting framework, not as a claim that all systematic-review procedures were completed. The available research records do not provide a complete, auditable record of database-level retrieval, screening decisions, and exclusion counts needed to report a PRISMA flow accurately. Accordingly, no PRISMA flow diagram, retrospective record counts, or formal systematic-review risk-of-bias scores are reported. The review instead uses thematic interpretation and critical consideration of the type and limitations of each source.

Information sources and search strategy

Literature was explored through Google Scholar, ScienceDirect, SpringerLink, and Garuda. The search focused on three economic legal instruments relevant to Indonesia's green economy transition: carbon taxation, energy subsidy reform, and green investment incentives. Publications from 2018 to 2026 in Indonesian and English were considered, while older foundational works and relevant legal or institutional documents were consulted separately for contextual purposes.

The principal search concepts and Boolean search strings used to explore the three policy domains are presented in Table 1.

Table 1. Literature Search Strategy and Search Concepts

Policy domain	Search string in English	Search string in Indonesian
Carbon taxation	"carbon tax" AND Indonesia AND ("green economy" OR "energy transition" OR emissions)	"pajak karbon" AND Indonesia AND ("ekonomi hijau" OR "transisi energi" OR emisi)
Energy subsidies	Indonesia AND ("energy subsidy" OR "fuel subsidy" OR "electricity subsidy") AND (reform OR emissions OR "energy transition" OR poverty)	Indonesia AND ("subsidi energi" OR "subsidi BBM" OR "subsidi listrik") AND (reformasi OR emisi OR "transisi energi" OR kemiskinan)
Green investment incentives	Indonesia AND ("green investment" OR "renewable energy investment") AND ("tax incentive" OR "tax allowance" OR "tax holiday" OR fiscal)	Indonesia AND ("investasi hijau" OR "investasi energi terbarukan") AND (insentif OR perpajakan OR fiskal)

The search strings represent the principal search concepts used to identify relevant literature across the selected databases and platforms. Candidate publications were considered using publisher information, abstracts, bibliographic metadata, and accessible full texts. Information obtained from abstracts or bibliographic records was distinguished from findings verified through full-text examination.

Eligibility criteria

The inclusion and exclusion criteria used to assess the relevance and eligibility of candidate sources are summarized in Table 2. These criteria were applied to distinguish scholarly publications relevant to the research questions from sources that provided only general contextual information. Peer-reviewed journal articles were prioritized for the core literature synthesis, while legislation, government and institutional reports, foundational publications, and previous reviews were considered separately for contextual purposes and reference tracing.

Table 2. Inclusion and Exclusion Criteria

Criteria	Inclusion criteria	Exclusion criteria
Publication period	Publications generally within 2018–2026. Older foundational works and current legal or institutional documents may be used separately for contextual purposes.	Publications outside the specified period for the core scholarly literature, unless they serve a relevant foundational or contextual purpose.
Language	Publications written in Indonesian or English.	Publications in other languages without an accessible full text that can be adequately analyzed.
Publication type	Relevant and verifiable peer-reviewed journal articles. Legislation, government and institutional reports, foundational publications, and previous reviews may be used as contextual or reference-tracing sources.	News articles, popular opinion pieces, promotional webpages, and publications without verifiable publication identities.
Substantive relevance	Studies examining carbon taxation, energy subsidy reform, or green investment incentives in Indonesia, or comparative studies with explicit relevance to Indonesia.	Publications discussing climate change or energy in general without sufficient analytical relevance to the research questions.
Evidence and methodology	Sources providing sufficient methodological, analytical, or documentary information to assess their contribution and limitations.	Sources with insufficient information to assess their relevance, analytical contribution, or evidentiary basis.
Duplication	One record for each distinct scholarly work, prioritizing the published journal version when available.	Duplicate records or earlier working-paper versions of the same work when a published journal version is available.

The criteria were applied with consideration of the type and availability of evidence in each source. Eligibility remained provisional when full-text access or publication details could not be adequately verified.

Literature selection and critical appraisal

The literature selection process involved several stages, beginning with the identification of candidate sources and followed by preliminary relevance assessment, eligibility assessment, examination of available full texts, and consideration of their evidentiary contributions. The procedures used to assess and select the literature are summarized in Table 3.

Table 3. Literature Selection and Eligibility Assessment

Selection stage	Assessment procedure	Decision and treatment
Identification of candidate sources	Candidate publications were identified through searches on Google Scholar, ScienceDirect, SpringerLink, and Garuda using the search concepts presented in Table 1.	Retrieved records were treated as candidate sources for further assessment, not automatically as included literature.
Preliminary relevance assessment	Titles, abstracts, keywords, and available publication information were examined to assess their relevance to carbon taxation, energy	Sources with no substantive connection to the research focus were not prioritized for further assessment.

Selection stage	Assessment procedure	Decision and treatment
	subsidy reform, and green investment incentives in Indonesia.	
Eligibility assessment	Candidate sources were assessed against the inclusion and exclusion criteria in Table 2, including publication period, language, publication type, substantive relevance, and availability of sufficient analytical or documentary information.	Sources meeting the criteria were considered eligible for use in the literature synthesis. Eligibility remained provisional when full-text access or publication details could not be adequately verified.
Full-text and evidence assessment	Available full texts were examined to identify the policy instrument addressed, analytical approach, principal findings, and limitations relevant to the research questions.	Sources were considered according to the adequacy and relevance of their evidence, rather than publication status alone.
Duplicate handling	Multiple records referring to the same scholarly work were checked to avoid repeated consideration of identical evidence.	One record was retained for each distinct scholarly work, prioritizing the published journal version when available.
Final use in the synthesis	Eligible sources were considered in the instrument-specific analysis and the cross-instrument qualitative synthesis.	The use of sources was determined by their relevance and evidentiary contribution. No numerical claim is made regarding a complete final corpus or screening flow.

The selection process was not treated as a numerical screening exercise because complete records of retrieval, screening, and exclusion were not preserved. Accordingly, no retrospective screening counts or PRISMA flow diagram are presented. The final use of each source in the synthesis depended on its relevance to the research questions and the extent to which its analytical or documentary evidence could be assessed.

3. RESULTS

Carbon Tax as an Emission Control Instrument

Carbon taxation is an economic legal instrument intended to internalize the negative environmental externalities associated with greenhouse-gas emissions. In the context of Indonesia's green transition, its principal function is to alter the economic incentives faced by emitters so that carbon-intensive activities reflect a greater share of their environmental costs.

The literature reviewed indicates that carbon taxation can perform a dual function: controlling emissions and encouraging green economic activity. Nurfatimah G et al. (2024) emphasize that a properly designed carbon tax can encourage energy efficiency, investment in clean technology, employment in green sectors, and improved competitiveness (Nurfatimah G. et al., 2024).

Effectiveness depends heavily on policy design. Liana (2023) stresses the importance of tariff levels, sectoral coverage, and the mechanism for using tax revenues (Liana, 2023). A rate that is too low may fail to create a meaningful behavioral incentive, while an excessive rate may generate resistance and distributional concerns (Soekarno et al., 2024). Andriani and Rahmi (2023) identify technical and institutional constraints in implementation and note that the existing tariff of IDR 30

per kilogram of CO2e may provide a relatively weak price signal when compared with stronger carbon-pricing approaches (Andriani & Rahmi, 2023).

The statutory carbon-tax rate established under Law No. 7 of 2021 is IDR 30 per kilogram of CO_2e, equivalent to IDR 30,000 per tonne of CO_2e. The High-Level Commission on Carbon Prices (2017) proposed an international benchmark of USD 40–80 per tonne of CO_2 by 2020 for pathways consistent with the Paris temperature goals (Carbon Prices., 2017). As an illustrative historical comparison, using an average 2020 exchange rate of approximately IDR 14,525 per USD, that benchmark corresponds to about IDR 581,000–1,162,000 per tonne, whereas the Indonesian statutory rate corresponds to approximately USD 2.07 per tonne at the same exchange rate (Bank., 2020). Thus, the nominal statutory rate is roughly 19–39 times lower than the Commission's 2020 benchmark. This comparison should not be interpreted as a direct estimate of the appropriate rate for Indonesia today: the Commission's figures are historical global benchmarks, and price year, exchange rates, income levels, sector coverage, exemptions, and complementary policies differ. Moreover, a statutory rate is not equivalent to the effective carbon price actually faced by every emitter, particularly where implementation and coverage remain limited. In marginal abatement cost curve (MACC) terms, emitters tend to adopt abatement options whose marginal cost is below the effective carbon price; a low price can therefore capture relatively inexpensive measures—such as operational efficiency and some energy-saving investments—while leaving higher-cost options, including some fuel-switching and capital-intensive technologies, unattractive without complementary measures. A credible policy pathway should assess both the rate and the breadth of coverage, and consider predictable, phased adjustments alongside investment support and distributional safeguards.

Another important issue is administrative capacity. Prasetyo (2023) identifies weak inter-agency coordination and insufficient emissions-reporting and verification infrastructure as structural challenges (Prasetyo, 2023). These issues are significant because a carbon tax requires credible measurement, reporting, verification, and enforcement mechanisms. Without reliable emissions data, the legal obligation to pay a carbon charge may be difficult to administer consistently.

The use of carbon-tax revenue is a central part of policy design, not a secondary administrative issue. Under Article 13 of Law No. 7 of 2021, revenue from the carbon tax may be allocated to climate-change control; this provides a legal basis for climate-related spending but does not by itself guarantee automatic earmarking or a particular allocation. Revenue-recycling choices should therefore be stated transparently through budget decisions and evaluated against clear outcomes. Possible options include targeted transfers or energy-bill support for vulnerable households, temporary and well-targeted assistance for affected small businesses and workers, public investment in renewable energy and grid infrastructure, energy-efficiency programmes, and competitive support for verified emissions-reduction projects. In aviation and transport, eligible programmes could include sustainable aviation fuel (SAF) supply-chain development, airport energy efficiency, and lower-emission ground-support systems, subject to transparent eligibility criteria and additionality tests. Recycling revenue to reduce other distortionary taxes may also improve economic efficiency, but the net effect depends on which tax is reduced, who benefits, and the administrative cost. The literature indicates that a carbon tax without compensatory and complementary policies may have regressive effects, particularly for low-income households (Maghfirani H. N. & Amani, 2022), whereas transparent clean-energy investment and social compensation can improve public

acceptability and distributional outcomes (Meila et al., 2024). Accordingly, effectiveness should be assessed not only by revenue collected but also by emissions reductions, the cost and additionality of supported abatement, clean-technology adoption, and the distribution of benefits and burdens (OECD, 2024).

The integration of carbon taxation with energy subsidy reform and other fiscal incentives can improve overall policy effectiveness. Carbon pricing creates a behavioral signal, while complementary fiscal measures support structural transformation and mitigate adverse social effects.

Energy Subsidy Reform for Clean Energy Transition

In terms of the effectiveness of economic legal instruments to promote the transition to a green economy in Indonesia, energy subsidy reform is an important and strategic step. Fossil energy subsidies such as fuel oil and coal-based electricity create false price signals that do not reflect the environmental costs of carbon-intensive energy consumption activities. This contradicts the basic legal principles of environmental economics that emphasize efficient resource allocation and internalization of negative externalities. Energy price adjustment through subsidy reduction is part of an environmental pricing mechanism that can improve the energy market structure and encourage a shift in consumption towards clean and efficient energy (Soekarno et al., 2024; R. Wibowo & Rasji, 2023). A study by Hidayat and Amalia (2023) shows that the majority of energy subsidies in Indonesia are still allocated to fossil fuels, which reinforces the dependence of society and industry on conventional energy (Hidayat & Amalia, 2023). Such subsidies weaken the competitiveness of green technologies and slow down the adoption of renewable energy. With the highest level of carbon emissions coming from the energy sector, as also highlighted in the carbon disclosure study by Doloksaribu et al. (2024), energy subsidy reform is an urgent instrument to curb emissions and accelerate the shift to clean energy sources (Doloksaribu et al., 2024). In addition, Aprillia et al. (2025) underline that the use of subsidy funds and carbon tax revenues should be directed to support strategic sectors, including clean energy and social protection for vulnerable groups (Aprillia et al., 2025). Research by Gobel et al. (2024) shows that energy subsidy policies in Indonesia tend to benefit wealthier households more than the poor and vulnerable (Gobel et al., 2024). The study recommends a shift from commodity-based subsidies to direct subsidies to households, to improve budget efficiency and promote an equitable energy transition.

Energy subsidy reform not only reduces dependence on fossil fuels, but also opens up significant fiscal space for the state to allocate funds to strategic sectors such as renewable energy development, green transportation and green technology research (Haptari & Widiastuti, 2023; Meila et al., 2024). In this context, subsidies can be redesigned into instruments that support green growth, rather than maintaining high carbon consumption. However, subsidy reform must also consider social justice. Removing energy subsidies without compensation may increase the burden on vulnerable groups, so social protection mechanisms such as direct cash transfers, subsidized electricity tariffs, or clean energy incentives are an important part of the policy approach (Haptari & Widiastuti, 2023). Yudhana and Madalina (2022) also emphasized that public funds derived from carbon taxes can be used to subsidize clean technologies, such as biomass heating systems or industrial energy efficiency (Yudhana & Madalina, 2022). With this scheme, fiscal incentives become more effective and result-oriented, especially if accompanied by transparent and accountable regulatory reforms.

Furthermore, energy subsidy reform will be more effective if implemented synergistically with a carbon tax. Integrating disincentive instruments (carbon tax) and de-incentivizing dirty energy (fossil subsidies) will create a consistent and comprehensive fiscal regulatory framework to drive the national energy transition. This integrated approach strengthens market signals towards a low-carbon economy and accelerates the achievement of Indonesia's net zero emission target (Aprillia et al., 2025; Sulistyowati et al., 2025). Thus, energy subsidy reform is not just a technical fiscal policy, but an important part of the legal transformation of the national economy towards equitable sustainable development.

The Effectiveness of Green Investment Incentives as an Economic Legal Instrument in Driving the Transition to a Green Economy in Indonesia

Green investment incentives are designed to reduce financial and market barriers that discourage investment in renewable energy, clean transportation, energy efficiency, and other low-carbon sectors. The policy rationale is that environmentally beneficial projects may face higher initial costs, technology risks, or uncertainty that are not fully captured by conventional market calculations. The reviewed literature identifies several forms of support, including tax holidays, tax allowances, import-duty exemptions, and other fiscal or financial mechanisms. These instruments can lower upfront investment costs and improve the attractiveness of green projects (R. Wibowo & Rasji, 2023). Meila et al. (2024) also associates green incentives with wider multiplier effects, including employment and diversification of the national energy mix (Meila et al., 2024).

The regulatory context should be specified precisely because the instruments are not interchangeable. OJK's Indonesia Green Taxonomy Edition 1.0 was published in 2022. In February 2024, OJK introduced the Indonesia Taxonomy for Sustainable Finance (TKBI), a transformed and updated framework that initially focused on the energy sector; TKBI Second Edition, issued in February 2025, expanded coverage to Construction and Real Estate, Transportation and Storage, and selected forestry and palm-oil activities, and explicitly included Sustainable Aviation Fuel (SAF) (OJK, 2022, 2024, 2025). Accordingly, the manuscript distinguishes the 2022 Green Taxonomy, TKBI 2024 (first edition), and TKBI 2025 (second edition), rather than referring to the 2024 framework as "Green Taxonomy 2.0." The taxonomy can guide classification and sustainable-finance allocation, but taxonomy alignment alone does not demonstrate that an investment is additional, bankable, or environmentally effective. In the electricity sector, PLN's dominant role as the single buyer/off-taker, as well as its role in transmission and distribution, shapes access to the market for independent power producers (IPPs). The financing implications depend on the project's procurement pathway and the specific power-purchase agreement (PPA), including tariff predictability, offtake and curtailment provisions, payment security, allocation of performance risks, and treatment of environmental attributes such as carbon credits.

Integrated Effectiveness of the Three Instruments

The effectiveness of economic legal instruments in supporting Indonesia's green economy transition needs to be assessed not only through their individual policy mechanisms but also through their environmental, fiscal, economic, distributional, and institutional implications. Carbon taxation, energy subsidy reform, and green investment incentives address different dimensions of the transition and may complement one another through their respective policy functions. A cross-instrument synthesis of their mechanisms, potential contributions, implementation requirements, and evidentiary limitations is presented in Table 4.

Table 4. Cross-Instrument Evidence Synthesis and Critical Appraisal

Analytical aspect	Carbon taxation	Energy subsidy reform	Green investment incentives
Primary policy mechanism	Internalizes emissions externalities through a carbon-price signal.	Changes relative energy prices by reducing support for fossil-fuel consumption and reallocating fiscal resources.	Reduces financial and market barriers to investment in renewable energy and other low-carbon activities.
Potential environmental contribution	Can encourage energy efficiency, emissions reduction, and clean-technology adoption, depending on the effective carbon price and sectoral coverage.	Can reduce incentives for fossil-energy consumption and improve the competitiveness of cleaner energy alternatives.	Can support renewable-energy deployment and low-carbon investment, although investment growth does not automatically demonstrate emissions reductions.
Fiscal and economic implications	Generates potential public revenue and influences production costs, investment decisions, and household expenditure.	Can create fiscal space through reduced subsidy expenditure, while affecting energy prices and household or industrial costs.	May stimulate private investment but also involves tax expenditures, public support costs, and possible fiscal efficiency concerns.
Distributional considerations	May impose disproportionate costs on lower-income households unless revenue use and compensation are appropriately designed.	Requires targeted compensation because subsidy reduction may increase the burden on vulnerable households; existing commodity subsidies may also distribute benefits unevenly.	Benefits may be concentrated among sectors or investors with better access to finance and incentives; distributional effects require assessment.
Governance and implementation conditions	Requires regulatory certainty, inter-agency coordination, credible emissions measurement, reporting, verification, and transparent revenue allocation.	Depends on political feasibility, institutional coordination, accurate beneficiary targeting, and credible social-protection mechanisms.	Requires regulatory certainty, transparent eligibility, administrative capacity, monitoring, performance evaluation, and credible investment arrangements.
Evidence base and limitations	Available extraction includes empirical-policy and model-based studies. Projections of revenue, emissions, and distributional effects must be distinguished from observed implementation outcomes.	Available extraction includes empirical, institutional, distributional, and policy studies. Findings differ in method and scope, including studies that also examine non-energy subsidies.	The manuscript discusses regulatory frameworks, financing conditions, and policy studies. However, the available extraction records do not establish an equally detailed study-level evidence matrix;

Analytical aspect	Carbon taxation	Energy subsidy reform	Green investment incentives
Critical appraisal	Effectiveness cannot be inferred from the statutory tax rate or projected revenue alone; actual price signals, implementation capacity, and revenue use matter.	Fiscal savings alone do not establish successful reform; environmental outcomes and the protection of vulnerable groups must also be considered.	The existence of incentives or taxonomy alignment does not establish additional investment or environmental effectiveness; measurable outcomes and counterfactual assessment are needed.
Potential complementarity	Provides the price signal that can discourage carbon-intensive activities.	Reinforces the price signal by reducing fiscal support for fossil-energy consumption and can provide resources for social protection or transition measures.	Can help overcome investment barriers and support the deployment of low-carbon technologies in response to stronger market and regulatory signals.

Table 4 indicates that the three instruments perform different but interdependent functions in supporting the green economy transition. Carbon taxation provides a price signal for internalizing emissions externalities, energy subsidy reform changes relative prices and the allocation of public expenditure, while green investment incentives seek to address financial and market barriers to low-carbon investment. Their effectiveness depends not only on individual policy design but also on regulatory certainty, institutional coordination, transparent monitoring and reporting, and adequate social protection. The comparison also highlights the importance of distinguishing observed or empirically estimated outcomes from model-based projections and policy expectations. In particular, the available evidence does not justify assuming that the three instruments have been evaluated with equal empirical depth.

4. DISCUSSION

Integrated Policy Effectiveness and Governance Conditions

The findings demonstrate that the three economic legal instruments address different but interdependent dimensions of the green economy transition. Carbon taxation seeks to internalize emissions externalities through a price signal; energy subsidy reform changes relative prices and reallocates public resources; and green investment incentives seek to mobilize capital towards low-carbon activities. A carbon tax may provide only a limited behavioral signal when its rate, coverage, or emissions-reporting system is weak. Subsidy reform may improve fiscal and environmental incentives, but can undermine equity if compensation does not adequately protect vulnerable households. Investment incentives may lower project costs, yet do not guarantee additional investment or emissions reductions where eligibility rules, regulatory certainty, monitoring, and project bankability remain inadequate.

The integrated synthesis identified four cross-cutting conditions: regulatory certainty, institutional coordination, transparent monitoring and reporting, and social protection. These conditions should be understood as mutually reinforcing governance requirements rather than as a

numerical ranking or frequency count of the reviewed literature. Regulatory certainty supports predictable decisions by firms and investors; institutional coordination connects fiscal, environmental, energy, and transport responsibilities; transparent monitoring enables assessment of emissions and fiscal outcomes; and social protection helps ensure that transition costs are not disproportionately borne by vulnerable groups. This interpretation is consistent with the evidence distinctions adopted in the review: observed outcomes, model-based projections, and policy arguments are not treated as equivalent. Accordingly, the policy value of the three instruments should be judged through measurable environmental, fiscal, economic, and distributional outcomes, while recognizing the limitations of the available secondary evidence.

Sectoral Implications for Aviation and Transport

The three instruments have direct applications to aviation and transport, sectors in which fuel use, infrastructure investment, and emissions-accounting obligations create distinct transition challenges. In aviation, carbon-pricing design should distinguish domestic flights from international operations covered by the International Civil Aviation Organization's Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA). Indonesia's aviation action plan identifies sustainable aviation fuels, fleet modernization, operational improvements, and continued enhancement of emissions inventories as mitigation measures (International Civil Aviation Organization (ICAO, 2025). Carbon-pricing measures for domestic aviation should therefore be coordinated with CORSIA and designed to avoid inconsistent or duplicative obligations while preserving incentives for measurable emissions reductions.

Green investment incentives can support the transition through financing for SAF production and supply chains, airport solar-power installations, energy-efficient terminal systems, and lower-emission ground-support equipment. The TKBI Second Edition's inclusion of Transportation and Storage and SAF provides a relevant sustainable-finance classification framework (OJK, 2025). In parallel, energy subsidy reform can influence the relative price of fossil-based transport fuels and create fiscal space for transport decarbonization, but its distributional and connectivity effects must be assessed, especially where aviation is essential for remote and island communities. Policy evaluation should consequently consider not only aggregate emissions and investment volume, but also SAF lifecycle emissions and sustainability certification, airport energy use, fuel availability, compliance costs, connectivity, and the distribution of costs between operators and passengers.

These sectoral applications clarify the relevance of the economic-law framework to SKYHAWK's aviation and transport focus. They are presented as policy implications drawn from the reviewed regulatory and institutional context, not as evidence that the current review has empirically measured the effects of these instruments on aviation outcomes.

Legal and Policy Implications

The findings support several specific legal and institutional priorities. First, the Ministry of Finance should undertake a targeted legal and policy assessment of Law No. 7 of 2021 on the Harmonization of Tax Regulations (UU HPP) and its implementing regulations, focusing on the operational status and predictability of the carbon-tax mechanism, the clarity of sectoral coverage, the relationship with emissions measurement, reporting and verification, and the transparency of carbon-tax revenue allocation. The assessment should identify which issues can be resolved through implementation or administrative guidance and which, if any, require regulatory amendment; the review does not establish in advance that statutory amendment is necessary. Any proposed rate

adjustment should be evidence-based and phased, with distributional assessment and targeted compensation. Second, the Government should assess the need for a formal inter-ministerial instrument involving the Ministry of Finance, the Ministry of Environment, and the Ministry of Energy and Mineral Resources, with the Ministry of Transportation included for aviation and transport implementation. Depending on legal review, this could take the form of an inter-ministerial regulation or coordinated ministerial decisions that assign responsibilities for emissions data, reporting and verification, fiscal incentives, revenue-use disclosure, and coordination with CORSIA-related obligations. The instrument should specify the lead agency, data-sharing duties, reporting timetable, and implementation review process rather than relying on general coordination commitments. Third, green-investment incentives should be linked to measurable environmental performance, transparent eligibility criteria, and periodic disclosure of fiscal costs and outcomes.

Limitations of the Study

This study has several limitations that should be considered when interpreting its findings. First, the review relies on secondary sources, including scholarly publications, policy reports, and institutional documents, and does not incorporate primary empirical data from government agencies, businesses, energy providers, or aviation operators. Consequently, the analysis identifies policy mechanisms, implementation challenges, and institutional conditions but does not establish causal effects or quantify the actual combined impact of the three economic legal instruments on Indonesia's green economy transition. Second, although the review applies explicit search concepts and eligibility criteria, a complete and auditable record of database-level search dates, retrieval totals, duplicate records, and screening decisions was not preserved. The review therefore cannot claim exhaustive coverage or full reproducibility, and its findings should be understood as a structured qualitative synthesis rather than a systematic review. Third, the availability and depth of evidence vary across the three policy instruments. The reviewed literature provides different levels of detail on carbon taxation, energy subsidy reform, and green investment incentives, which limits the extent to which their effectiveness can be compared on an equivalent empirical basis. Finally, the aviation-related analysis is based on policy and institutional literature and is presented as a sectoral implication; it does not constitute an empirical assessment of the effects of these instruments on aviation emissions, operating costs, or investment outcomes.

Future Research Agenda

Future research could address these limitations through several complementary approaches. First, quantitative studies could evaluate the implementation and effects of Indonesia's carbon-pricing policy after the introduction of the legal framework under Law No. 7 of 2021, including its implications for emissions, energy costs, fiscal revenue, and sectoral competitiveness. Such studies could incorporate marginal abatement cost curves, scenario analysis, or economy-wide modelling to assess alternative carbon-price levels and revenue-recycling arrangements. Second, empirical legal and institutional research could examine the implementation of carbon-tax regulations, inter-ministerial coordination, emissions measurement, reporting and verification, and the accountability of green fiscal incentives. Third, comparative research involving other countries could identify policy-design options and institutional practices relevant to Indonesia, while accounting for differences in economic structure and regulatory capacity. Fourth, aviation-specific research could assess the feasibility and policy requirements of sustainable aviation fuel deployment, airport renewable-energy investment, energy-efficiency measures, and coordination between domestic

carbon-pricing arrangements and CORSIA. These research directions would provide a stronger empirical basis for evaluating the environmental, fiscal, distributional, and sectoral outcomes of economic legal instruments in Indonesia.

5. CONCLUSION

This review indicates that carbon taxation, energy subsidy reform, and green investment incentives can support Indonesia's green economy transition through different but potentially complementary mechanisms. Their effectiveness is conditional rather than automatic: carbon pricing depends on the strength and coverage of the price signal and credible emissions administration; subsidy reform depends on the management of fiscal and distributional effects; and investment incentives depend on regulatory certainty, additionality, monitoring, and project bankability. The integrated assessment therefore emphasizes policy coherence, accountable implementation, and measurable environmental and social outcomes. In aviation and transport, these principles can inform policy design for sustainable aviation fuel, airport energy use, transport investment, and coordination with international aviation emissions mechanisms.

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7. CONFLICT OF INTEREST

The authors declare that there is no conflict of interest regarding the publication of this article. All authors have reviewed and approved the manuscript and take responsibility for its content, findings, and interpretations.

8. AI POLICY

The authors acknowledge the use of artificial intelligence (AI) tools to assist with language editing, grammar correction, improving sentence clarity, and organizing the manuscript. The use of these tools was limited to supporting the writing process and did not replace the authors' intellectual contributions, critical analysis, or scholarly judgment. AI tools were not credited as authors. The authors take full responsibility for verifying the accuracy and reliability of all content, data, citations, and references, and for ensuring the academic integrity of the manuscript. The use of AI tools complies with applicable ethical standards and SKYHAWK's publication policies.

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