Green Tax Policy as a Fiscal Instrument for Climate Transition: Comparative Analysis of Indonesia and Selected Countries

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Abstract. Growing climate risks and the EU CBAM, which enters its definitive phase in 2026, have increased pressure on ASEAN countries to establish credible carbon pricing policies. Despite this growing urgency, the design and implementation of green tax policies vary considerably across the region. This study compares the development of green tax in Singapore, Thailand, Indonesia, Malaysia, and Vietnam by examining policy design, institutional arrangements, implementation, and the factor shaping policy outcomes. A qualitative multiple case study approach was adopted, combining within case and cross case analyses to identify common patterns and differences across countries. The findings show that Singapore has developed the region's most advanced carbon pricing framework through a legally binding carbon tax supported by broad emissions coverage and complementary policy measures. Thailand and Vietnam are progressing toward emissions trading system, while Malaysia is preparing to introduce a sector specific carbon tax. Indonesia, despite being the largest carbon emitter in ASEAN, continues to implement one of the region's lowest carbon tax rates and has experienced limited activity in its domestic carbon market. Across the five cases, policy effectiveness is influenced not only by carbon tax rates but also by institutional readiness, regulatory certainty, emissions coverage, and the design of revenue recycling mechanism. External policy developments, particularly the EU CBAM, have also emerged as an important catalyst for accelerating domestic carbon pricing reforms. These findings suggest that strengthening institutional capacity, improving policy coherence, and expanding regional cooperation will be as important as increasing carbon prices in supporting effective climate mitigation across ASEAN.

Keywords: green tax policy; carbon pricing; ASEAN; emissions trading scheme; carbon border adjustment mechanism; multiple case study

1 Introduction

Southeast Asia (ASEAN) is currently facing two major structural challenges. On one side, the region continues to experience rapid economic expansion, while on the other it is becoming increasingly vulnerable to the impacts of climate change. This situation has elevated the role of green taxation as an important fiscal instrument for addressing environmental externalities by incorporating the environmental costs of polluting activities into taxation systems (OECD, n.d.). Previous empirical evidence further

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indicates that environmental taxes are associated with lower CO_2 emissions in both the short and long term, highlighting their potential contribution to strengthening national climate policy and supporting the broader implementation of green tax reforms across ASEAN (Shaikh, Amin, Shabbir, & Song, 2024).

From a global standpoint, ASEAN countries are facing growing external pressure following the implementation of the European Union's Carbon Border Adjustment Mechanism (CBAM), which will be fully enforced in 2026. Under this mechanism, exporters to the European market are expected to operate under a domestic carbon pricing system that is comparable to the EU's framework, otherwise, they will be subject to the CBAM levy. For export-oriented ASEAN economies, including Malaysia, Indonesia, Vietnam, and Thailand, this policy has created a strong economic incentive to establish credible domestic carbon pricing mechanisms in order to maintain their competitiveness in the European market (European Commission, n.d.; Shidiq, et al., 2024).

Despite facing similar external pressures, ASEAN countries have adopted markedly different approaches to green tax implementation. Singapore has implemented a legally binding carbon tax since 2019, whereas most neighboring countries are still developing their policies through planning, pilot programmes, or limited implementation. These differences reveal a gap in the existing literature, as few studies have provided a systematic comparison of green tax policies across ASEAN by examining their institutional arrangements, tax rates, policy coverage, and implementation outcomes within a consistent case study framework.

To address this gap, this study pursues three objectives. First, it examines the policy design and institutional architecture of green taxes in five ASEAN countries: Singapore, Thailand, Indonesia, Malaysia, and Vietnam. Second, it compares tax rates, policy coverage, and implementation effectiveness across these countries. Third, it identifies key factors that facilitate or hinder the implementation of green tax reforms in the region. These objectives also serve as the basis for the analytical framework applied throughout the discussion, allowing each country to be assessed using the same criteria and supporting a coherent cross-country synthesis.

2 Literature Review

2.1 Pigouvian Tax Theory and the Pricing of Environmental Externalities

Green tax, often referred to as an environmental tax, is a fiscal policy instrument that seeks to influence economic behavior by incorporating the environmental costs of economic activities into market prices. Its theoretical foundation originates from Pigouvian economics, which argues that governments can address market failures arising from negative externalities by imposing taxes that reflect the social costs generated by those activities (Pigou, 1920). In climate policy, this principle is commonly implemented through carbon pricing, where greenhouse gas emissions are assigned an economic value. Among the available carbon pricing instruments, a carbon tax is

regarded as the most straightforward approach because it establishes a fixed price for each tonne of carbon dioxide equivalent (tCO_2e) emitted (Metcalf, 2019).

2.2 Definition, Classification, and the Double Dividend Hypothesis

The Organization for Economic Co-operation and Development (OECD) defines environmental taxes as taxes whose bases are directly associated with activities or products that have adverse environmental impacts. These taxes may be imposed on a wide range of environmental tax bases, including energy products such as transport fuels, motor vehicles and transport services, emissions to air and water, ozone-depleting substances, waste generation, noise pollution, and the use of natural resources (OECD, n.d.). Consistent with this definition, the OECD, the International Energy Agency (IEA), and the European Commission describe environmentally related taxes as compulsory and unrequited payments to governments that are levied on tax bases considered environmentally relevant (OECD, 2010).

Green tax consists of several fiscal instruments, including carbon taxes, energy taxes, taxes on air and water pollution, and waste taxes. Although these instruments differ in their tax bases, they all aim to encourage more environmentally responsible behaviour by incorporating environmental costs into economic activities. The literature suggests that an effective green tax can produce both environmental and economic benefits, an idea commonly referred to as the double dividend hypothesis. Evidence reported by Freire González (2018), based on 69 simulations from 40 computable general equilibrium (CGE) studies, shows that about 55 percent of the simulations achieved this outcome. The environmental benefit, reflected in lower emissions, was consistently observed across most studies. In contrast, the economic benefit, such as higher efficiency, increased output, or improved employment, varied depending on how governments recycled tax revenues. Other studies using nonlinear dynamic models also indicate that environmental taxes contribute to sustainable development, particularly when they are supported by effective government policies, greater public awareness of environmental issues, and continuous technological progress (Fan, Li, & Yin, 2019).

From a climate policy perspective, carbon taxes are the most important subcategory of green taxes because they directly target greenhouse gas (GHG) emissions, the primary driver of climate change. A comparative study by Koppl and Schratzenstaller (2023) shows that carbon taxes have become the most widely studied climate policy instrument in the academic literature, with over 150 empirical studies analyzing their effectiveness across various national contexts from 1990 to 2023. (Köppl & Schratzenstaller, 2023).

2.3 Carbon Tax versus Emissions Trading Scheme: Choosing a Carbon Pricing Instrument

The literature on carbon pricing commonly classifies policy instruments into two broad categories: carbon taxes and emissions trading schemes (ETS). A carbon tax establishes a fixed price for each unit of carbon emissions while allowing the level of

emissions to respond to that price. In contrast, an ETS limits the total amount of emissions and allows the carbon price to emerge through trading in the market. Although both instruments pursue the same objective of reducing greenhouse gas emissions, their economic impacts depend on how each policy is designed and implemented. Evidence from general equilibrium studies in ASEAN suggests that policy design is as important as the level of the tax itself. For example, under a scenario targeting a 15 percent reduction in emissions, a carbon tax in Malaysia was estimated to reduce real GDP by about 1.4 to 1.5 percent, whereas an energy tax was associated with a slightly larger decline of 1.7 to 1.8 percent. These findings indicate that the choice of policy instrument and the allocation of tax revenues play an important role in determining overall economic outcomes (Nurdianto & Resosudarmo, 2016; Nguyen, Nong, Siriwardana, & Pham, 2023).

Beyond economic performance, the success of carbon pricing also depends on public acceptance. Research conducted by the Economic Research Institute for ASEAN and East Asia (ERIA) shows that public willingness to pay for carbon pricing differs substantially across ASEAN and East Asian countries. The study further indicates that acceptance is shaped not only by the additional financial burden imposed on households but also by whether the policy is perceived as fair and whether governments communicate clearly how tax revenues will be allocated and used (Muyasyaroh, Anbumozhi, Kalirajan, & Karthick, 2025).

3 Methods

3.1 Research Design

This research employs a qualitative multiple case study design to examine the implementation of green tax policies across ASEAN. A multiple case study is appropriate for investigating contemporary phenomena within their real-world settings, particularly when the boundaries between the phenomenon and its context are difficult to distinguish (Yin, 2018). This approach is well suited to green tax reform because policy design, institutional capacity, and domestic political and economic conditions interact closely in shaping policy implementation.

This research focuses on five ASEAN countries, namely Singapore, Thailand, Indonesia, Malaysia, and Vietnam. Each country is treated as an individual case and analysed separately before a cross case comparison is conducted. Following the replication logic proposed by Yin (2018), the cases are selected to examine similarities and differences in the design, implementation, and governance of green tax policies rather that to achieve statistical generalization.

Case selection was based on purposeful sampling, which is widely used in qualitative research to identifiy information rich cases that can provide meaningful insights into the research questions (Merriam, 2001; Yin, 2018). These five countries were chosen because they represent different stages of green tax development in ASEAN. Singapore has implemented a legally binding carbon tax, Thailand and Vietnam have

established legal frameworks while preparing for emissions trading, and Malaysia and Indonesia still face policy and implementation challenges.

3.2 Data Sources and Collection Procedures

As a qualitative case study, the evidence base of this research is drawn from multiple sources of evidence, in line with Yin's (2018) recommendation to strengthen construct validity through data triangulation (Yin, 2018). Data were collected through systematic document analysis, encompassing: (a) official legislative and regulatory documents in each country (laws, government regulations, presidential regulations, and ministerial decrees related to carbon pricing); (b) policy reports published by international and regional organizations (OECD, IEA, World Bank, ERIA, ASEAN Centre for Energy); (c) indexed peer-reviewed journal articles discussing the design and impact of green tax in each country and the region as a whole; and (d) official publications of domestic policy-implementing bodies (carbon exchange authorities, ministries of environment, and national climate change secretariats).

Merriam (2001) argues that documents are a highly valuable data source in qualitative case study research because they are stable, non-reactive to the presence of the researcher, and traceable, thereby enabling cross-source verification. Consistent with this principle, all documents used in this study were traced to their primary sources and systematically recorded in a case study database, as recommended by Yin (2018) to maintain a chain of evidence (Merriam, 2001; Yin, 2018).

3.3 Data Analysis Technique

Data analysis in this study follows the interactive qualitative data analysis framework developed by Miles, Huberman, and Saldaña (2014), which consists of three activities occurring simultaneously and iteratively: (1) data condensation, the process of selecting, focusing, and simplifying raw document data into thematic categories aligned with the three research objectives; (2) data display, the organization of condensed data into thematic matrices per country to facilitate systematic comparison; and (3) conclusion drawing and verification, the process of interpreting emerging patterns and verifying them against the source data (Miles, Huberman, & Saldana, 2014).

Operationally, data were coded into three main themes aligned with the research objectives: (a) policy design and institutional architecture, (b) rates, coverage, and implementation effectiveness, and (c) barriers and drivers of reform. Within-case analysis was conducted first for each of the five countries, producing the case profiles presented in Sections 4.1 through 4.5. Cross-case analysis was then conducted by juxtaposing thematic matrices across countries to identify patterns, similarities, and differences, presented in Section 4.6, following the approach recommended by Yin (2018) to strengthen external validity through replication logic (Creswell & Creswell, 2018; Yin, 2018).

3.4 Trustworthiness of the Data

To ensure the trustworthiness of the findings, this study applies a source-triangulation strategy, juxtaposing legislative documents, international organization reports, and academic journal articles for every substantive claim, as recommended in qualitative research design by Creswell and Creswell (2018). In addition, this study applies Yin's (2018) chain-of-evidence principle, ensuring that every conclusion in the discussion section can be traced back to the underlying data and documentary sources (Creswell & Creswell, 2018; Yin, 2018).

4 Results and Discussion

4.1 Green Tax in the ASEAN Context

Carbon emissions remain one of the main environmental challenges across ASEAN, making environmental tax reform an increasingly important policy instrument for supporting the achievement of Nationally Determined Contributions (NDCs) under the Paris Agreement. Despite growing policy interest, comparative studies that examine the design, tax rates, and policy coverage of carbon taxation across ASEAN are still limited, particularly when compared with the extensive literature on OECD and EU countries (Nguyen, Nong, Siriwardana, & Pham, 2023).

Recent evidence highlights the diversity of green tax approaches adopted within the region. Lin, Juchelkova, Štěpanec, Aye, and Adam (2026) compared developments in Indonesia, Singapore, and ASEAN more broadly using a narrative comparative synthesis. Their findings emphasise that policy harmonisation, innovative financing mechanisms, and greater transparency through digital technologies are essential for mobilising investment in the region's renewable energy transition (Lin, Juchelkova, Štěpanec, Aye, & Adam, 2026).

Similar conclusions are reported by the ASEAN Centre for Energy. Although several ASEAN countries have introduced or are preparing carbon pricing policies, their level of progress differs considerably. Brunei has taken early initiatives, Cambodia and Vietnam continue to develop their policy frameworks, while Thailand and Malaysia are exploring the introduction of carbon taxes and emissions trading schemes. However, implementation continues to face several challenges, including dependence on fossil fuels, limited financial resources, insufficient technical capacity, and underdeveloped market institutions (Rakhiemah, et al., 2024).

These differences reflect the diverse economic and institutional characteristics of ASEAN countries. Singapore represents a high-income economy driven largely by services and finance, whereas Indonesia and Vietnam have larger manufacturing and resource based sectors. This variation provides the basis for selecting the five countries examined in this study, as they represent different levels of fiscal capacity, institutional development, and green tax implementation. The following sections analyse each case using the same analytical framework, covering policy design and institutional arrangements, tax rates and policy coverage, implementation effectiveness, and the main barriers and enabling factors.

4.2 Singapore

Policy Design and Institutional Architecture of Green Tax

Singapore is the first ASEAN country to fully implement a carbon tax through legally binding legislation, making it region's most advanced example of green tax implementation. The Carbon Pricing Act (CPA), enacted by the Singapore Parliament in 2018, established the legal basis for the carbon tax, which came into effect on 1 Januari 2019. This marked the interlocution of the first operational carbon pricing system in ASEAN (National Climate Change Secretariat Singapore, n.d.).

Singapore's carbon tax framework goes beyond setting a tax rate and incorporates several institutional mechanisms that strengthen its implementation. One of these is the International Carbon Credit (ICC) Framework, introduced on 1 January 2024, which allows liable companies to offset up to 5 percent of their taxable emissions by purchasing high quality international carbon credits. Eligible credits must be certified under recognized standards, such as Gold Standard or Verra, and comply with Article 6 of the Paris Agreement (Chang, 2024). To reduce the risk of carbon leakage and maintain industrial competitiveness, Singapore also introduced the Transition Framework for Emissions Intensive Trade Exposed (EITE) companies. Through this framework, emissions intensive industries that complete in international markets may receive limited emissions allowances during the transition period (STX, 2023).

Table 1. The five pillars of the Singapore Green Plan 2030 (City in Nature, Sustainable Living, Energy Reset, Green Economy, and Resilient Future) as the institutional umbrella framework surrounding Singapore's carbon tax.

No	Pillar	Description
1	City in Nature	Create a green, liveable and sustainable hom for Singaporeans
2	Sustainable Living	Conservation of resources by consuming less, recycling more and taking more public transport
3	Energy Reset	Employment of clear energy and using it more efficiently
4	Green Economy	Enterprises seizing new opportunities in sustanibility and prepare Singaporeans to take on "green" jobs
5	Resilient Future	Resilient to adapt to climate change to ensure Singapore's long-term survival

Table 1 illustrates that Singapores's carbon tax is embedded within the broader framework of the Singapore Green Plan 2030 rather than being implemented as a standalone policy. The framework is built around five strategic pillars covering energy, buildings, transport, and education, allowing the carbon tax to complement other climate initiatives through a consistent carbon pricing signal. This integration reflects a policy approach that combines fiscal instruments with sector specific measures to support national climate objectives.

Carbon tax revenue is also channeled into several complementary programmes. Households receive support through the Household Utilities Credit to help offset higher energy costs, while the S$5 billion Future Energy Fund, announced in the 2024 Budget, finances the transition towards cleaner energy sources (National Climate Change Secretariat Singapore, n.d.). In addition to carbon pricing, Singapore has strengthened its climate governance by requiring listed companies on the Singapore

Exchange (SGX) to publish annual sustainability reports. Since 2024, these disclosures have been introduced in phases following the recommendations of the Task Force on Climate Related Financial Disclosures (TCFD).

Rates, Coverage, and Implementation Effectiveness

Singapore introduced its carbon tax at an initial rate of S$5 per tCO2e for the 2019 to 2023 period. Rather than aiming for an immediate reduction in emissions, the initial rate was intended to give industries time to adjust their business models, strengthen emissions accounting systems, and prepare decarbonizations strategies (Habibah, 2023). According to Tseng (2022), the relatively low tax rate generated only limited behavioral change during the early years of implementation. However, it played an important role in establishing the institutional foundations needed for future policy expansion. During this period, Singapore strengthened its monitoring, reporting, and verification (MRV) system, developed national carbon registry, and established a compliance framework with relatively limited resistance from industry (Tseng, 2022).

Table 2. Schedule of Singapore's carbon tax rate increases, 2019-2030, from S$5/tCO2e to S$50-80/tCO2e.

Year	Carbon Tax Rate
2019-2023	S$5/$tCO_2e$
2024	S$25/$tCO_2e$
2026	S$45/$tCO_2e$
2030	S$50-80/$tCO_2e$

Table 2 illustrates Singapore’s long term carbon tax roadmap, reflecting a gradual and predictable increase in tax rate over time. Rather than introducing a high carbon price from the outset, the government adopted a phased approach that provided industries with time to strengthen their preparedness before higher tax rates were introduced. This sequencing suggest that policy credibility and regulatory certainty were considered as important as the tax rate itself, allowing businesses to adjust investment decisions and decarbonizations strategies over the longer term.

The broad coverage of Singapore’s carbon tax further reinforces the effectiveness of this policy framework. According to the OECD (2024) report, 86.3 percent of the country's greenhouse gas emissions in 2023 were subject to a positive Effective Carbon Rate (ECR), while the carbon tax directly covered around 77 percent of total emissions. Such extensive coverage reduces the risk of carbon leakage across sectors and provides a more consistent carbon price throughout the economy (OECD, 2024).

Evidence from a city level computable general equilibrium (CGE) model also suggest that implementing a domestic carbon tax is more cost effective than relying on border carbon adjustments imposed by trading partners. Although the model projects a short term reduction in real GDP of between 0.008 and 0.52 percent by 2030, these economic effects are expected to diminish as Singapore’s economy continues its transition towards a lower carbon development pathway (Li & Su, 2017).

Barriers and Drivers of Successful Reform

Several factors have contributed to the successful implementation of Singapore's carbon tax. A strong legal foundation has been in place since the enactment of the Carbon Pricing Act in 2018, providing regulatory certainty for businesses. This has been supported by a clear and predictable schedule of tax rate increases, broad emissions coverage across sectors, and revenue recycling measures such as the Household Utilities Credit and the Future Energy Fund, which help maintain public support for the policy.

Despite these strengths, several challenges remain. The planned increase in carbon tax rates towards 2030 may place greater pressure on emissions intensive and trade exposed industries, particularly in maintaining their international competitiveness. In addition, Singapore's reliance on international carbon credits through the International Carbon Credit (ICC) Framework means that the effectiveness of this mechanism will continue to depend on the environmental integrity and governance of Article 6 under the Paris Agreement.

4.3 Thailand

Policy Design and Institutional Architecture of Green Tax

Thailand has made substantial progress in developing its carbon pricing framework and is emerging as one of the leading countries in ASEAN after Singapore. A key milestone is the draft Climate Change Act, which provides the legal basis for introducing a carbon tax, establishing an emissions trading system (ETS), and creating a national institution to oversee climate policy. Although the draft has been approved, the ETS has not yet been fully enacted because it still requires parliamentary approval and an official implementation timeline has not been confirmed (Lo, 2025).

The proposed ETS combines elements of both cap and trade and baseline and credit systems. Under this framework, emission allowances are allocated through five-year allocation plans, while regulated entities may use certified voluntary carbon credits to meet up to 15 percent of their compliance obligations (Suttiprasit, 2026).

Alongside these regulatory developments, Thailand has already established the Thailand Voluntary Emission Reduction Program (T VER), which is administered by the Thailand Greenhouse Gas Management Organization (TGO). The programme encourages participation from businesses and other stakeholders in voluntary greenhouse gas emission reduction projects, allowing certified emission reductions, known as TVERs, to be traded in the domestic voluntary carbon market (Greenhouse Gas Mitigation Mechanism, 2016).

Rates, Coverage, and Implementation Effectiveness

Thailand plans to begin implementing its emissions trading system (ETS) in 2029, with allocation plans scheduled for publication at least one year before the start of each compliance period (Suttiprasit, 2026). The proposed framework allows regulated entities to meet up to 15 percent of their compliance obligations through carbon offsets. This threshold is higher than the 10 percent limit proposed in an earlier par-

liamentary draft, reflecting a stronger emphasis on implementation flexibility while maintaining the overall objectives of emissions reduction.

Thailand has also expanded its international cooperation through a bilateral partnership with Singapore under Article 6.2 of the Paris Agreement. As the first Implementation Agreement of its kind in Southeast Asia, the partnership is expected to create additional financing opportunities for domestic carbon projects and strengthen Thailand's position in the regional carbon market (Fairatmos, 2025; Kesavawong, 2024).

Table 3. Key takeaways from the Singapore-Thailand carbon credit agreement and its implications for ASEAN carbon market cooperation.

No	Key Takeaways	Description
1	First ASEAN IA under Article 6.2	This is the first time Singapore has signed an Implementation Agreement in Southeast Asia. It establishes a framework for credit transfers between the two nations.
2	Boost for Regional Collaboration	The agreement paves the way for the others ASEAN countries such as Vietnam, Indonesia, Malaysia, and Cambodia to consider similar partnerships. A more connected regional carbon market could increase liquidity and credibility.
3	Support for Net Zero Pathways	By enabling cross-border carbon credit trading, the deal provides both countries with additional tools to meet their climate commitments while channeling funds into real climate projects.
This agreement signals the start of more structured carbon market in ASEAN. While individual countries like Indonesia and Malaysia have been exploring domestic carbon pricing and project development, regional collaboration has been slower to take shape. The Singapore – Thailand deal could serve as a blueprint for others. It shows that ASEAN nations can align under Article 6.3, share benefits, and create a pipeline of high-quality, verifiable carbon credits that not only serve compliance needs but also attract international investment. For businesses, this development means new opportunities. Companies across the region can participate in or benefit from carbon projects that generate co-benefits sucha as: - Restoring degraded ecosystems - Supporting local communities with new income streams - Enhancing biodiversity conservation - Driving investment into sustainable land use and renewable energy		

Table 3 highlights the broader significance of the Singapore and Thailand carbon credit agreement beyond bilateral cooperation. As the first Implementation Agreement established under Article 6.2 of the Paris Agreement in Southeast Asia, the initiative represents an important milestone in the development of regional carbon market governance. The agreement demonstrates how cross border cooperation can support carbon credit transfers while strengthening institutional arrangements for international carbon markets.

The partnership also has wider implications for other ASEAN countries. It provides a practical reference for economies that are developing domestic carbon pricing systems, including Indonesia, Malaysia, Vietnam, and Cambodia. As more countries

establish compatible regulatory frameworks, opportunities for regional carbon market integration and investment in high quality carbon projects are expected to expand.

Beyond facilitating compliance with national climate commitments, stronger regional cooperation could increase investment in projects that deliver environmental and social benefits. These include ecosystem restoration, biodiversity conservation, sustainable land use, renewable energy development, and new income opportunities for local communities. In general, the Singapore and Thailand partnership illustrates how institutional cooperation can accelerate the development of ASEAN's carbon market while supporting the region's long term climate objectives.

Barriers and Drivers of Successful Reform

Evidence from Thailand suggests that the economic effects of carbon taxation depend not only on the tax itself but also on the accompanying compensation measures. Wattanakuljarus (2019) found that a carbon tax designed to support a 20 percent reduction in emissions by 2030 could lower social welfare and household consumption as higher production costs increase commodity prices and reduce labour and capital income. The study also shows that the distributional impacts vary across income groups, with targeted social transfers playing an important role in protecting low-income households. However, compensation is effective only when it is well targeted and supported by policies that strengthen the absorption of labor and capital into productive sectors (Wattanakuljarus, 2019).

In general, Thailand's progress is supported by strong legislative commitment and expanding regional cooperation. At the same time, uncertainty over the implementation timeline of the emissions trading system and the potential distributional effects of carbon pricing remain important challenges for future policy implementation.

4.4 Indonesia

Policy Design and Institutional Architecture of Green Tax

Indonesia has established the legal foundation for green tax through a series of interconnected regulations. Law No. 32 of 2009 on Environmental Protection and Management provides the overarching legal framework, followed by Government Regulation No. 46 of 2017, which introduces environmental economic instruments. This framework was further strengthened through Presidential Regulation No. 98 of 2021 on Carbon Economic Value (Nilai Ekonomi Karbon or NEK), which sets out Indonesia's carbon pricing system, including the emissions trading scheme (ETS). The legal basis for carbon taxation was subsequently incorporated into Law No. 7 of 2021 on the Harmonization of Tax Regulations (HPP), establishing an initial carbon tax rate of Rp30 per kilogram CO_2e, or approximately US$2 per tCO_2e.

Another important milestone was the launch of the Indonesia Carbon Exchange (IDXCarbon) on 26 September 2023 under the supervision of the Financial Services Authority (OJK). The platform is intended to support Indonesia's carbon pricing framework by facilitating emissions trading, voluntary carbon market transactions,

and other carbon credit mechanisms within a single national marketplace (Otoritas Jasa Keuangan, 2024).

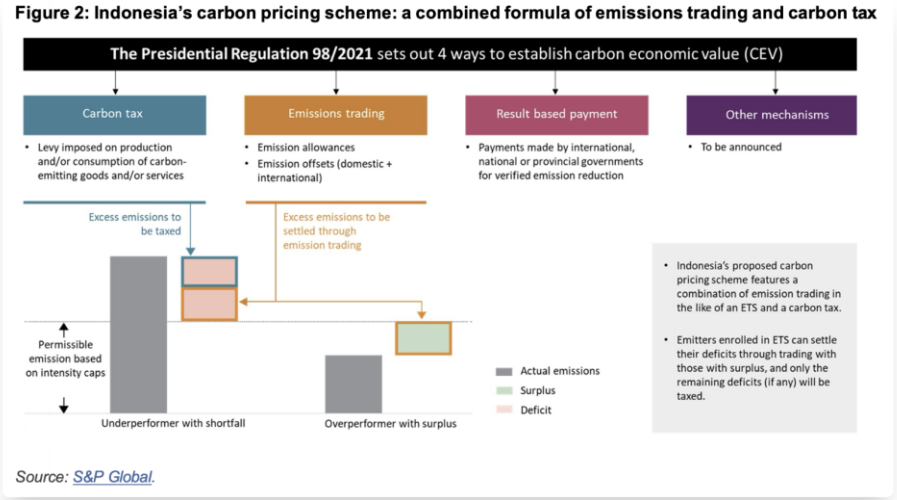


Fig 1. Indonesia's hybrid carbon pricing scheme under Presidential Regulation 98/2021, combining carbon tax and emissions trading (cap-and-trade).

Figure 1 illustrates Indonesia's carbon economic value framework under Presidential Regulation No. 98 of 2021. The regulation establishes four policy instruments comprising carbon tax, emissions trading, result based payments, and other carbon pricing mechanisms. Within this framework, entities that exceed their emissions cap may first meet their obligations by purchasing allowances from entities with surplus emissions. A carbon tax is imposed only on any remaining emissions after the trading mechanism has been exhausted. This arrangement provides regulated entities with considerable flexibility in meeting their compliance obligations. However, its effectiveness depends on the stringency of the emissions cap, as a generous allocation of allowances may weaken the carbon price signal in practice.

Rates, Coverage, and Implementation Effectiveness

Indonesia has set its carbon tax at Rp30,000 per tCO2e (approximately US$2.02 per tonne), substantially lower than the initial proposal of Rp75,000 per tCO_2e (Setiawan, Zahari, Purba, Moeis, & Hidayatno, 2022). Compared with carbon pricing adopted in many other jurisdictions, this rate remains relatively low. Existing studies suggest that Indonesia would require a carbon price of around US$36 to US$43.78 per tCO_2e to achieve its emission reduction commitments under the Paris Agreement. At the current level, the carbon tax is estimated to reduce emissions by only about 1.5 percent, indicating that its environmental impact is likely to remain limited without further adjustments to the tax rate (Isoaho, Goritz, & Schulz, 2017; Dissanayake, Mahadevan, & Asafu-Adjaye, 2020; Kamandika & Dhakal, 2023).

Indonesia's carbon market is currently limited to coal fired power plants (PLTU), with 245 registered participants representing a combined installed capacity of 54 GW.

Emissions caps are regulated under Ministerial Decree No. 14.K/TL.04/MEM.L/2023, which sets different thresholds according to power plant type and generating capacity. The allowable emissions range from 1.297 tCO2e/MWh for plants with a capacity of 25 to 100 MW to 0.911 tCO2e/MWh for non-mine mouth plants exceeding 400 MW. Although this framework provides a basis for emissions trading, the current thresholds remain relatively generous. As a result, only a limited number of facilities exceed their allocated emissions caps, reducing demand for carbon credits and carbon tax payments. This situation weakens the carbon price signal and limits incentives for emissions reduction (Yustika, 2025).

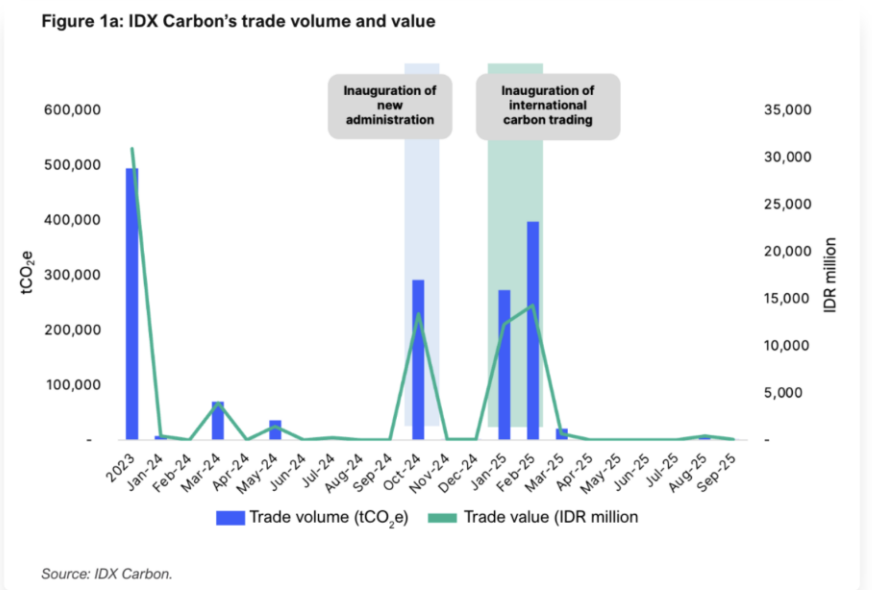


Fig 2. IDXCarbon trade volume and value, 2023-2025.

Figure 2 indicates that trading activity on IDXCarbon has remained inconsistent since its launch. Transaction volumes increased during several key policy events, including the market's initial launch, the inauguration of a new administration, and the introduction of international carbon trading. Outside these periods, however, trading activity remained very limited, suggesting that the market has yet to achieve sustained participation.

This pattern is consistent with the overall performance of IDXCarbon. By 2025, cumulative transaction values had reached only around Rp78 billion (approximately US$4.9 million), with eight registered projects and 132 active participants. Compared with more established carbon markets, Indonesia's market remains relatively small. The European Union Emissions Trading System (EU ETS) includes more than 11,000 regulated participants and covers around 40 percent of regional greenhouse gas emissions, while Japan's GX ETS, introduced in 2024, had already attracted around 700 participants and is expected to expand further as mandatory participation is phased in from 2026 (Timorria, 2025; Yustika, 2025).

Barriers and Drivers of Successful Reform

Indonesia presents a notable contrast in the ASEAN carbon pricing landscape. Despite being the region's largest emitter of carbon dioxide, with emissions from the fossil fuel and industrial sectors reaching 812 million tonnes in 2024, the country continues to apply a relatively low carbon tax and a carbon pricing system that remains fragmented (Nabila, 2026; worldometer, 2024). At the same time, Indonesia is among the ASEAN countries most vulnerable to the impacts of climate change. Although the carbon tax was originally scheduled to take effect on 1 April 2022, its implementation has been postponed several times because of delays in developing the domestic carbon market and broader economic considerations (Nugraha, 2022).

Several structural challenges continue to slow the implementation of green tax policies. Existing regulations, including Ministerial Regulation No. 50/2017, limit the economic attractiveness of renewable energy investment by capping electricity prices, reducing incentives for private sector participation (Sulaiman, 2019). Indonesia also continues to face difficulties in mobilising large scale international investment to support its energy transition (Institute for Energy Economics and Financial Analysis , 2024).

Similar implementation challenges are identified by Yudhanto and Murwendah (2025), who found that although green tax provisions within the Motor Vehicle Tax (PKB) and Motor Vehicle Fuel Tax (PBBKB) are broadly consistent with environmental tax principles, their implementation is constrained by relatively low tax rates, limited transparency in the use of tax revenue, and uneven institutional capacity across local governments. These findings suggest that strengthening revenue allocation and improving local implementation capacity remain important priorities for future green tax reform(Yudhanto & Murwendah, 2025).

4.5 Malaysia

Policy Design and Institutional Architecture of Green Tax

Malaysia is entering a new phase in the development of its climate policy. The country has committed to achieving net zero emissions by 2050 and reducing greenhouse gas emission intensity by 45 percent by 2030 relative to 2005 levels under its Nationally Determined Contribution (NDC) to the Paris Agreement. A major step towards these targets was announced in Budget 2025, which introduced plans to implement a carbon tax on the iron, steel, and energy sectors beginning in 2026 (energynews.pro, n.d.).

Recent research also highlights the growing importance of carbon taxation within Malaysia's climate policy framework. Abdullah and Mustafa (2025), through a comparative analysis of carbon tax legislation in several countries, argue that a well-designed carbon tax could provide an effective legal instrument for reducing greenhouse gas emissions while supporting Malaysia's transition towards a low carbon economy (Abdullah & Mustafa, 2025).

Rates, Coverage, and Implementation Effectiveness

Achieving Malaysia's net zero target will require substantial investment, with estimated financing needs ranging from MYR 435 billion to MYR 1.85 trillion. Previous studies suggest that meeting this requirement will depend on a combination of effective carbon pricing policies and the continued expansion of green finance (Fairatmos, 2025; Trexon Energy, n.d.). At present, the government has confirmed that the proposed carbon tax will initially apply to the iron, steel, and energy sectors. However, key aspects of the policy, including the tax rate, sectoral coverage, and collection mechanism, have yet to be formally announced and are expected to be clarified through Budget 2026 (Yong, 2025).

As these design features remain under development, the effectiveness of Malaysia's carbon tax cannot yet be evaluated. The analysis presented in this study therefore focuses on the country's policy direction and institutional readiness rather than implementation outcomes.

Barriers and Drivers of Successful Reform

Malaysia's progress towards carbon pricing is driven largely by external policy developments, particularly the European Union's CBAM, which enters its definitive phase in January 2026. Malaysian exporters in carbon intensive sectors, including steel, aluminium, cement, fertiliser, electricity, and hydrogen, are expected to be directly affected by the new carbon certificate requirements based on the emissions embodied in their products (Yong, 2025).

Despite this growing external pressure, considerable policy uncertainty remains. While the government has announced plans to introduce a carbon tax, it has not yet clarified whether an emissions trading system (ETS) will be developed alongside it. The absence of a clear long term policy framework creates uncertainty for businesses as they plan future investment and compliance strategies (Yong, 2025).

4.6 Vietnam

Policy Design and Institutional Architecture of Green Tax

Vietnam has adopted environmental taxation for more than a decade through the Environmental Protection Tax (EPT), which came into effect in 2012. Unlike a carbon tax, the EPT is an excise-based tax applied to a range of environmentally harmful products, including petrol, diesel, kerosene, coal, plastic bags, herbicides, and pesticides. Since 2019, the tax on petrol has been set at VND 4,000 per litre (LuatVietnam, n.d.; Viet Nam News, 2018).

Building on this existing framework, Vietnam is preparing to introduce an emissions trading system (ETS) as its primary carbon pricing instrument. According to the current roadmap, implementation is expected to begin in 2027 after the completion of the greenhouse gas inventory and monitoring, reporting, and verification (MRV) system development phase scheduled for 2022 to 2026 (International Carbon Action Partnership, 2025; Timorria, 2025).

Rates, Coverage, and Implementation Effectiveness

Vietnam has experienced one of the fastest increases in carbon emissions in ASEAN. Emissions more than doubled over the past two decades, rising from around 175 million tonnes to 371 million tonnes CO2e in 2024 (McCulloch, Cordon-Navarro, Duong, & Dünnenberger, 2026; VOAIndonesia, 2019). Despite this trend, evidence suggests that environmental taxation can be expanded without imposing excessive burdens on households. Using data from the 2020 Vietnam Household Living Standards Survey and an input output approach, Quynh, Quoc, Ngoc, and Thu (2023) found that although the Environmental Protection Tax (EPT) increased fuel prices, its overall effect on household welfare remained relatively modest. The study further suggests that Vietnam has scope to strengthen environmental taxation or introduce a carbon tax, provided that appropriate compensation measures are in place (Quynh, Quoc, Ngoc, & Thu, 2023).

Similar findings emerge from studies on Vietnam's proposed emissions trading system. Nguyen (2024) estimated that achieving a 15.8 percent reduction in carbon emissions through an ETS could reduce GDP by 3.7 percent and lower welfare by 2.89 percent of GDP. However, these economic costs can be moderated through effective revenue recycling. The study shows that returning ETS revenues through reductions in income tax generates greater welfare gains than allocating the revenues to general government expenditure (Nguyen P. T., 2024).

Barriers and Drivers of Successful Reform

Vietnam's progress in developing carbon pricing is supported by more than a decade of experience with the Environmental Protection Tax (EPT), which has strengthened the country's institutional and administrative capacity for future policy expansion. Do and Burke (2021) argue that carbon pricing introduced at a relatively low level and increased gradually could help Vietnam achieve its Nationally Determined Contribution (NDC) targets. Their analysis also suggests that a carbon tax offers greater administrative simplicity, whereas an emissions trading system (ETS) may be more politically acceptable. In addition, auctioning emission allowances is considered more effective than free allocation because it generates public revenue while maintaining a relatively straightforward implementation process. However, the effectiveness of either instrument ultimately depends on the stringency of the emissions cap, as an overly generous cap could weaken the intended environmental outcomes (Do & Burke, 2021).

Evidence from more recent research further supports the role of environmental fiscal policies in Vietnam's low carbon transition. Using data from 2012 to 2022, Trang, Chi, Nhi, and Hong (2024) found that both green finance and environmental taxation contribute positively to sustainable development. Despite these encouraging findings, Vietnam continues to face the challenge of rapidly increasing emissions, while the expansion of carbon pricing remains gradual. The Environmental Protection Tax has yet to be substantially strengthened, and the planned ETS is still in the preparation

phase, limiting its contribution to emissions reduction at present (Trang, Chi, Nhi, & Hong, 2024).

4.7 Comparative Cross-Case Synthesis

Following the cross-case analysis procedures proposed by Yin (2018) and Miles, Huberman, and Saldaña (2014), Table 4 presents a comparative overview of the five ASEAN countries examined in this study. The comparison is organized around the three analytical dimensions applied consistently throughout the analysis: policy design and institutional architecture, carbon pricing and emissions coverage, and the main implementation challenges.

Table 4. Comparative Cross-Case Synthesis

Country	Policy instrument and Status	Carbon Pricing	Coverage	Main Challenge
Singapore	Carbon tax in force since 2019	S$45/tCO₂e (2026), increasing to S$50–80 by 2030	Around 77% of national GHG emissions	Maintaining industrial competitiveness while increasing carbon prices
Thailand	ETS under development with T-VER operating voluntarily	ETS planned for 2029	Voluntary market; mandatory ETS not yet implemented	Regulatory certainty and implementation timeline
Indonesia	Carbon tax and National Carbon Economic Value (NEK) framework	Rp30,000/tCO2e (US$2)	Limited to coal-fired power plants	Low tax rate, generous emissions cap, and limited market activity
Malaysia	Carbon tax announced for 2026	Rate not yet announced	Initial coverage planned for iron, steel, and energy sectors	Policy design remains under development
Vietnam	Environmental Protection Tax (EPT) in place since 2012; ETS planned	EPT on environmentally harmful products; ETS targeted for 2027	Fuel products and selected environmentally harmful goods	Rapid emissions growth and limited carbon pricing coverage

A comparison across the five cases reveals substantial differences in the maturity of carbon pricing policies across ASEAN. Singapore represents the region's most advanced system, having established a legally binding carbon tax supported by complementary measures such as international carbon credit utilisation, revenue recycling, and mandatory climate disclosure. Vietnam also benefits from a relatively mature institutional foundation through its Environmental Protection Tax, although its transi-

tion towards emissions trading is still underway. In contrast, Malaysia remains at an earlier stage, with the proposed carbon tax yet to move beyond broad policy commitments into a fully defined regulatory framework.

The analysis also highlights considerable variation in carbon prices and emissions coverage. Singapore currently applies the highest explicit carbon price in ASEAN and has announced a transparent schedule for future rate increases, providing greater policy certainty for regulated entities. Indonesia represents the opposite end of the spectrum. Although it has established the legal basis for carbon pricing through the National Carbon Economic Value framework, implementation remains limited by a relatively low carbon tax, restricted sectoral coverage, and modest trading activity within IDXCarbon. Thailand and Vietnam occupy an intermediate position, with both countries focusing on expanding institutional capacity before fully implementing mandatory emissions trading systems.

Despite these differences, several common trends emerge across the five cases. First, institutional readiness appears to play a more important role than the carbon tax rate alone. Countries that invested earlier in emissions monitoring, reporting, verification (MRV), legal frameworks, and market institutions have made more consistent progress in implementing carbon pricing. Second, external policy developments have become an increasingly important catalyst for domestic reform.

The European Union's CBAM, together with growing cooperation under Article 6 of the Paris Agreement, has strengthened incentives for ASEAN countries to accelerate the development of credible carbon pricing mechanisms. Finally, many implementation challenges remain shared across the region. Regulatory fragmentation, limited emissions coverage, uncertainty over future policy design, and the need for more effective revenue recycling continue to constrain the effectiveness of green tax reforms, even in countries where implementation has already begun.

In general, the comparison suggests that the effectiveness of green tax reform depends not only on the level of carbon pricing, but also on the broader institutional environment in which the policy operates. Stable legal frameworks, credible long-term policy commitments, well-developed carbon market infrastructure, and transparent use of carbon revenues appear to be equally important in determining the success of carbon pricing across ASEAN.

5 Conclusion and Recommendations

This study demonstrates that the development of green tax policies across ASEAN remains highly uneven. While all five countries recognise carbon pricing as an important instrument for supporting climate mitigation, they differ substantially in institutional readiness, policy design, implementation, and market maturity. Singapore has established the region's most comprehensive carbon pricing framework through a legally binding carbon tax supported by complementary measures such as revenue recycling, international carbon credit utilisation, and mandatory climate disclosure. At the other end of the spectrum, Indonesia and Malaysia continue to face significant implementation challenges, although both countries have begun laying the legal and

institutional foundations for future carbon pricing. Thailand and Vietnam occupy an intermediate position, with ongoing efforts to expand their institutional capacity before fully implementing emissions trading systems.

The comparative analysis also highlights that differences in policy outcomes cannot be explained by carbon tax rates alone. Institutional capacity, regulatory certainty, and the credibility of long-term policy commitments appear to play an equally important role in shaping implementation. Across the five cases, Singapore combines relatively broad emissions coverage with a transparent schedule for carbon tax increases, whereas Indonesia continues to operate a low carbon tax with limited sectoral coverage. Malaysia and Thailand are still refining their policy frameworks, while Vietnam is building on its long-standing Environmental Protection Tax as it prepares for the introduction of an emissions trading system. These findings suggest that successful green tax reform depends on the interaction between policy design, institutional preparedness, and implementation capacity rather than on a single fiscal instrument.

Several common drivers and challenges also emerge from the cross-case comparison. External policy developments, particularly the European Union's CBAM, have become an important catalyst for accelerating carbon pricing reforms across ASEAN. Regional cooperation under Article 6 of the Paris Agreement further supports the development of carbon markets and cross border carbon credit mechanisms. At the same time, recurring challenges remain evident across the region, including fragmented regulatory frameworks, relatively low carbon prices, limited emissions coverage, and uncertainty surrounding long term policy implementation.

These findings have several policy implications. Countries that have already introduced carbon pricing, particularly Indonesia, would benefit from a gradual and predictable increase in carbon tax rates supported by a transparent implementation roadmap and stronger market infrastructure. For Malaysia and Thailand, establishing regulatory certainty and communicating a clear implementation timeline should become immediate priorities to improve business confidence and investment planning. At the regional level, closer ASEAN cooperation would help strengthen monitoring, reporting, and verification (MRV) standards, improve the integrity of carbon credit markets, and enhance interoperability across national carbon pricing systems. Such coordination would also improve ASEAN's collective preparedness in responding to external policy instruments such as the European Union's CBAM.

This study is subject to several limitations. The analysis is based primarily on qualitative document review and therefore reflects the availability and quality of public information at the time the research was conducted. Consequently, the findings are intended to provide analytical rather than statistical generalisation. Future studies could strengthen the evidence base by incorporating quantitative approaches, mixed methods, or interviews with policymakers and other stakeholders to better understand the political, institutional, and economic factors influencing green tax reform across ASEAN.

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