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Carbon Pricing in Asia: Examining Emissions Trading Systems and Carbon Taxes

Aligning carbon pricing mechanisms, price levels, and policy reforms helps meet decarbonization goals

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Contents

Key Findings 4
Executive Summary 5
Introduction 6
Types of Carbon Pricing 6
  Carbon Tax 7
  Emissions Trading System (ETS) 7
  Carbon Crediting Mechanism 8
  Differences and Suitability 9
Carbon Pricing in Asia 11
  ETS: China, South Korea, Kazakhstan, and Indonesia 12
  Carbon Tax: Japan and Singapore 13
  Carbon Tax/ETS Under Development: Thailand, Malaysia, Taiwan, and Vietnam 13
Carbon Prices Remain Too Low to Support Decarbonization 14
Aligning Carbon Prices with Marginal Abatement Costs 16
Barriers to Effective Carbon Pricing 18
  Allocation Method 19
  Limited and Uneven Sectoral Coverage 20
  Inadequate Targets 23
  Fossil Fuel Subsidies 26
Room for Proactive Policies to Advance Decarbonization and Reduce Poverty 28
The Role of Voluntary Carbon Markets (VCMs) in Compliance Systems 29
Conclusion 31
Appendices 33
  National Level ETS 33
  Local Level ETS 37
  Carbon Tax 40
About IEEFA 41
About the Authors 41

Figures and Tables

Figure 1: Asia Contributes Over Half of Global GHG Emissions 11
Figure 2: Existing ETSs and Carbon Taxes in Asia 12
Figure 3: ETS and Carbon Tax Price Trends in Asia (2015–2025) 15
Figure 4: Marginal Abatement Cost Range 17
Figure 5: Allocation Method of Existing ETSs in Asia 19
Figure 6: Global GHG Emissions by Sector (Based on 2023 Emissions) 21
Figure 7: Sector Share of Global GHG Emissions Covered by an ETS and/or Carbon Tax 21
Figure 8: Percentage of National GHG Emissions Covered by an ETS and/or Carbon Tax in Asia 22
Figure 9: Trends of EU ETS Overall Cap and Linear Reduction Factor 24
Figure 10: Trends of South Korea’s ETS Overall Cap 25
Figure 11: Trends of Kazakhstan’s ETS Overall Cap 25
Figure 12: Calculating an Effective Carbon Rate 27
Table 1: Carbon Tax and Emissions Trading System Comparison 11
Table 2: Fossil Fuel Subsidies in Asia 27
Table 3: Voluntary Carbon Credits in Regulatory Carbon Pricing Schemes 30

Key Findings

Carbon pricing can steer countries toward low-emission pathways and generate revenue for environmental and social needs. Several Asian nations have established carbon taxes or emissions trading systems, but prices remain below USD20 per tonne of carbon dioxide equivalent (tCO_2e) — far short of the USD50–USD100/tCO_2e needed by 2030 to meet climate goals.

The oversupply of emissions allowances, stemming from overly generous allocation, hinders the effectiveness of Asia's carbon markets. Carbon prices remain low due to allocations favoring fossil fuel-intensive firms, limited sectoral coverage, weak targets (based on intensity rather than actual emissions), and persistent fossil fuel subsidies.

A phased carbon price starting at USD15–USD25/tCO_2e, with predictable annual increases of USD10–USD15/tCO_2e, can provide investment certainty and support long-term decarbonization. In addition to incentivizing low- and zero-emission technologies, revenue from carbon pricing instruments can also fund regional climate initiatives.

Eliminating fossil fuel subsidies could strengthen Asian carbon markets. Savings could be redirected to fund climate projects and social safety nets, and offset energy costs for lower-income households.

Executive Summary

Carbon pricing is based on the principle that emitters should pay for the damage caused by their greenhouse gas (GHG) emissions. Asia accounts for over 50% of annual GHG emissions, and faces critical challenges in creating carbon pricing mechanisms to drive decarbonization and help meet climate goals. Although several Asian countries have established carbon taxes or emissions trading systems (ETSs), the prices are still far lower than the estimated USD50–USD100 per tonne of carbon dioxide equivalent (tCO_2e) required by 2030 to meet the targets of the Paris Agreement. Current regional prices remain below USD20/tCO_2e, which is too low to achieve significant emission reductions or encourage substantial investment in clean technologies.

Various challenges hinder the efficiency and effectiveness of Asia's carbon markets. The main issue is the oversupply of allowances, driven by overly generous allocation methods, limited sectoral coverage that reduces participation and demand, unambitious targets, and the persistence of fossil fuel subsidies. In the initial phases of their ETS implementation, countries like China and South Korea have generously allocated free allowances, leading to a market surplus and reduced prices. This contrasts with the European Union (EU), which has increasingly moved towards auctioning more than 50% of its allowances. Another challenge is the limited sectoral coverage of these schemes. Most carbon pricing systems concentrate on the power sector, leaving significant emissions from buildings, agriculture, and transportation largely unpriced. China is broadening its ETS to include heavy industry, and South Korea's system covers over 70% of national emissions. However, a comprehensive, economy-wide application is still absent.

Additionally, many systems set unambitious targets. For example, China's national ETS uses an intensity-based cap, limiting emissions per output unit, rather than setting an absolute cap on total emissions. This design increases total emissions as the economy grows, is less effective, and more costly than the absolute caps utilized by the EU and South Korea. Pervasive fossil fuel subsidies, which actively work against carbon price signals, compound the problem. In 2022, these subsidies amounted to USD1.25 trillion globally. The East Asia and Pacific regions had the largest subsidy share, undermining the financial incentive to decarbonize.

According to studies examining sectoral marginal abatement costs, a wide range of carbon prices could drive decarbonization. A multifaceted strategy is necessary to transform carbon pricing into an effective decarbonization tool. Policymakers should adopt a phased yet ambitious approach, starting with a modest carbon price of USD15–USD25/tCO_2e and then implementing a predictable annual increase of USD10–USD15/tCO_2e for investment certainty. This should be accompanied by eliminating fossil fuel subsidies, with savings redirected to climate projects and social safety nets (such as universal cash transfers), to protect vulnerable households from rising energy costs. Studies indicate that recycling carbon revenue in this way can make carbon pricing a progressive policy that reduces poverty and inequality.

Introduction

Carbon pricing assigns a monetary value to the emission of carbon dioxide (CO_2) and other greenhouse gases (GHG) that cause environmental damage and may not otherwise be economically incorporated. This method can help reduce emissions by increasing the cost of carbon-intensive activities. When appropriately designed and priced, carbon pricing is one of the most effective tools for steering countries toward low-emission pathways. It obliges emitters to pay for their carbon emissions. Such pricing is implemented through an emissions trading system (ETS) or a carbon tax. The revenue generated can also fund climate mitigation and adaptation efforts that advance net-zero targets.

Finland introduced the world's first carbon tax in 1990[1], pioneering market-based tools to address climate change by directly pricing emissions. That same year, the United States (US) launched the Acid Rain Program under the Clean Air Act, marking the first large-scale cap-and-trade system aimed at reducing sulfur dioxide and nitrogen oxide emissions from the power sector.[2] In 2005, the European Union (EU) established its Emissions Trading System (EU ETS), the world's first significant and long-standing carbon market. The EU ETS covers key sectors and has become a global benchmark for carbon trading schemes.

Currently, there are 80 mandatory carbon pricing mechanisms (43 carbon taxes and 37 ETSs) worldwide, operating at either national, subnational, or regional levels.[3] These collectively covered nearly 13 gigatonnes of CO_2 equivalent or approximately 28% of global GHG emissions.[4] In Asia, these markets exist in China (a national ETS and eight subnational pilot ETSs across two cities and six provinces), Kazakhstan (national ETS), Japan (a national carbon tax and two subnational ETSs), South Korea (national ETS), Singapore (national carbon tax), and Indonesia (national ETS and a carbon tax).

Types of Carbon Pricing

Carbon pricing is based on the principle that emitters should pay for the damage caused by GHG emissions — an approach economists call 'internalizing externalities'.[5] These emissions impose significant social and environmental costs, including climate change, biodiversity loss, and health impacts. Yet these costs are often not reflected in market prices. Carbon pricing ensures that these hidden costs are factored into economic decisions by assigning a monetary value to each tonne of CO_2 or other GHGs emitted. This encourages businesses to adopt cleaner technologies, driving innovation in low-carbon solutions, and influencing consumers to make more sustainable choices.

[1] International Monetary Fund. Finland's Green Building Revolution. 02 November 2021.
[2] United States Environmental Protection Agency. Acid Rain Program. 21 March 2025.
[3] World Bank. State and Trends of Carbon Pricing 2025. 10 June 2025.
[4] World Bank. State and Trends of Carbon Pricing 2025. 10 June 2025.
[5] International Monetary Fund. Externalities: Prices Do Not Capture All Costs. Date accessed: 20 May 2025.

There are three primary approaches to carbon pricing:

- **Carbon tax:** Imposes a fixed price per unit of GHG emitted
- **Emissions trading system (ETS):** Sets a cap on total emissions and allows entities to buy and sell emission allowances
- **Carbon crediting mechanism:** Generates tradable credits for verified emission reductions from projects or activities outside capped sectors

Notably, the issuance source or authority of these approaches varies. Governments or regulatory authorities typically impose carbon taxes, which are not market-based. However, financial costs, impacts, and prices may be considered while establishing these taxes. ETSs are a mix of government policy and market prices, with a cap decided by the authorities and the trade value within those caps established by participants. In contrast, carbon crediting mechanisms and voluntary carbon credits are the most “market-based” among the three types, with pricing decided on a “willing buyer and willing seller” basis.

Carbon Tax

A carbon tax is a price-based mechanism that directly imposes a fixed cost on GHG emissions, typically measured per tonne of carbon dioxide equivalent (tCO_2e). Unlike ETSs, carbon taxes provide price certainty but do not guarantee a specific level of emissions reduction. Governments impose carbon taxes to make fossil fuel use and high-emission activities more expensive. When set at an effective level, such taxes encourage businesses and individuals to reduce carbon emissions by adopting cleaner alternatives and improving energy efficiency. Carbon tax rates should ideally be increased over time to induce greater carbon emissions reduction and spur decarbonization.

Emissions Trading System (ETS)

ETSs, also known as cap-and-trade programs, are market-based mechanisms that can be structured in different ways. They operate under an **intensity-based cap**, which regulates emissions per unit of output (for example, the amount of carbon dioxide emitted per kilowatt-hour [CO_2e/kWh] of electricity generated), or a **volume-based cap**, which imposes an absolute emissions limit over a defined period.

An **intensity-based cap** offers companies more flexibility but does not guarantee a reduction in total emissions, especially if production increases significantly. In contrast, a **volume-based cap** is generally more effective in cutting overall emissions, as it sets a fixed emissions allowance. These approaches depend on several factors, including economic conditions, market maturity, and policy objectives.

Emission credits are permits that allow the holder to emit a specific amount of GHGs. Entities with surplus credits can sell them, while those facing shortfalls can purchase credits to offset their unavoidable emissions. These credits are often initially allocated for free by governments to reduce the compliance burden on participants, prevent carbon leakage, and ensure a smooth transition. Over time, many systems shift toward auctioning allowances, establishing a transparent carbon price based on supply and demand, and upholding the 'polluter pays' principle. This incentivizes companies to reduce emissions or invest in new low- or no-emission technologies. Auction revenues can then be directed by governments toward funding low-carbon infrastructure, supporting low-income households or transitioning industries, and financing climate adaptation and mitigation programs. This helps achieve legally binding emissions reduction targets cost-effectively.

Carbon Crediting Mechanism

Carbon crediting mechanisms generate tradable credits from projects that voluntarily reduce, avoid, or remove emissions outside regulated sectors. Projects such as reforestation, renewable energy deployment, or methane capture are issued carbon credits after their emissions impact is independently verified. Entities can purchase these credits to offset their emissions, often as part of voluntary climate commitments or to comply with regulatory offset provisions within ETSs.

These voluntary carbon markets (VCMs) have recently emerged as a complement to compliance-driven carbon tax and ETS regimes. Businesses intending to fulfil environmental objectives, driven either by internal ambition or stakeholder preference, often purchase voluntary carbon credits to contribute to decarbonization elsewhere if they cannot immediately decarbonize their own operations. Many businesses are also part of groups such as the Renewable Energy 100 (RE100), a global initiative led by the Climate Group and CDP, that bring together large, influential companies from around the world, committed to sourcing 100% of their electricity demand from renewable energy.[6] While direct procurement is preferred, companies may also use alternatives such as Renewable Energy Certificates (RECs) or equivalent third-party validated instruments to meet commitments.[7]

Meanwhile, governments can use international frameworks like Article 6 of the Paris Agreement[8] to help reach their pledged climate ambitions. Article 6.2 allows countries to cooperate directly by trading emissions reductions through bilateral or multilateral agreements, with safeguards such as adjustments to prevent double counting.[9] Additionally, Article 6.4 creates a United Nations (UN) supervised carbon market mechanism that generates tradable credits from approved emission reduction projects.[10]

Industry-specific schemes also make use of credits. For instance, the aviation industry employs credits to meet requirements under programs such as the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA).[11] The International Maritime Organization's (IMO) proposed

[6] Climate Group RE100. RE100 Members. Date accessed: 15 August 2025.
[7] Climate Group RE100. RE100 Technical Criteria. 24 March 2025.
[8] United Nations Climate Change. Article 6 of the Paris Agreement. Date accessed: 15 August 2025.
[9] United Nations Climate Change. Article 6.2. Date accessed: 16 August 2025.
[10] United Nations Climate Change. Article 6.4. Date accessed: 16 August 2025.
[11] International Civil Aviation Organization. Carbon Offsetting and Reduction Scheme for International Aviation. Date accessed: 15 August 2025.

carbon credit trading system, which sets annual GHG fuel intensity targets for large ships, is scheduled to be formally adopted in October 2025.[12]

Carbon credits enter the market through multiple pathways. Certification bodies, such as Verra[13] and Gold Standard[14], independently validate, monitor, verify, and issue credits through established methodologies. International arrangements like the Kyoto Protocol's Clean Development Mechanism and the Paris Agreement's Article 6 enable the generation of global credits. National governments can also design domestic crediting schemes, establishing rules, registries, and oversight structures for credit issuance within their borders.

A significant development in Asia's carbon landscape is the increasing linkage between VCMs and compliance mechanisms. This integration is a deliberate policy choice, aiming to provide flexibility and cost-effectiveness for regulated entities while simultaneously mobilizing private finance for climate projects.[15] This strategic convergence is crucial for scaling up GHG emission reductions and lowering the overall mitigation cost, which are vital for transitioning to decarbonized economies.

In summary, various programs and partners contribute to circulating carbon credits, providing diverse parties with the tools to account for carbon emissions or enhance environmental sustainability.

ETS and carbon taxes are the primary ways in which governments and regulatory authorities impose a carbon emissions cost within an economic system, with carbon credits from VCMs playing a subordinate role. These methods are critical to limiting GHG emissions in Asia. The choice between ETSs and carbon taxes depends on the features of individual economies.

Differences and Suitability

Carbon taxes establish a predictable price on emissions, providing businesses with clarity for decarbonization planning. These taxes are relatively easy to implement, enforceable through existing revenue collection systems, and can encompass multiple sectors, thus ensuring broad economy-wide coverage. Upstream carbon taxes on fossil fuels and their uses are less challenging to enforce than organizing and monitoring an emissions cap-and-trade market. Tax revenue can be used to advance the green transition by investing in clean energy or supporting low-income households affected by higher costs caused by the tax.

However, while carbon taxes stipulate the penalty for producing a unit of tCO_2e emissions, they do not impose a cap or any quantitative limit on the actual amount, and cannot guarantee specific emission reductions. They may also be regressive unless paired with social safety nets,

[12] International Maritime Organization. IMO Approves Net-Zero Regulations for Global Shipping. 11 April 2025.
[13] Verra. Program Overview. Date accessed: 16 August 2025.
[14] Gold Standard. Gold Standard for the Global Goals. Date accessed: 16 August 2025.
[15] Number Analytics. Carbon Trading in Asia: A Comprehensive Guide. Date accessed: 02 August 2025.

compensation, and other offsetting benefits. Although more straightforward to implement, carbon taxes require a standardized and verifiable method to measure and monitor emissions.

Singapore is an example that illustrates the competing objectives policymakers face when implementing carbon taxes. The country introduced Southeast Asia's first carbon tax in 2019, with plans to increase the rate significantly by 2030.[16] A clearly defined trajectory has encouraged businesses to consider longer-term decarbonization investments and supported policy credibility. Transparency has been strengthened through measures such as the Biennial Transparency Report, which explains the rationale for the taxes and the use of generated revenues.[17] However, the provision of rebates on the announced tax rates[18], while offering relief to some entities, has been non-transparent about the extent of rebates offered, and introduced unpredictability and uncertainty.

ETS regimes offer cost-effective emission reductions by allowing participants the flexibility to either reduce emissions where most cost-effective or purchase allowances. These systems primarily rely on price signals to drive decarbonization and GHG reduction. ETSs offer a guaranteed specific GHG emission reduction, regardless of the price, especially when featuring an absolute emissions cap (in contrast to an intensity-based quota). An ETS design can also incorporate flexibility, such as adjusting annual emission limits or setting more lenient caps in earlier years that become stricter over time, giving participants room to adapt.

The principal drawback with ETS is that such a system is not as straightforward as a tax-based one. The institutional ability to design, implement, and monitor an ETS can be challenging, especially for less developed economies. Setting appropriate limits is another obstacle, as a lenient cap leads to low ETS prices that do not encourage decarbonization. Robust measurement, reporting, and verification (MRV) systems are also needed for effectiveness.

As a result, ETSs offer quantity certainty and dynamic pricing only if there is a reasonable cap and robust enforcement. Oversupply and weak enforcement limit effectiveness, as seen recently in South Korea and China[19], where allowance prices have dropped and reductions have slowed. Therefore, an ETS may be more suitable for economies with strong institutional capacity and mature energy sectors. Such systems are increasingly preferred by upper-middle to high-income Asian countries aiming for cost-effective, large-scale emissions control.

[16] NCCS Singapore. Carbon Tax. 31 July 2025.
[17] National Climate Change Secretariat Singapore. Singapore's First Biennial Transparency Report. 2024.
[18] Business Times. Singapore offers carbon tax rebates for refiners near term: sources. 14 June 2024.
[19] OPIS Insights. Deciphering Oversupply: Asia Pacific Emissions Markets and Policy Perspectives. 27 June 2024.

Table 1: Carbon Tax and Emissions Trading System Comparison

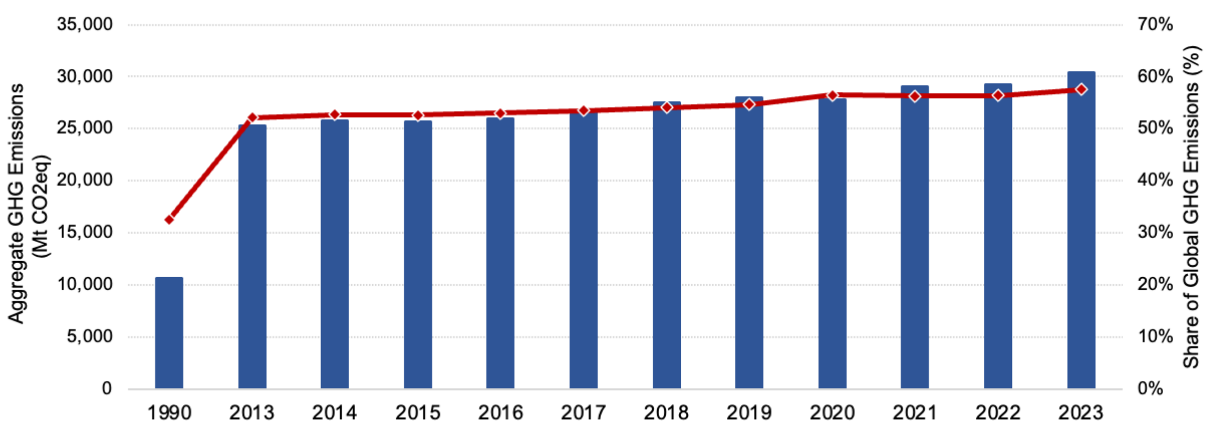
	Carbon Tax	Emissions Trading System (ETS)
Regulatory	Taxation - mandatory	Mandatory/Conditional – depending on scope and sector
Price Certainty	High (fixed per tonne of CO_2)	Low (market determined)
Emission Reduction	Variable	High if cap is credible and fixed
Administration	Easier (via tax authorities)	More complex (needs MRV, sophisticated markets)
Coverage	Usually broad, covering most sectors	Narrower, covering energy intensive sectors
Public Acceptability	Stronger if revenue is used progressively	Mixed (may be perceived as business-friendly)

Source: IEEFA.

Carbon Pricing in Asia

Asia, the world's most populous region, accounts for over 50% of global GHG emissions (Figure 1). Emissions are expected to keep rising, driven by rapid economic growth and growing energy demand. The region is warming at nearly twice the global average and experienced its hottest year in 2024[20], heightening its vulnerability to extreme weather events that threaten lives, ecosystems, and economies.

Figure 1: Asia Contributes Over Half of Global GHG Emissions



Note: GHG emissions include CO_2 (fossil fuel only), methane (CH_4), nitrous oxide (N_2O), and a group of gases containing fluorine (F-gases).
Source: Emissions Database for Global Atmospheric Research (EDGAR); IEEFA.

[20] World Meteorological Organization. State of the Climate in Asia 2024. 23 June 2025.

Carbon pricing plays a vital role in supporting sustainable economic growth in Asia. If appropriately priced, it can be a powerful tool to drive innovation and clean technology adoption, generate revenue that can be reinvested in climate projects, and align economic growth with national and global climate goals.

Figure 2: Existing ETSs and Carbon Taxes in Asia

	Instrument	GHG Coverage	Sectoral Coverage	Regulated Gases	No. of Entities
South Korea	National ETS: volume-based cap	79% of national GHG emissions	Heat and power, industry, buildings, waste, transportation, public sector	CO_2, CH_4, N_2O, HFCs, PFCs, and SF_6	685
China	National ETS: intensity-based cap	60% of national CO_2 emissions	Power, steel, cement, aluminium	CO_2 (power steel, cement, aluminum), CF_4 & C_2F_6 (aluminum)	3,757
Kazakhstan	National ETS: volume-based cap	50% of national CO_2 emissions	Power and centralized heating, extractive industries and manufacturing, processing industry	CO_2	212
Indonesia	National ETS: intensity-based cap	24% of national GHG emissions	Power	CO_2, CH_4, N_2O	146
Japan	National carbon tax & subnational ETS	70% of national GHG emissions	Carbon tax: fossil fuels ETS: buildings, industry	CO_2	Tokyo ETS: 1,400 Saitama ETS: 600
Singapore	National carbon tax	70% of national GHG emissions	Manufacturing, power, water, waste	CO_2, CH_4, N_2O, SF_6, NF_3, HFCs, PFCs	50

Source: IEEFA.

ETS: China, South Korea, Kazakhstan, and Indonesia

The four national ETSs in China, South Korea, Kazakhstan, and Indonesia differ in sectoral scope, gases covered, and cap-setting approach (volume- or intensity-based). South Korea's ETS has the broadest coverage, regulating 79% of national emissions and the widest range of gases. China follows at around 60% after recently expanding beyond the power sector to include steel, cement, and aluminum. Kazakhstan's ETS covers about 50% of national CO_2 emissions, while Indonesia's scheme remains limited to the power sector only.

Indonesia plans to evolve its ETS into a hybrid 'cap-tax-and-trade' system, under which facilities exceeding their ETS limits would face a carbon tax of IDR30,000/tCO_2e (approximately USD1.8/tCO_2e).[21] Implementation was scheduled for April 2022, but has been repeatedly postponed, and there is no confirmed timeline.

Carbon Tax: Japan and Singapore

Japan and Singapore have opted for carbon taxes as their primary national carbon pricing instruments. Similar to ETSs, these taxes differ in sectoral scope and the types of GHG covered. Singapore's broader carbon tax applies to all major GHG emissions from large industrial facilities. Approximately 70% of national emissions in both countries are subject to carbon pricing. In Japan, coverage includes the subnational ETS programs in Tokyo and Saitama, alongside the national carbon tax.

Carbon Tax/ETS Under Development: Thailand, Malaysia, Taiwan, and Vietnam

In January 2025, Thailand's cabinet approved the Ministry of Finance's proposal to introduce a carbon tax to reduce GHG emissions further. The tax, set at THB200/tCO_2e (around USD6.2/tCO_2e), applies to petroleum products such as benzene, gasohol, kerosene, jet fuel, diesel, biodiesel, liquefied petroleum gas, propane, and fuel oil.[22]

The Malaysian government announced plans to introduce a carbon tax by 2026, targeting high-emission sectors such as iron, steel, and energy.[23] The tax could later apply to other key industries, especially those already covered under the EU's Carbon Border Adjustment Mechanism (CBAM) and other jurisdictions.

Taiwan and Vietnam are adopting ETSs as their preferred mechanism. The Taiwan Carbon Solution Exchange has recently signed an agreement with the European Energy Exchange (the EU ETS's main trading platform) for building the country's ETS.[24] Vietnam has also started an ETS pilot project, covering the power, cement, and steel sectors.[25]

[21] Reccessary. Indonesia Defers Carbon Tax Rollout Amid Inflation Concerns. 06 April 2022.
[22] Reuters. Thai Cabinet Approves Collection of Carbon Tax. 21 January 2025.
[23] The Edge Malaysia. Malaysia to Introduce Carbon Tax for Select Industries by 2026 – PM. 18 October 2024.
[24] Focus Taiwan. Taiwan Carbon Solution Exchange signs MOU with European counterpart - Focus Taiwan. 30 June 2025.
[25] Vietnamnet Global. Vietnam steps up Net Zero journey with strong global and domestic action. 13 August 2025.

Carbon Prices Remain Too Low to Support Decarbonization

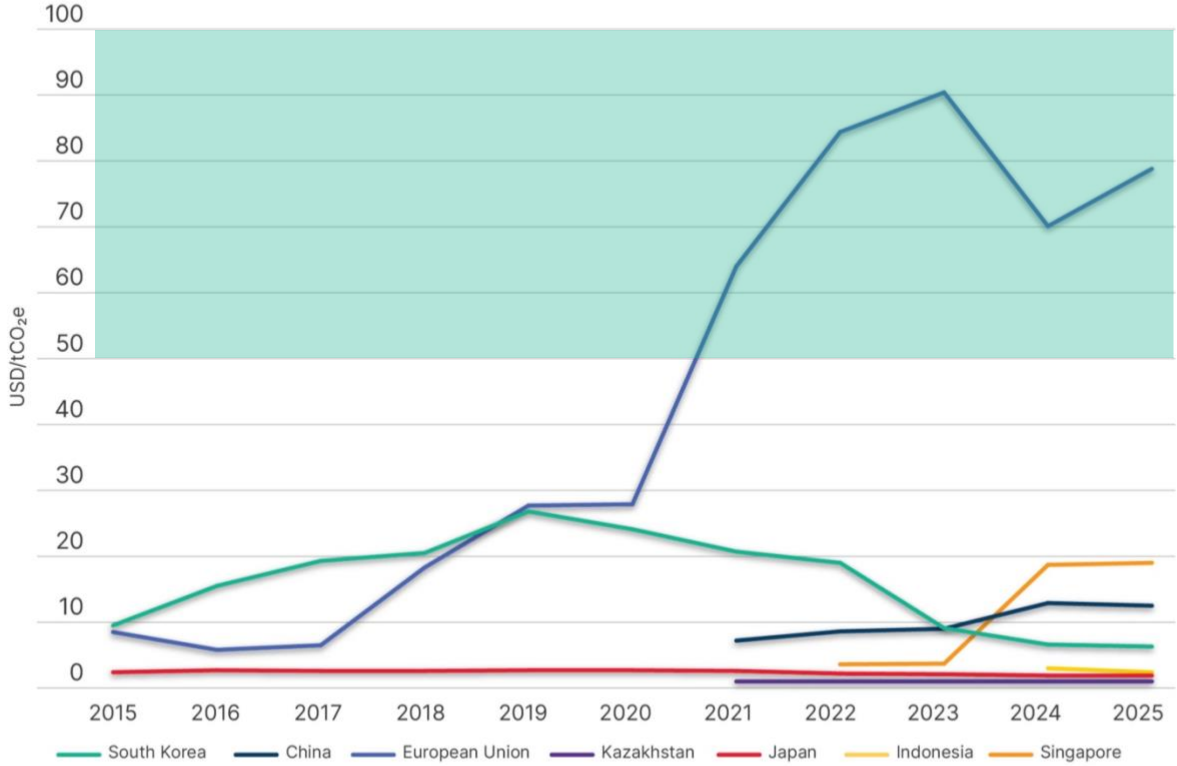
Significant carbon price differences exist across regions, and between the costs on exchanges and ETSs and those recommended by studies and reports.

Although global carbon revenue exceeded USD100 billion in 2023[26] and 2024[27], carbon prices remain far lower than required to meet international climate targets. In 2017, the High-Level Commission on Carbon Prices estimated that direct carbon prices must be between USD40/tCO_2e and USD80/tCO_2e by 2020, and be in the USD50/tCO_2e to USD100/tCO_2e range by 2030 to limit global warming to below 2 degrees Celsius.[28]

Similarly, in 2022, the Intergovernmental Panel on Climate Change reported that marginal abatement costs would need to reach around USD90/tCO_2e[29] by 2030 and USD210/tCO_2e[30] by 2050 to remain within the 2-degree limit.[31] Recently, the Network for Greening the Financial System projected that carbon prices would need to increase to approximately USD300/tCO_2e by 2035 under a net-zero transition scenario.[32]

[26] World Bank Group. Global Carbon Pricing Revenues Top a Record $100 Billion. 21 May 2024.
[27] World Bank Group. Global Carbon Pricing Mobilizes Over $100 Billion for Public Budgets. 10 June 2025.
[28] Carbon Pricing Leadership Coalition. Report of the High-Level Commission on Carbon Prices. 29 May 2017.
[29] In 2015 prices, per tonne of CO_2 had an uncertainty range of USD60-USD120.
[30] In 2015 prices, it had an uncertainty range of USD140-USD340.
[31] Intergovernmental Panel on Climate Change. IPCC Sixth Assessment Report. 2022.
[32] NGFS. NGFS long-term scenarios for central banks and supervisors. November 2024. Page 21.

Figure 3: ETS and Carbon Tax Price Trends in Asia (2015–2025)



Note: The carbon tax trajectories for Japan and Singapore account for exchange rate fluctuations. The shaded area represents the estimated range of carbon prices needed by 2030 to limit global warming to below 2 degrees Celsius.
Source: IEEFA; International Carbon Action Partnership (ICAP); Japan's Ministry of Environment; Singapore's National Environment Agency; IDX Carbon.

Except for EU carbon permits, which averaged EUR71.2/tCO_2e (USD78.8/tCO_2e) in the first half of 2025, no other carbon pricing system is at the levels recommended to meet global climate goals. Most systems, especially those in emerging markets, remain significantly underpriced. In Asia, China's emission allowances traded at an average of RMB90.3/tCO_2e (USD12.5/tCO_2e) in the first quarter of 2025, broadly unchanged from the 2024 average price of RMB92.3/tCO_2e (USD12.9/tCO_2e). South Korea's allowances approximated KRW9,021/tCO_2e (USD 6.3/tCO_2e) (year-to-date until 11 July 2025), while Kazakhstan's carbon price remains at just USD1/tCO_2e.

Similarly, current rates remain too low to drive consequential emission reductions in countries with carbon taxes. Japan's carbon tax is particularly modest, at only JPY289/tCO_2e (USD2/tCO_2e) since its introduction in 2021. By contrast, Singapore's carbon tax is higher at SGD25/tCO_2e (USD18.6/tCO_2e) and is scheduled to increase to SGD45/tCO_2e (USD33.3/tCO_2e) in 2026, and to SGD50–SGD80/tCO_2e (USD37.0–59.2/tCO_2e) by 2030.

A realistic carbon price may be gauged from the credits established under Sections 45Q and 45V of the US Inflation Reduction Act[33, 34], which aim to incentivize decarbonization and carbon reduction technologies such as carbon capture, utilization, and storage (CCUS), and direct air capture (DAC). The Act provides a credit of USD60–USD130 per tonne of carbon captured using CCUS, and USD85–USD180 per tonne using DAC. Despite these incentives, there has been limited progress in encouraging CCUS and DAC projects due to the high operating costs and significant upfront investments required.

These findings suggest that carbon prices under the various emission pricing regimes need to increase significantly to drive decarbonization in real-world applications.

Aligning Carbon Prices with Marginal Abatement Costs

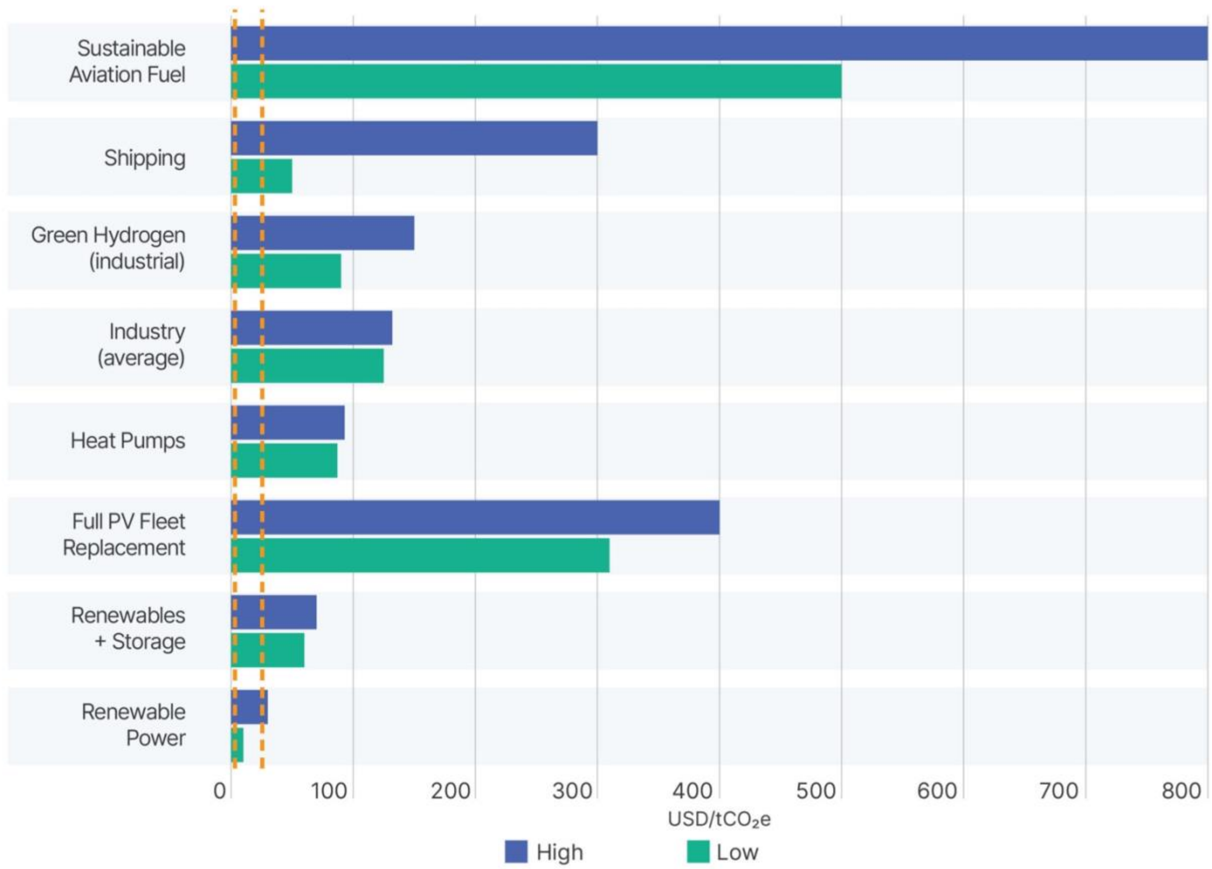
A carbon price or an ETS does not automatically transform the energy or emissions backdrop. Size, sectoral reach, and carbon tax level are critical factors for success. If the carbon price is too low, emitters simply pay for allowances or taxes rather than invest in reducing emissions. In these instances, the carbon price becomes another business cost with little climate impact. If the price rises moderately but remains insufficient to generate substantial investment in low-carbon technologies, companies will likely pass the added cost on to consumers. This can create inflationary effects, acting as a tariff for buyers. These higher costs would disproportionately affect lower-income households, as they allocate a larger share of their income to essentials like energy, transport, and food.

Determining the appropriate carbon prices for Asian economies requires evaluating the costs of shifting from high- to low-carbon technologies. Marginal abatement costs (MACs) are a potential assessment method. These costs vary significantly across sectors and decarbonization activities, reflecting differing technological maturity, capital intensity, and low-carbon alternative viability.

Existing research on decarbonization costs and MACs indicates a wide range of estimates. Figure 4 highlights these significant variations and shows that carbon prices remain too low in most places.

[33] Inflation Reduction Act. Inflation Reduction Act. Date accessed: 02 September 2025.
[34] Inflation Reduction Act. Domestic Content Bonus Credit Guidance under Sections 45, 45Y, 48, and 48E. Date accessed: 02 September 2025.

Figure 4: Marginal Abatement Cost Range



Note: Dotted lines represent current carbon pricing levels in Asia.
Source: IEEFA; BNEF; IEA; Goldman Sachs; Environmental Defense Fund; DNV.

For low-cost abatement opportunities, particularly in power generation (such as coal-to-renewables switching), a carbon price of between USD10/tCO_2e and USD30/tCO_2e is likely to be effective, since renewable sources are broadly competitive with fossil fuels for new generation. While adding storage to renewable capacity to guarantee availability would increase costs, falling storage prices make this less critical. Goldman Sachs' 2025 Carbonomics report, which provided MAC estimates for various sectors, found a MAC of USD65/tCO_2e for renewable power with storage.[35]

In contrast, higher carbon prices are essential for sectors with significant decarbonization costs. Bloomberg New Energy Finance (BNEF) estimates that replacing Europe's existing fleet of internal combustion engine (ICE) cars with electric vehicles (EVs) would require a carbon price of EUR407/tCO_2e[36] — a figure consistent with the Carbonomics report.[37] While expensive, this replacement would have the maximum reduction in future emissions. More limited approaches, such

[35] Goldman Sachs. Carbonomics: Tariffs, deglobalization and the cost of decarbonization. February 2025.
[36] BNEF. EU ETS II Market Outlook 2025. 06 March 2025.
[37] Goldman Sachs. Carbonomics: Tariffs, deglobalization and the cost of decarbonization. February 2025.

as the replacement of only new cars, have far lower MACs, according to research by the Environmental Defense Fund.[38]

Similarly, replacing fossil fuel-powered heating with decarbonized heat pumps would be viable for building heating with carbon prices of between EUR87/tCO_2e and EUR93/tCO_2e.[39] The International Energy Agency (IEA) estimates USD87/tCO_2e as the average MAC for heat pumps.[40]

In 2024, BNEF estimated that abating emissions in steelmaking would require carbon prices ranging from USD144/tCO_2e in the US to USD105/tCO_2e in India and USD83/tCO_2e in China.[41] For decarbonized ethylene production in India and China, carbon prices above USD230/tCO_2e would be necessary. Across the region, carbon capture in aluminum oxide or petrochemicals manufacturing would require average prices above USD200/tCO_2e, assuming viable transport and storage techniques were available at scale. The Environmental Defense Fund estimates a MAC range between USD90/tCO_2e and USD150/tCO_2e for renewables-based hydrogen technology in industry.[42] Goldman Sachs estimates a weighted average MAC of USD130/tCO_2e for industry as a whole, with a high USD420/tCO_2e cost for "hard to emit" sectors that rely on hydrogen.[43]

IEEFA[44] found that sustainable aviation fuel (SAF) prices are at least 2.5 times that of regular jet fuel due to the high decarbonization cost. Another BNEF report[45] estimates a minimum of USD252/tCO_2e, while the Goldman Sachs estimate is above USD550. A Norwegian Environment Agency study found a MAC of USD300/tCO_2e for full abatement of shipping emissions, and USD50–USD100 for 20-30% abatement.[46]

To summarize, MACs can differ depending on variables such as location, emission intensity of the technology replaced, and period of replacement, among other factors. Regardless of the particular MAC for any application, the existing carbon tax and ETS pricing regimes globally are inadequate to address the challenge of rapid decarbonization.

Barriers to Effective Carbon Pricing

Low carbon prices in regulatory systems primarily result from low carbon taxes or emission credit prices. Regulators establish low prices, fearing a high cost impact on consumers and the supposed risk to economic competitiveness in the short term. These reservations lead to unambitious targets and caps, reflecting a lack of political will and decreasing the carbon price. Carbon prices are kept low by allocation methods that benefit existing fossil fuel-intensive firms through "grandfathering"

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[38] Environmental Defense Fund. A revamped cost curve for reaching net-zero emissions. 26 August 2021.
[39] BNEF. EU ETS II Market Outlook 2025. 06 March 2025.
[40] IEA. Abatement cost in industry sector
[41] BNEF. 2024 Levelized Cost of Net-Zero Materials. 24 July 2024.
[42] Environmental Defense Fund. A revamped cost curve for reaching net-zero emissions. 26 August 2021.
[43] Goldman Sachs. Carbonomics: Tariffs, deglobalization and the cost of decarbonization. February 2025.
[44] IEEFA. Can South Korea's Aviation Industry Pivot to Green Skies?. 10 December 2024.
[45] BNEF. Sustainable Jet Fuels Need High Carbon Price to Compete. 27 April 2021.
[46] Science Direct. Longva et al. Marginal abatement cost curves for CO_2 emission reduction from shipping to 2050. June 2024.

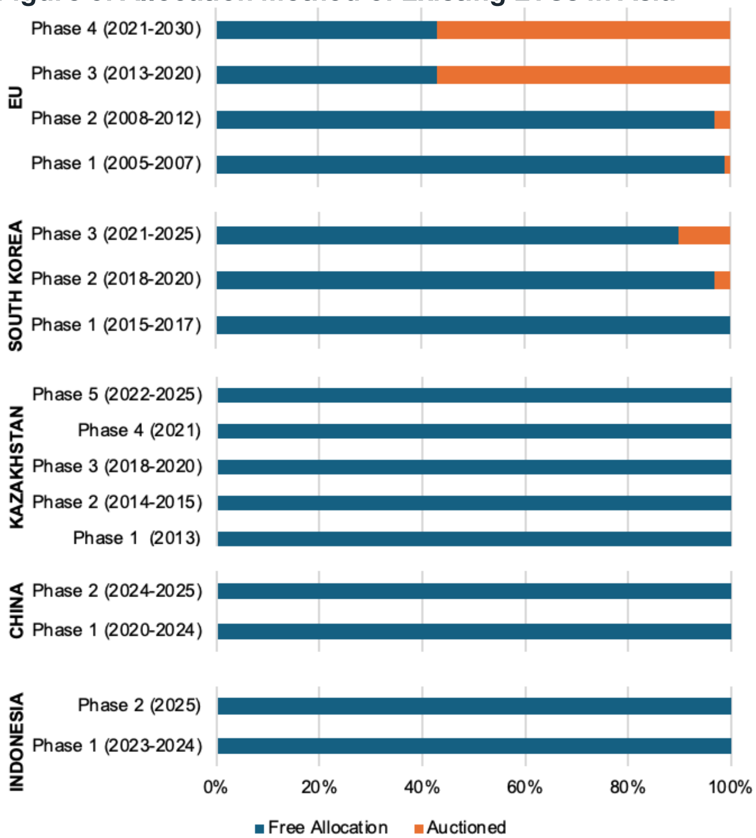
provisions, limited sectoral coverage, weak targets based on intensity rather than actual emissions, and persistent fossil fuel subsidies that distort competitiveness.

This limited ambition contrasts with the scale of climate-related risks. Populations in Asia, frequently exposed to climate-related risks, demonstrate higher support for carbon pricing. For example, the recent climate awareness survey by the ISEAS-Yusof Ishak Institute[47] shows that most of the nearly 3,000 Southeast Asian respondents feel that national carbon taxes are justified and should be implemented.

The oversupply of allowances stems from several factors and is a key reason carbon prices remain low. This surplus reduces prices because of fundamental supply and demand dynamics. In an ETS, the cost of allowances reflects the balance between the number of allowances available (supply) and the compliance needs of regulated entities (demand).

Allocation Method

Figure 5: Allocation Method of Existing ETSs in Asia



Source: IEEFA; European Union; South Korea's Ministry of Environment; Singapore's National Environment Agency; Shanghai Environment and Energy Exchange; National Plan of the Republic of Kazakhstan; ICAP.

[47] ISEAS-Yusof Ishak Institute. The Southeast Asia Climate Outlook: 2024 Survey Report. 17 September 2024.

In the early implementation phases, allowances are typically allocated for free to ease the transition for covered entities, help them remain competitive, and mitigate the risk of carbon leakage. Carbon leakage occurs when companies relocate production to countries with less stringent environmental regulations to avoid carbon costs. However, free allocation should not become a permanent feature. An effective carbon pricing system should gradually reduce free allocation and transition toward a market-based approach where most allowances are auctioned.

The EU ETS has made significant strides in the transition, with the share of auctioned allowances steadily increasing across phases. In Phase 1, nearly all allowances were allocated for free, with only a few member states conducting limited auctions. Phase 2 saw a modest rise, with around 3% auctioned and about 90% still distributed for free. A major shift occurred in Phase 3, where auctioning became the primary method, covering up to 57% of the cap. Sectors considered at significant risk of carbon leakage continued receiving 100% free allocation. However, for sectors not on the carbon leakage list[48], free allocation was gradually phased out from 80% in 2013 to 30% by 2020.[49] This approach continued in Phase 4, with some sectors at the highest risk of relocation receiving 100% free allowances, while less exposed sectors will receive up to 30% until 2026, with free allocation fully phased out by 2034.

In Asia, South Korea allocated all allowances for free in Phase 1 and only began limited auctioning in 2019. It covered 3% of allowances in Phase 2 and increased to just 10% in Phase 3, although further increases are under consideration. Since their launch, the ETSs in China, Kazakhstan, and Indonesia have relied entirely on free allocation through output-based benchmarking.

Phasing out free allocation is important for Asian ETSs to strengthen credibility and effectiveness, and to establish a credible market price for carbon. Heavy reliance on free allowances weakens the carbon price signal and limits incentives for companies to reduce emissions and invest in low- or zero-emission technologies. Greater reliance on market mechanisms, such as auctioning, ensures firms bear the actual cost of carbon and creates a more equitable system across sectors. It also generates essential public revenue that governments can channel into climate initiatives. With global measures like the EU CBAM, continued reliance on free allocation risks leaving Asian markets misaligned with international standards and trade expectations.

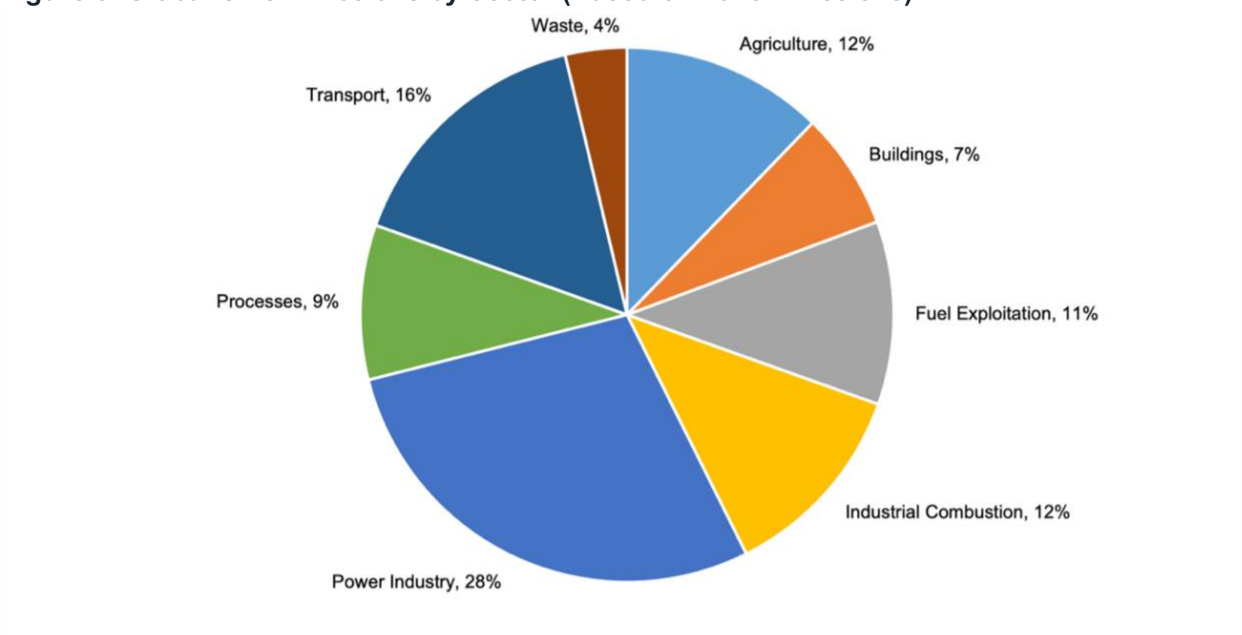
Limited and Uneven Sectoral Coverage

Another limitation of current carbon pricing systems is the uneven coverage across sectors. The power sector, which accounts for almost 30% of GHG emissions, has the highest level of carbon pricing. Emissions from this sector are easier to regulate as they come from relatively concentrated and well-monitored sources (such as power plants and fuel distribution networks), simplifying implementation. Consequently, over 50% of global power sector emissions are covered by a carbon price. Heavy industries such as cement, steel, and aluminum are emissions-intensive and trade-

[48] European Union. Official Journal of the European Union. 08 May 2019.
[49] European Commission. Carbon Leakage. Date accessed: 14 August 2025.

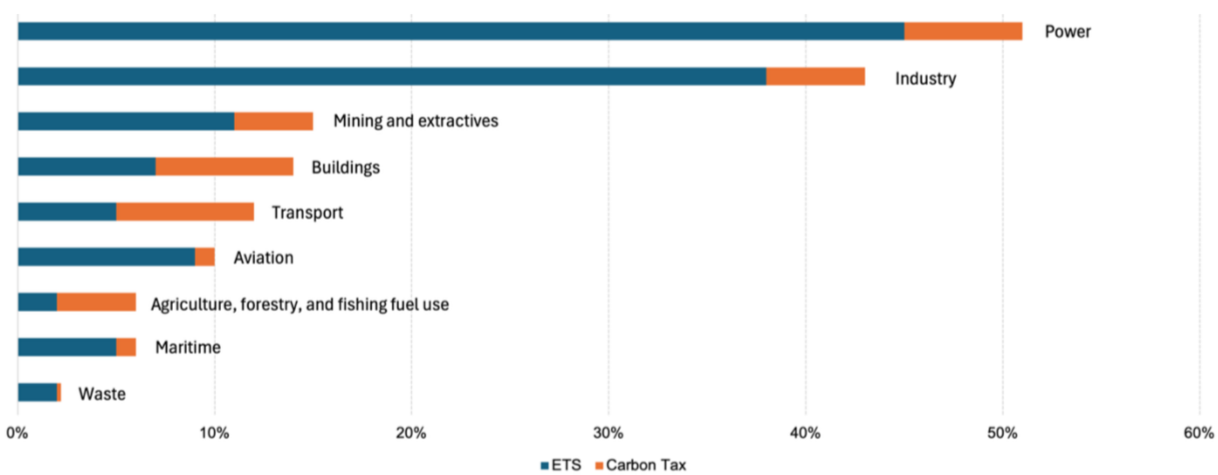
exposed, raising carbon leakage concerns. China's recent ETS expansion[50] has increased global carbon pricing coverage in the industrial sector, contributing 20% of global GHG emissions, to over 40%. However, in most countries, substantial industrial emissions remain unpriced.

Figure 6: Global GHG Emissions by Sector (Based on 2023 Emissions)



Source: EDGAR; IEEFA.

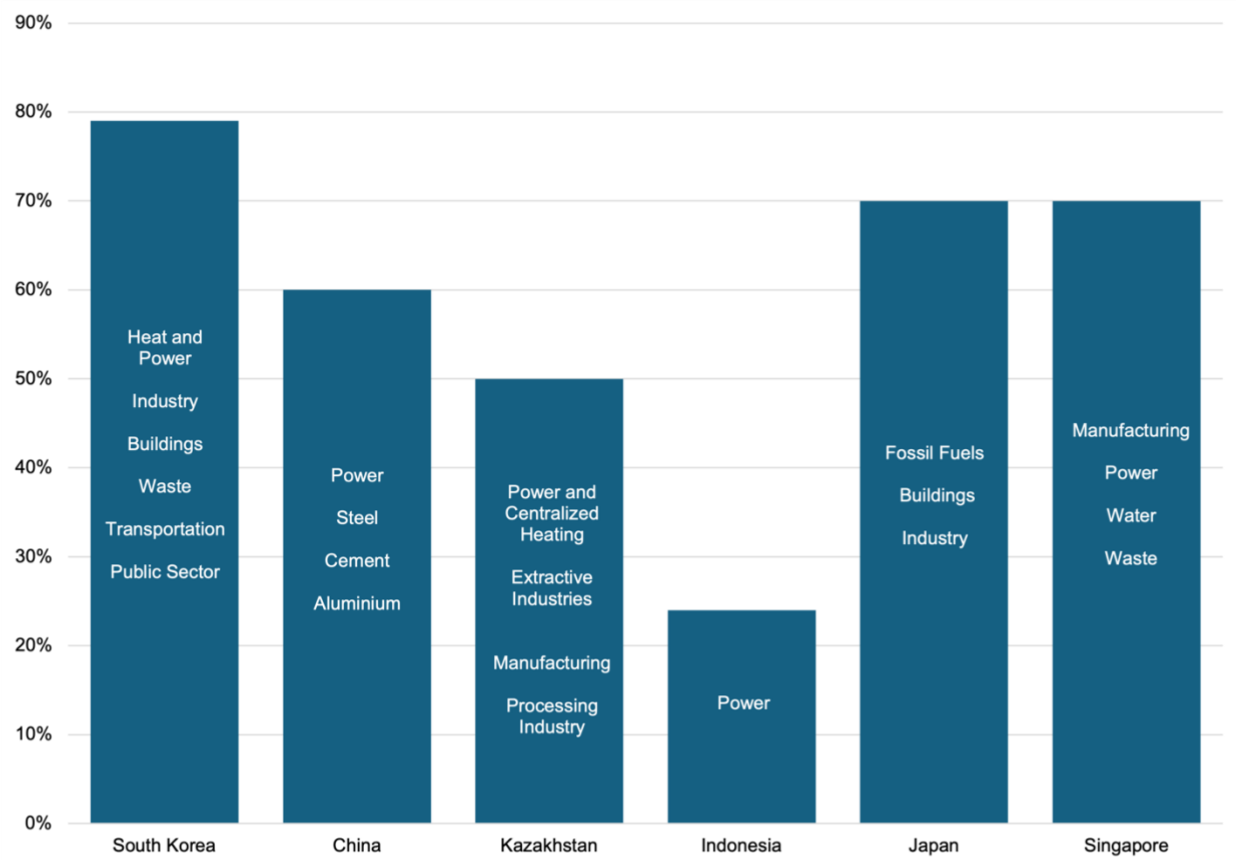
Figure 7: Sector Share of Global GHG Emissions Covered by an ETS and/or Carbon Tax



Source: World Bank; IEEFA.

[50] The State Council of the People's Republic of China. Three Additional Industries Added to Carbon Trading Market. 27 March 2025.

Figure 8: Percentage of National GHG Emissions Covered by an ETS and/or Carbon Tax in Asia



Note: China and Kazakhstan's percentages refer to their respective national CO_2 emissions coverage.

Source: IEEFA.

Apart from the power and industrial sectors, others have significantly lower carbon pricing coverage, generally below 20% (Figure 7). Carbon pricing encompasses only around 15% of mining and extractive industries, which account for 13% of global GHG emissions. This is mainly through the EU ETS and in resource-rich countries like Australia, South Africa, and Canada.[51] The building sector has even lower coverage (13%), primarily due to challenges in measuring emissions and assigning responsibility. Emissions in this sector span the design, construction, and occupancy phases, with designers, developers, and occupants all influencing a building's carbon footprint.

Agriculture, which accounts for over 12% of global GHG emissions, remains largely excluded from carbon pricing due to technical, economic, and political challenges. Agricultural emissions are diverse and complex to measure, stemming from millions of sources such as livestock and fertilizer use. Biological variability across soils, climates, and farming practices further complicates monitoring and standardization. Introducing a carbon price also raises concerns about food security and farmer livelihoods, as higher production costs could translate into increased food prices and

[51] World Bank. State and Trends of Carbon Pricing 2025. 10 June 2025.

disproportionate burdens on rural communities. Reflecting these sensitivities, the EU in 2024 dropped specific targets for farming from its 2040 climate pathway following farmers' protests.[52] Contrastingly, Denmark is introducing the world's first carbon tax on agricultural emissions in 2030. The tax will target livestock emissions and nitrogen pollution[53], which could set a precedent for integrating agriculture into carbon pricing frameworks worldwide.

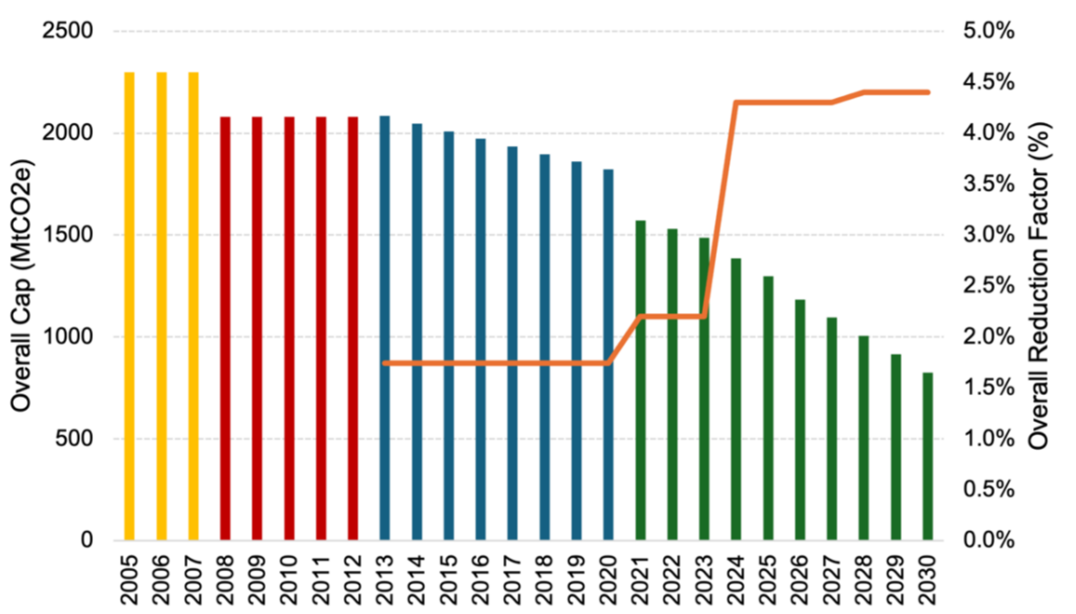
In summary, sectoral coverage of Asian ETSs and carbon taxes is highly uneven (Figure 8). The only common feature across frameworks is the inclusion of the power sector. Outside of this sector, coverage is fragmented and inconsistent. Some countries, like China and Indonesia, have focused almost exclusively on power in the early stages, while others, such as South Korea and Kazakhstan, extend coverage to some heavy industry segments. This may change as China's recently announced roadmap to expand sectoral coverage by 2030[54] could encourage other countries in the region to follow suit. Currently, however, the transport, building, agriculture, and waste sectors remain largely excluded across the region. This uneven scope leads to wide variations in national coverage. In countries with low coverage, the small number of participants constrains market liquidity. Differing national coverages also limit comparability and collectively weaken the credibility of Asian carbon markets.

Inadequate Targets

There are two main approaches to limiting GHG emissions through an ETS. An **absolute cap** sets a clear, fixed limit on the total amount of GHGs that covered entities are allowed to emit over a specified period. The second approach is based on **emissions intensity,** which sets targets relative to metrics such as emissions per unit of Gross Domestic Product (GDP) or per unit of output, rather than a fixed quantity.

[52] Reuters. EU recommends ambitious 2040 climate target, goes light on farming. 06 February 2024.
[53] ESG News. Denmark Becomes First-Ever to Impose CO2 Emissions Tax on Agriculture. 27 June 2024.
[54] State Council of China. 2030 ETS Roadmap. 25 August 2025

Figure 9: Trends of EU ETS Overall Cap and Linear Reduction Factor



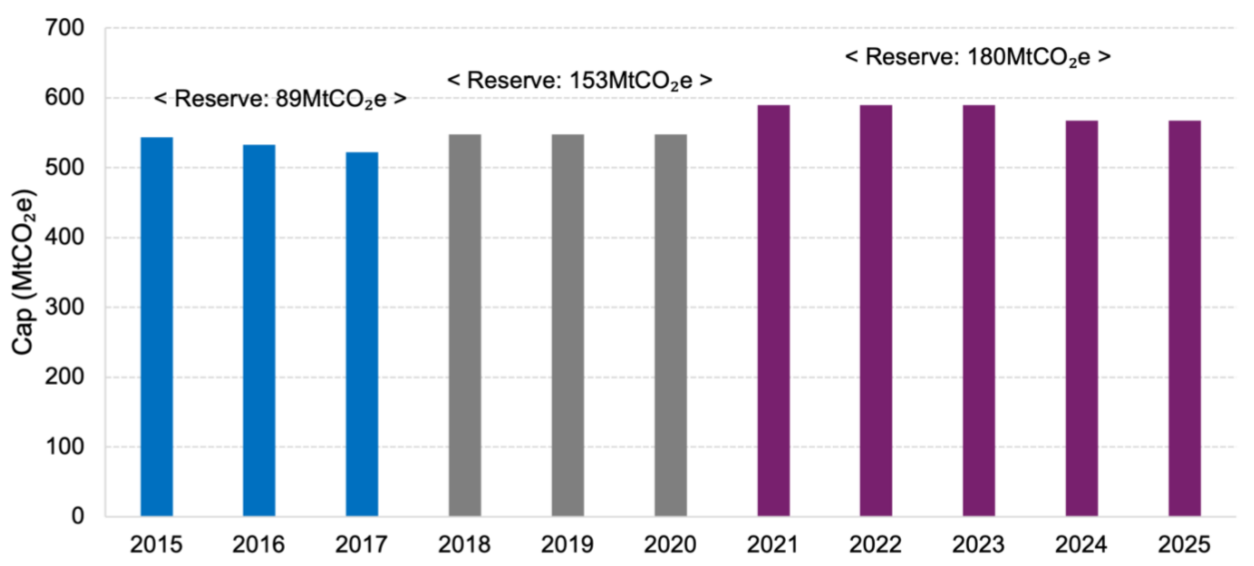
Note: The different colors represent the various phases of the EU ETS.
Source: European Commission; IEEFA.

The EU ETS uses the absolute cap approach. The overall cap in Phase 1 (2005–2007) and Phase 2 (2008–2012) was not set centrally but through national allocation plans. Each EU member state proposed the amount of allowances it would allocate to its domestic industries, subject to the European Commission's review and approval. The generous caps set by some countries led to a surplus of allowances, which drove carbon prices down and undermined the scheme's effectiveness.

A single EU-wide cap was introduced at the beginning of Phase 3. The cap declines annually through a linear reduction factor (LRF), which specifies the rate at which allowances decrease yearly. The annual reduction rate was initially set at 1.74% until 2020, before rising to 2.2% from 2021 to 2023, and 4.3% between 2024 and 2027. It will increase further to 4.4% from 2028 (Figure 9).[55] In addition to the LRF, the cap was also adjusted downward and rebased in 2024 by 90 million allowances to reflect updated emissions data, with a further adjustment of 27 million scheduled for 2026. Together, rebasing and LRF ensure that the supply of allowances declines more stringently over time.

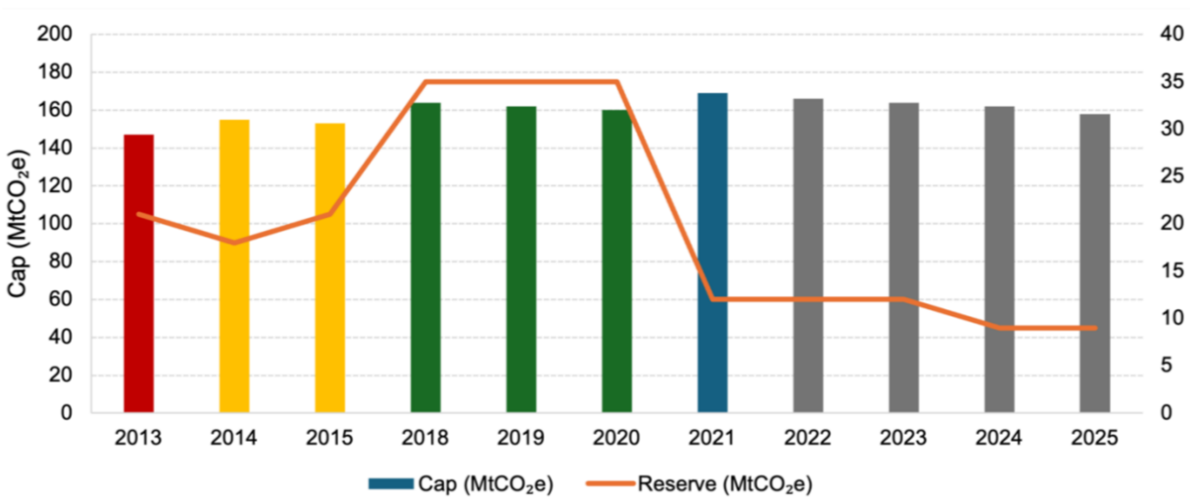
[55] European Commission. EU ETS Emission Cap. Date accessed: 28 May 2025.

Figure 10: Trends of South Korea's ETS Overall Cap



Source: South Korea's Ministry of Environment; IEEFA.

Figure 11: Trends of Kazakhstan's ETS Overall Cap



Source: National Plan of the Republic of Kazakhstan; AIFC; IEEFA.

In Asia, only South Korea and Kazakhstan adopt an absolute cap approach. South Korea sets its ETS cap in multi-year phases, where allowances are decided based on national reduction targets, historical emissions, and economic considerations. The system also maintains a reserve to accommodate new entrants and stabilize the market. The increase in the overall cap at the start of Phase 2 (2018–2020) and Phase 3 (2021–2025) reflected the expansion of sectoral coverage and the growing number of participants. Kazakhstan takes a similar approach through phase-based allocation plans (Figure 11).

Unlike the EU ETS, which follows a fixed LRF, South Korea and Kazakhstan's approach is less predictable but provides greater flexibility for cap adjustments in response to political and economic priorities. However, reductions under both systems have been modest, as phase-level caps are politically determined and often aligned with business-as-usual projects. Stringent cap-setting aligned with long-term targets will be necessary for these systems to meet national climate goals and advance net-zero pathways materially.

The emission intensity approach increases overall emissions if economic or industrial activity grows, while encouraging efficiency and lower carbon intensity. Developing countries often favor intensity-based caps over absolute caps due to concerns about economic growth, competitiveness, and carbon leakage.

While understandable, this preference involves many trade-offs. First, total emissions can still increase even if emissions per unit decline, weakening the effectiveness of ETSs in meeting climate goals. Carbon prices in intensity-based systems also tend to be lower, providing less incentive for obligated entities to invest in clean technologies. Additionally, linking and synchronizing intensity-based systems becomes challenging since absolute cap-based systems are standard in developed economies.

ETSs in China and Indonesia adopt the emission intensity approach. However, China plans to introduce absolute emissions caps in specific industries from 2027 and implement a complete cap-and-trade system by 2030.[56]

Overall, intensity-based caps can serve as a reasonable starting point and a practical transitional step, especially in countries where economic development is a priority. However, these systems should evolve to absolute caps to ensure environmental integrity and international alignment.

Fossil Fuel Subsidies

Fossil fuel subsidies significantly weaken carbon pricing efforts. The Net Effective Carbon Rate (Net ECR), a metric developed by the Organization for Economic Co-operation and Development (OECD), takes into consideration instruments that raise the cost of emitting carbon (such as carbon taxes, ETS, and energy taxes) and those that reduce it (such as fossil fuel subsidies). This measurement is a better reflection of real policy signals on emissions. A low or negative Net ECR indicates that a country's climate policy architecture is undermined by subsidized fossil fuels even when carbon pricing is implemented.

[56] Reuters. China's Carbon Market to Introduce Absolute Emissions Caps from 2027. 26 August 2025.

Figure 12: Calculating an Effective Carbon Rate

Source: OECD; IEEFA.

In 2022, global subsidies were an estimated USD7 trillion, or 7.1% of global GDP.[57] These consist of:

- **Explicit subsidies** (18% of the total): Direct support through capped fuel prices, tax breaks for producers, and energy bill coverage for consumers
- **Implicit subsidies** (82% of the total): Underpricing of environmental costs and lost consumption tax revenues

The East Asia and Pacific (EAP) regions accounted for the largest subsidy share with 38% of explicit and 48% of total (explicit and implicit) fossil fuel subsidies, followed by Europe (16% explicit, 11% total) and South Asia (5%–12% explicit, 5%–9% total).[58] As a share of GDP, the burden is also highest in Asia, accounting for about 10% in both EAP and South Asia, compared to just 3% in Europe.

Table 2: Fossil Fuel Subsidies in Asia

Country	Explicit Subsidy (USD billion)	Implicit Subsidy (USD billion)	Total Subsidies (USD billion)	Percentage of GDP
China	270	1,966	2,235	12.5%
South Korea	65	97	162	8.1%
Japan	34	276	310	5.8%
Indonesia	78	116	195	15.4%
Vietnam	7	50	56	14.3%
India	32	314	346	10.6%
Thailand	23	60	84	15.4%
Malaysia	18	63	81	19.7%
Philippines	1	18	19	4.7%
Kazakhstan	18	37	55	26.1%

Note: Based on 2022 data.
Source: IMF.

[57] International Monetary Fund. IMF Fossil Fuel Subsidies Data: 2023 Update. 24 August 2023.
[58] International Monetary Fund. IMF Fossil Fuel Subsidies Data: 2023 Update. 24 August 2023.

In absolute terms, China ranked first among Asian countries with fossil fuel subsidies of USD2.2 trillion, followed by India at USD346 billion and Japan at USD310 billion. However, when measured as a share of GDP, Kazakhstan led the region with subsidies equal to 26%, followed by Malaysia at 19.7%, and Indonesia and Thailand at 15.4% each.

Such high subsidy levels are a significant obstacle to the energy transition. By artificially lowering fossil fuel costs, subsidies blunt the price signal needed to shift demand toward cleaner alternatives. They also create lock-in effects by encouraging continued investments in fossil fuel infrastructure, crowding out capital that could otherwise flow to renewable energy sources. Unless reformed, Asia's heavy reliance on fossil fuel subsidies will remain a critical barrier to achieving its decarbonization and climate ambitions.

Room for Proactive Policies to Advance Decarbonization and Reduce Poverty

The prevalence of fossil fuel subsidies suggests that more proactive policies are needed. Removing these subsidies is politically sensitive, even though it would enable funds to be reallocated to essential public services such as health, education, and public safety. The ISEAS-Yusof survey[59] showed that less than half of Southeast Asian respondents favor removing subsidies – even though the main beneficiaries are industries and affluent business owners. Public reluctance stems from worries of potentially higher prices. However, carefully structuring a mix of relief measures and directing carbon tax or emission revenues to lower-income groups could address these concerns.

A study on carbon tax impacts on developing economies by the German Institute of Development and Sustainability (IDOS) found that such taxes can be regressive and increase poverty — but only if not strategically redistributed.[60] The report concluded that revenue redistribution from a carbon tax of USD50/tCO_2e could considerably reduce global poverty "by between 16% and 27% (110 to 190 million people), and reduce inequality (the average Gini coefficient would decline by between 4% and 8%)".

Similarly, a World Bank report on South Asia[61] highlighted the importance of active and strategic intervention aligned with a carbon tax. It found that such a tax, without revenue recycling, would be regressive, causing 20% of the most economically disadvantaged households to lose approximately 1% of their total consumption — a significant impact for those near the poverty line.

The study noted that USD32 billion was spent annually on fossil fuel subsidies in Southeast Asia, which could be reassigned to create a robust social safety net. For context, the World Bank

[59] ISEAS-Yusof Ishak Institute. The Southeast Asia Climate Outlook: 2024 Survey Report. 17 September 2024.
[60] IDOS. The impact of carbon taxation and revenue redistribution on poverty and inequality - German Institute of Development and Sustainability (IDOS). November 2022.
[61] World Bank. Are Carbon Taxes Good for South Asia?. May 2023.

estimated that USD10 billion in well-targeted cash transfers can lift over 50 million people out of extreme poverty in the Asia-Pacific region. Therefore, redirecting even a third of the existing subsidy spending could create a significant buffer for those most vulnerable to carbon tax impacts.

Additionally, both studies arrive at the same conclusion regarding carbon revenue utilization — lump-sum (universal) transfers are exceptionally effective. The IDOS report states that redistributing revenues back to households can fully offset the negative impacts and, if designed well, also reduce poverty and inequality, particularly in low- and middle-income countries.[62] This is consistent with the World Bank's modeling for South Asia, which found that under an equal carbon dividend scheme, 20% of the lowest-income households become net beneficiaries, resulting in a nearly 2% gain in consumption.

Other examples also provide models for minimizing the social impact of carbon taxes. The EU's Social Climate Fund (SCF), financed by 25% of revenue from its new ETS (up to EUR65 billion from 2026 to 2032), provides a quantitative benchmark.

Similar methods can be applied in Asia to minimize any negative social effects and enhance the positive impact of carbon taxes. In Indonesia, for example, an assumed carbon tax of USD25/tCO_2e could generate approximately USD16.3 billion annually (based on its 2022 emission of 652 million tonnes of CO_2 equivalent).[63] The Philippines, with around 155 million tonnes of CO_2[64], could raise USD3.8 billion in carbon revenue. Allocating 25%–30% of this amount to an SCF would create a substantial pool for targeted support.

The Role of Voluntary Carbon Markets (VCMs) in Compliance Systems

Asian countries are increasingly incorporating VCMs into their strategies. Carbon markets are a critical mechanism for bridging the climate financing gap and helping achieve Nationally Determined Contributions (NDCs).

Asian countries, recognizing the potential to reduce abatement costs and mobilize finance, are strategically incorporating voluntary credits into their compliance mechanisms. Singapore, Japan, and South Korea are emerging as potential buyers of carbon credits under Article 6 of the Paris Agreement, and Thailand was the first country to sell Internationally Transferred Mitigation Outcomes (ITMOs) to Switzerland.

[62] IDOS. The impact of carbon taxation and revenue redistribution on poverty and inequality - German Institute of Development and Sustainability (IDOS). November 2022
[63] IEA. Indonesia - Countries & Regions - IEA. Date accessed: 01 August 2025.
[64] Worldometer. Philippines CO2 Emissions - Worldometer. Date accessed: 01 August 2025.

Table 3: Voluntary Carbon Credits in Regulatory Carbon Pricing Schemes

Country	Instrument (s)	VCC Offset Allowance (%)*	Quality Control	International Agreements	Operational Status & Dates	Key Sectors Covered / Targeted
Singapore	Carbon Tax	5% (from 2024); up to 10% (2025 carry-over)	High-quality international credits: real, additional, permanent, leakage-free, independently verified, not double-counted, Article 6 aligned. Verra and Gold Standard accepted.	Signed agreements with 8 countries (Bhutan, Chile, Ghana, Papua New Guinea, Paraguay, Peru, Rwanda, Thailand); MOUs with 15 countries; coalition with UK, Kenya.	Tax: Jan 2019; VCC offset: 2024 (carry-over to 2025); tax rates staggered to 2030. Credits from agreements not yet online.	Manufacturing, Power, Waste, Water (70% of emissions). Rebates for Refiners, Petrochemicals.
China	National ETS	Up to 5% of verified emissions exceeding ETS targets (using China Certified Emission Reduction [CCERs])	Domestic CCERs only. Accurate accounting, conservative estimation, transparent disclosure, no double registration. New CCER credits eligible from Jan 2025.	Not linked with any other system.	ETS: 2021; CCER relaunch: Jan 2024 (official restart timeline pending).	Power, Steel, Cement, Aluminum Smelting.
Indonesia	ETS (Coal Power Sector); Carbon Levy/Tax (Planned)	ETS allows offset credits. Rules for allowance shortfalls (e.g., up to 85% adjustment, 15% PTBAE-PU reduction). No explicit VCC % for tax	“Surplus principle” for international sales (beyond NDC commitments). National SRNPPI standard. Finalizing MRAs with Verra, Gold Standard, Plan Vivo by May 2025.	MRA with Japan (Oct 2024).	ETS: Early 2023; IDX Carbon: Sept 2023; Carbon Levy/Tax: established but not yet implemented; ETS Phase 2: 2025.	ETS: Coal-fired power plants (expanding to captive coal, gas power plants). IDX Carbon: Renewable energy (plans for nature-based/forestry not yet eligible).
Japan	Carbon Tax; GX-ETS; GX-Surcharge (Planned); Sub-national ETSs	J-Credits (domestic) and JCM credits (bilateral) eligible for GX-ETS. No explicit % for tax	FSA framework for transparency and traceability (blockchain). Credits must be real and additional.	JCM with 31 partner countries. Article 6 Implementation Partnership (100+ countries/orgs). MRA with Indonesia (Oct 2024).	Carbon Tax: 2012; GX-ETS voluntary: FY2024–2025; GX-ETS mandatory: FY2026; GX-Surcharge: FY2028; Tokyo Stock Exchange Carbon Credit Market: Oct 2023; TCCM: April 2025.	GX-ETS: 700+ companies (>50% of national emissions); Power sector (auctioning from FY2033). Sub-national ETSs: Commercial/industrial buildings, factories.
Malaysia	Carbon Tax (Planned); ETS (Under Consideration)	Up to 5% of emissions (under planned carbon tax, mirroring Singapore)	Voluntary Carbon Market initiative (Budget 2022). Bursa Malaysia Carbon Exchange (March 2023).	Negotiating pact with Singapore. ASEAN chairmanship (2025) for regional alignment.	Carbon Tax: planned for 2026; ETS: under consideration; Bursa Malaysia Carbon Exchange: March 2023. National Carbon Market Policy and ETS rollout confirmed.	Planned Carbon Tax: Iron, Steel, Energy industries. Potential expansion to Cement, Aluminum, Fertilizer, Electricity, Hydrogen.
South Korea	K-ETS	Allows offset credits for compliance. No explicit VCC % for tax	Compliance units required (allowances or offset credits). Offset credit conversion period extended to 5 years.	Not linked with other systems. Potential buyer under Article 6. MOU with 7 countries. NDC	K-ETS: 2015; Phase 3: 2021–2025.	Heat & Power, Industry, Buildings, Waste, Transportation (domestic aviation, freight, rail, passenger, maritime

				allows international credits (5% of target).		shipping), Public sector.
Thailand	Carbon Tax (Planned); ETS (Planned)	Up to 15% of ETS surrender obligations (via TGO-certified credits)	Credits must be registered and certified by Thailand Greenhouse Gas Management Organisation (TGO). Project developers must measure, report, verify.	ITMO agreements with Switzerland & Singapore.	Draft CCA under review (implementation expected 2026). Carbon Tax & ETS: not yet implemented. Voluntary carbon trading (15% offset limit): considered for launch in 2027.	Planned Carbon Tax: high-emission sectors, coal-fired power plants. Carbon Credits: Energy, Transportation, Agriculture, Forestry (reforestation).

*Note: * VCC offset allowance is the extent to which voluntary carbon credits (VCCs) can be used to fulfil ETS or carbon tax obligations.*
Source: IEEFA.

There are differences in how Asian countries utilize VCMs to pursue decarbonization. Singapore stands out in the region for its rising carbon taxes and active interest in procuring high-quality international credits through bilateral agreements. The country has positioned itself as a regional carbon market hub, allowing companies to pay 5% of their carbon tax through voluntary credits. It has also allowed a rollover of this percentage to the following year, citing a "constrained supply" of quality credits and highlighting the practical challenges of scaling up compliance-grade offsets. This situation underscores the need for continued investment in project development to create more global credit sources and robust verification frameworks.

China prefers domestic integrity, allowing a limited percentage of national China Certified Emission Reduction (CCER) carbon credits for compliance, while avoiding links with external systems. Indonesia is pursuing a national plan for carbon credits, emphasizing NDC achievement over international sales, reflecting a commitment to sovereignty rather than emission reductions. Japan is following a phased carbon pricing strategy and transitioning its Green Transformation-Emissions Trading System (GX-ETS) from voluntary to mandatory, along with a planned carbon levy.

Malaysia and Thailand are also developing their carbon pricing frameworks. Malaysia has plans for a carbon tax with an offset provision, mirroring Singapore's model, and is establishing a domestic carbon exchange. Thailand's Draft Climate Change Act proposes a comprehensive system integrating a carbon tax and ETS, with a notable 15% offset allowance, and has already demonstrated international readiness through ITMO sales.

Conclusion

A robust financial structure linked to a carbon pricing system is essential to generate significant revenue from carbon permit sales. This depends on setting ambitious emission limits and allocating a substantial share of the permits through transparent bidding processes. A pivotal factor in achieving successful auctions lies in integrating ETSs with electricity markets and the overall economy. When emission expenses are factored into manufacturing costs, the end products can be appropriately priced. Meanwhile, targeted assistance programs should be implemented to protect those most at risk. Safeguards should also be introduced to prevent the relocation of industrial activity to regions with less stringent climate rules, preserving environmental integrity and economic stability.

Regional policymakers should strategically plan to implement ambitious carbon pricing mechanisms in a phased manner. Current carbon pricing across the region is far below the levels needed for effective decarbonization and is unlikely to provide an incentive for reducing emissions. Starting with a modest price of USD15–USD25/tCO_2e and plans for a predictable annual increase of USD10–USD15/tCO_2e would give businesses and households time to adapt and eventually align with the International Monetary Fund's recommended carbon price floor for emerging economies. Concurrently, fossil fuel subsidies should also be phased out, and a substantial share of the savings should be redirected to social and climate-related programs.

Appendices

National Level ETS

South Korea

	First Phase			Second Phase			Third Phase				
	2015	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**
Covered Sectors	23 sub-sectors from heat and power, industry, buildings, waste, and transportation (domestic aviation)			62 sub-sectors from heat and power, industry, buildings, waste, transportation (domestic aviation), and public sector			69 sub-sectors from heat and power, industry, buildings, waste, transportation (domestic aviation, freight, rail, passenger, and maritime shipping), and public sector				
Covered GHG	CO_2, CH_4, N_2O, HFCs, PFCs, and SF_6										
Threshold	Companies emitting >125,000 tCO_2/year and facilities emitting more than >25,000 tCO_2/year										
No. of Entities	525			589			685				
% of National GHG Emissions	66%			70%			79%				
Approach	Cap-and-trade										
Overall Cap (million tCO_2e)	1,687			1,796			3,082				
Allocated Allowances (million)	543	533	522	548	548	548	589	589	589	567	567
Reserve (million)	89			153			180				
Compliance Tools & Flexibility Mechanisms	Offsets: 10% (domestic credits only) Free allowances: 100% Banking*: Allowed Borrowing**: up to 20%			Offsets: 10% (up to 5% international credits) Free allowances: 97% Banking: Allowed Borrowing: up to 15%			Offsets: Up to 5% (domestic/international credits) Free allowances: 90% Banking: Allowed Borrowing: up to 15%				

Notes: Carbon Dioxide = CO_2, Methane = CH_4, Nitrous Oxide = N_2O, Hydrofluorocarbons = HFCs, Perfluorocarbons = PFCs, Sulfur hexafluoride = SF_6

** Banking allows participants to carry over surplus allowances for use in future compliance periods.*

*** Borrowing permits the use of future allowances to meet current compliance obligations.*

Source: South Korea's Ministry of Environment; International Carbon Action Partnership (ICAP).

China

	First Compliance Cycle	Second Compliance Cycle		Third Compliance Cycle	Fourth Compliance Cycle
	2021	**2022**	**2023**	**2024**	**2025**
Covered Sectors	Power				Power, Steel, Cement, Aluminum
Covered GHG	CO_2				CO_2 (Power Steel, Cement, Aluminum), CF_4 & C_2F_6 (Aluminum)
Threshold	Entities emitting >26,000 tCO_2/year				
No. of Entities	2,162	2,257	2,257	2,257	3,757 (estimated)
% of National CO_2 Emissions	40%				60%
Approach	Intensity-based				
Supply of Allowances (million tCO_2e)	4,500	5,096	5,104	N/A	N/A
Compliance Tools & Flexibility Mechanisms	Offsets: 5% (domestic credits only) Free allowances: 100% Banking: Allowed Borrowing: Not allowed	Offsets: 5% (domestic credits only) Free allowances: 100% Banking: Allowed Borrowing: Allowed with conditions		Offsets: 5% (domestic credits only) Free allowances: 100% Banking: Allowed Borrowing: Not allowed	Offsets: 5% (domestic credits only) Free allowances: 100% Banking: Allowed Borrowing: Not allowed

Notes: Due to the impact of Covid-19, borrowing was temporarily allowed during the second compliance cycle (2022 and 2023, based on emissions in 2021 and 2022) for entities with an allowance shortfall rate of 10% or more. The amount of borrowed allowances was capped at 50% of the shortfall.[65]

From 2026 (for compliance with 2025 emissions) onwards, banking is only allowed with government approval. The maximum amount of allowances that can be carried forward is 10,000 tonnes plus 1.5 times the net amount of allowances sold between 2024 and 2025.[66]

Source: Ministry of Ecology and Environment of the People's Republic of China; Shanghai Environment and Energy Exchange; ICAP.

[65] Ministry of Ecology and Environment of the People's Republic of China. 生态环境部应对气候变化司相关负责人就《2021、2022年度全国碳排放权交易配额总量设定与分配实施方案（发电行业）》答记者问. 16 March 2023.

[66] 人民网. 在推动企业减排同时，不给企业造成较高履约压力——碳配额分配制度稳中求进. 28 October 2024.

Kazakhstan

	First Phase	Second Phase		Third Phase			Fourth Phase	Fifth Phase			
	2013	2014	2015	2018	2019	2020	2021	2022	2023	2024	2025
Covered Sector	Power sector and centralized heating, extractive industries and manufacturing (oil and gas, metallurgy, chemical)			Power sector and centralized heating, extractive industries and manufacturing (oil and gas, metallurgy, chemical) and processing industry (building materials: cement, lime, gypsum, bricks)							
Covered GHG	CO_2										
Threshold	Entities emitting >20,000 tCO_2/year										
No. of Entities	178	166	166	225	225	225	218	212	212	212	212
% of National CO_2 Emissions	50%										
Approach	Cap and trade										
Overall Cap (million tCO_2e)	147	155	153	164	162	160	169	166	164	162	158
Reserve (million)	21	18	21	35	35	35	12	12	12	9	9
Compliance Tools & Flexibility Mechanisms	Offsets: Allowed (only domestic credits outside the scope of ETS are allowed) Free allowances: 100% Banking: Allowed in phase 3 and beyond Borrowing: Not allowed										

Notes: The Kazakhstan ETS was suspended in 2016 and 2017 for improvement on allowance allocation mechanism.

Allowances were allocated based on historical emission (grandparenting) in phase 1 and 2. Benchmarking (best practice emission intensity) was introduced as an option in phase 3 but has subsequently become the default method in phase 4 and 5.

Source: National Plan of the Republic of Kazakhstan; Astana International Financial Centre (AIFC); The Kazakhstan Institute for Strategic Studies; ICAP.

Indonesia

	First Phase		Second Phase
	2023	2024	2025
Covered Sectors	Power		
Covered GHG	CO_2, CH_4, N_2O		
Threshold	Coal power plants with an installed intensity of >100MW	Coal power plants with an installed intensity of >25MW	N/A
No. of Entities	99	146	N/A
% of National GHG Emissions	24%		
Approach	Intensity-based		
Supply of Allowances (million tCO_2e)	212	246	N/A
Compliance Tools & Flexibility Mechanisms	Offsets: Allowed Free allowances: 100% Banking: Allowed (within phases) Borrowing: Not allowed		

Source: Otoritas Jasa Keuangan; ICAP.

Local Level ETS

China (Beijing, Chongqing, Fujian, Guangdong, Hubei, Shanghai, Shenzhen, Tianjin pilot ETSs)

	Beijing	Chongqing	Fujian
	Phase 1: 2013-2015 Phase 2: 2016-2020 Phase 3: 2021-present	**2014-present**	**2016-present**
Covered Sectors	Transport, Buildings, Industry, Power	Industry	Domestic aviation, Industry
Covered GHG	CO_2	CO_2, CH_4, N_2O, HFCs, PFCs, SF_6	CO_2
Threshold	2013-2015: Entities emitting >10,000 tCO_2/year 2016 onwards: Entities emitting >5,000 tCO_2/year	2014-2020: Entities emitting >26,000 tCO_2/year 2021 onwards: Entities emitting >13,000 tCO_2/year	2016-2019: Entities emitting >10,000 tCO_2/year 2019 onwards: Entities emitting >5,000 tCO_2/year
No. of Entities	882	334	293
% of City GHG Emissions	30%	40%	38%
Approach	Intensity-based	2013-2020: absolute cap 2021 onwards: intensity-based	Absolute cap
Compliance Tools & Flexibility Mechanisms	Offsets: Up to 5% of annual emissions (50% must come from projects within Beijing) Free allowances: 95% Banking: Allowed Borrowing: Not allowed	Offsets: Up to 5% of annual emissions Free allowances: Mostly (proportion of auction is not disclosed) Banking: Allowed Borrowing: Only allowed from 2021 onwards	Offsets: Up to 5% of annual emissions (only projects within Fujian from entities not covered under the ETS with conditions) Free allowances: 95% Banking: Allowed Borrowing: Not allowed
	Guangdong	**Hubei**	**Shanghai**
	Phase 1: 2013-2015 Phase 2: 2016-2020 Phase 3: 2021-present	**2014-present**	**Phase 1: 2013-2015 Phase 2: 2016-present**
Covered Sectors	Domestic Aviation, Industry	Industry	Maritime, Domestic Aviation, Transport, Buildings, Industry, Power
Covered GHG	CO_2	CO_2	CO_2
Threshold	2013-2021: Entities emitting >20,000 tCO_2/year 2022 onwards: Entities emitting >10,000 tCO_2/year	2014-2015**:** Entities with energy consumption of >60,000 tce/year 2016-2022**:** Entities with energy consumption of >10,000 tce/year	**2013-2015:** **Power and industry:** Entities emitting >20,000 tCO2/year **Others:** Entities emitting >10,000 tCO_2/year **2016-present:**

		2023 onwards**:** Entities emitting >13,000 tCO_2/year	**Maritime:** Entities emitting >100,000 tCO_2/year / energy consumption of >50,000 tce/year **Industry, Aviation and Data Center:** Entities emitting >20,000 tCO_2/year / energy consumption of >10,000 tce/year (except for data center) **Road transport and Buildings:** Entities emitting >10,000 tCO_2/year / energy consumption of >10,000 tce/year
No. of Entities	391	449	378
% of City GHG Emissions	40%	50%	36%
Approach	Absolute cap	Absolute cap	Absolute cap
Compliance Tools & Flexibility Mechanisms	Offsets: Up to 10% of annual emissions (70% must come from projects within Guangdong) Free allowances: 96%-100% Banking: Allowed Borrowing: Not allowed	Offsets: Up to 10% of annual emissions (only projects within Hubei) Free allowances: Mostly (proportion of auction is not disclosed) Banking: Allowed with conditions Borrowing: Not allowed	Offsets: Phase 1 (up to 5%), Phase 2 (2016-2018: 1%, 2019-2020: 3%, 2022 onwards: 5%) Free allowances: Mostly (proportion of auction is not disclosed) Banking: Allowed Borrowing: Not allowed
	Shenzhen	**Tianjin**	
	2013-present	**2014-present**	
Covered Sectors	Waste, Transport, Buildings, Industry	Mining and Extractives, Industry	
Covered GHG	CO_2	CO_2	
Threshold	Entities emitting >3,000 tCO_2/year	Entities emitting >20,000 tCO_2/year	
No. of Entities	737	159	
% of City GHG Emissions	50%	50%	
Approach	Absolute cap	Absolute cap	
Compliance Tools & Flexibility Mechanisms	Offsets: Up to 20%) Free allowances: Mostly (proportion of auction is not disclosed) Banking: Allowed Borrowing: Not allowed	Offsets: Up to 10% Free allowances: Mostly (proportion of auction is not disclosed) Banking: Allowed Borrowing: Not allowed	

Note: tce = tonne of coal equivalent.

Source: ICAP.

Japan (Tokyo Cap-and-Trade Program & Saitama Target Setting ETS)

	Phase 1	Phase 2	Phase 3	Phase 4
	2010-2016	2015-2022	2020-2026	2025-2031
Covered Sectors	Buildings, Industry			
Covered GHG	CO_2			
Threshold	Entities with total consumptions of fuels, heating, and electricity of >1,500 kiloliters per year (crude oil equivalent)			
No. of Entities	Tokyo: 1,400 Saitama: 600			
% of GHG Emissions	Tokyo: 40% Saitama: 17%			
Approach	Cap-and-trade			
Compliance factor (reduction below base-year emissions)	Tokyo: 6-8% Saitama: 6-8%	Tokyo: 15-17% Saitama: 13-15%	Tokyo: 25-27% Saitama: 20-22%	Tokyo: 48-50% Saitama: 48-50%
Compliance Tools & Flexibility Mechanisms	Offsets: Allowed (no limit) Free allowances: 100% Banking: Allowed Borrowing: Not allowed			

Notes: A phase is defined as the compliance period plus an additional 18-month adjustment period, during which time facilities may continue to trade credits in order to reach their targets for the corresponding compliance period.

Contrary to the South Korea ETS, the Tokyo Cap-and-Trade Program and Saitama Target Setting ETS do not issue tradeable allowances. Instead, each facility receives an individual absolute reduction target.

The lower compliance factor applies to office buildings and factories that use district heating and cooling for more than 20% of their energy consumption.

Source: Tokyo Metropolitan Government; ICAP.

Carbon Tax

Japan

Taxed products	Tax rate before October 2012	Carbon tax		
		1 October 2012	April 2014	April 2016
Crude oil and petroleum per kiloliter	JPY2,040	+JPY250 (Total: JPY2,290)	+JPY250 (Total: JPY2,540)	+JPY260 (Total: JPY2,800)
Gaseous hydrocarbon (LPG/LNG) per tonne	JPY1,080	+JPY260 (Total: JPY1,340)	+JPY260 (Total: JPY1,600)	+JPY260 (Total: JPY1,860)
Coal per tonne	JPY700	+JPY220 (Total: JPY920)	+JPY220 (Total: JPY1,140)	+JPY230 (Total: JPY1,370)

Notes: LPG = liquefied petroleum gas, LNG = liquefied natural gas

Japan levies a carbon tax of JPY 289 per tonne of CO_2, applied in addition to existing fossil fuel tax rates and calculated according to each fuel's carbon content.

Cruel oil and petroleum: JPY 289/t-CO2 x 2.62kg - CO2/kℓ = JPY760/kℓ

Gaseous hydrocarbon: JPY289/t-CO2 x 2.70kg - CO2/t = JPY 780/t

Coal: JPY289/t-CO2 x 2.33kg - CO2/t = JPY670/t

Source: Japan's Ministry of Environment.

Singapore

	2022	2023	2024	2025	2026	2027	2028	2029	2030
Covered Sectors	Manufacturing (manufacturing and manufacturing related services); Power (supply of electricity, gas, steam, compressed air and chilled water for air-conditioning); Water (water supply and sewage); and Waste (waste management)								
Covered GHG	CO_2, CH_4, N_2O, SF_6, NF_3. HFC, and PFC								
Threshold	Entities emitting >26,000 tCO_{2e}/year								
No. of Entities	50								
% of National GHG Emissions	70%								
Tax rate /tCO_2e	SGD5	SGD5	SGD25	SGD25	SGD45	SGD45	SGD50 – SGD80	SGD50 – SGD80	SGD50 – SGD80
Offset	Not allowed		Up to 5%						

Notes: Unutilized offset limits are allowed to be rolled over to the next year.

Source: Singapore's National Environment Agency.

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The Institute for Energy Economics and Financial Analysis (IEEFA) examines issues related to energy markets, trends and policies. The Institute's mission is to accelerate the transition to a diverse, sustainable and profitable energy economy. www.ieefa.org

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