AMRO
ASEAN +3 MACROECONOMIC RESEARCH OFFICE

Analytical Note

Carbon Pricing in ASEAN+3 Economies: Progress and Challenges[1]

November 7, 2022

I. Introduction

1. **The Paris Agreement requests all countries to voluntarily define their own commitments to reduce greenhouse gas (GHG) emissions under the so-called Nationally Determined Contributions (NDCs).**[2] Effectively replacing the Kyoto Protocol, the Paris Agreement came into force in 2016 and is the principal framework for international negotiations on climate change, especially by introducing binding agreements for countries that have signed it to make necessary mitigation and adaptation efforts. Unlike the Kyoto Protocol, which sets the maximum emissions targets (assigned amounts) for certain developed countries and economies,[3] the Paris Agreement applies to all countries, but countries can set their own emission targets and decide what policies and instruments are used to achieve them, including carbon pricing, in their NDCs.

2. **Carbon pricing is one of the key mitigation measures to cut GHG emissions by putting prices on carbon.** Climate change has a far-ranging impact on the environment and public health, with a high cost on the public and on future generations. Given the negative externality of GHG emissions, economic theory prescribes internalizing the social cost of emissions by setting the carbon price equal to the social cost of carbon emissions and charging all parties that produce emissions. With proper price signals from the carbon pricing system, GHG emitters are expected to reduce their emissions by reducing energy consumption, shifting to cleaner fuels, and redirecting new investment to clean technologies.

3. **This note aims to review progress in carbon pricing implementation in the ASEAN+3 region, and discusses the challenges in the adoption and implementation of carbon pricing**. The structure of this note is as follows. Section II reviews key concepts in carbon pricing instruments. Section III presents the progress in adopting emission trading systems, carbon taxes, and carbon crediting mechanisms in ASEAN+3 economies. Section IV is about fuel and commodity taxes and subsidies in the region. Section V discusses various issues and challenges related to carbon pricing, while Section VI offers some key policy recommendations to address the challenges.

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[2] NDCs are national climate action commitments that a country must prepare, communicate, and maintain in order to reduce its GHG emissions and to adapt to the impacts of climate change. NDCs must be updated and submitted every five years to the United Nations Framework Convention on Climate Change (UNFCCC) secretariat.

[3] 36 countries participated in the first emission reduction commitment period (2008-2012), and the current emission allowances for the second reduction period (2013-2020) are based the Doha Amendment that set for the target for 37 developed countries and economies in transition over the period 2013-2020. None of the ASEAN+3 economies are among the 37 countries in the second commitment period. Japan was one of the countries in the first commitment period, but has no obligations in the second commitment period of the Kyoto Protocol after 2012.

II. Carbon Pricing Instruments

4. **Various carbon pricing instruments have been developed**. Some instruments try to establish a direct linkage between the price and the level of GHG emissions, while others are based on indirect linkages (World Bank, 2022). Currently, 68 carbon pricing instruments (both direct and indirect) have been fully implemented globally in 35 countries (including the E.U. as one), and 14 of them are in operation in four economies of the region. Other member countries have not adopted any instrument yet, but most of them have explicitly mentioned carbon pricing in the NDCs as part their future efforts on climate action (Table 1).

Table 1. Carbon Pricing in ASEAN+3 Economies

	Mentioned in NDCs	Type of Carbon Pricing		Sector Coverage[1]	Carbon Price (USD per tCO_2e)[2]	Revenue Collected (2021, USD mn)
		ETS	Carbon Tax			
BN	O			Industry	NA	NA
KH	O			Transport	NA	NA
CN	O			Transport, Buildings, Industry, Domestic Aviation, and Power	6.37	40.24[3]
HK	NA			NA	NA	NA
ID	O			Coal-fired power generation	2.1	NA
JP	X			Buildings and Industry	4.13 (ETS) 2.36 (Tax)	1,800.33[4]
KR	O			Waste, Domestic Aviation, Buildings, Industry, and Power	18.75	243.50
LA	X			NA	NA	NA
MM	X			NA	NA	NA
MY	X			NA	NA	NA
PH	X			NA	NA	NA
SG	O			All facilities that emit a minimum of 25,000 tCO_2e GHG emissions per annum	3.69	152.98
TH	X			NA	NA	NA
VN	X			NA	NA	NA

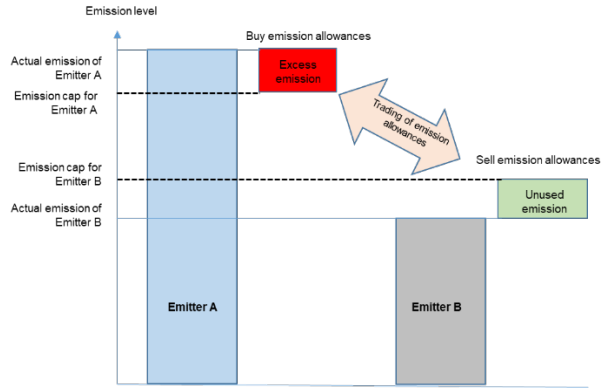
Source: NDC Registry (https://unfccc.int/NDCREG); International Carbon Action Partnership (ICAP) ETS Map (https://icapcarbonaction.com/en/ets); World Bank Carbon Pricing Dashboard (https://carbonpricingdashboard.worldbank.org/); national authorities; AMRO staff compilations.
Note: Fully implemented; Under development; Under Consideration; Undecided; NA= Not Available. BN = Brunei; CN = China; HK = Hong Kong, China; ID = Indonesia; JP = Japan; KH = Cambodia; KR = Korea; LA = Lao PDR; MY = Malaysia; PH = Philippines; SG = Singapore; TH = Thailand; and VN = Vietnam; CO2e stands for carbon oxide equivalent, a metric measure that is used to compare the emission from various GHG that equivalent amount to carbon dioxide with the same global warming potential (https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Glossary:Carbon_dioxide_equivalent).
[1] Sectors mentioned in NCDs or covered in the current/planned ETS/Carbon Taxes; [2] Average prices as of April 1, 2022; [3] Chongqing pilot ETS; [4] Japan Carbon Tax.

5. **Direct carbon pricing instruments include an emission trading system (ETS), a carbon tax, and a carbon crediting mechanism.** In an ETS, a government sets a ceiling (cap) on the GHG emissions of each emitter,[4] and the allowances are distributed to each emitter freely or by auctions. An ETS creates a marketplace for low emitters to trade their extra allowances to large emitters to ensure that all emitters follow their pre-allocated GHG emission

[4] The national level total cap for all emitters is generally set according to the national emission target set in the NDCs (see Appendix).

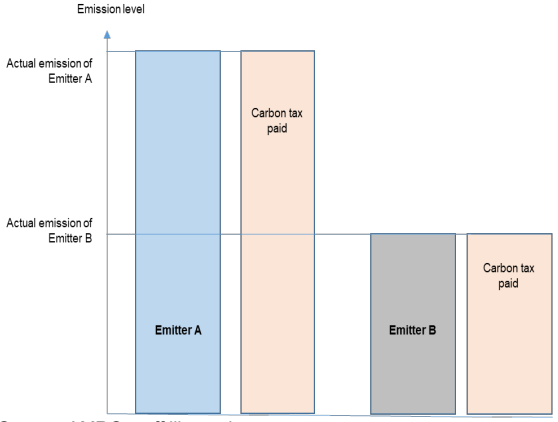
targets (Figure 1). With the allocated cap on emissions and the trade mechanism, an ETS is also known as a cap-and-trade system. Meanwhile, a carbon tax is the emitter's compulsory contribution levied by the government on GHG emissions. The carbon tax rate is a price that emitters must pay for each tonne of GHG they emit (Figure 2). Taxing emissions directly as a source of externality, the carbon tax is a Pigouvian tax affecting the behavior of emitters, but it cannot guarantee a minimum level of GHG reduction. Therefore, an ETS can be combined with a carbon tax to result in a cap-and-tax scheme (Figure 3), where an emitter can both buy emission allowances and pay a carbon tax to offset its excess emission. Lastly, unlike an ETS and a carbon tax that are based on the polluter-pay-principle, a carbon crediting mechanism allows an emitter to invest in a voluntary emission reduction project and get credit from the emission reduction if the post-project emission is below the pre-project emission baseline (Figure 4). The carbon credit can also be used to offset an emission excess from the emitter's other projects.

Figure 1. An ETS Scheme



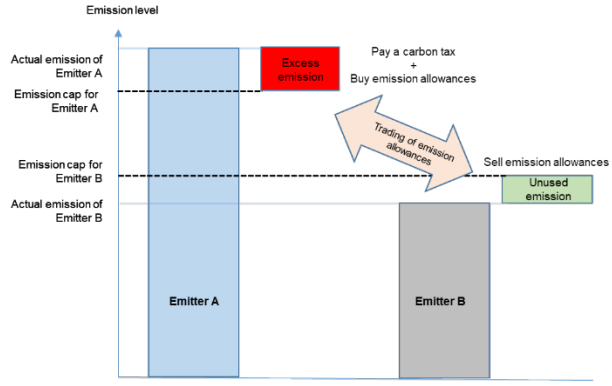
Source: AMRO staff illustration.
Note: Emitter A produces more emissions than its allowance, while Emitter B produces less than its allowance. Both parties can trade the allowances where Emitter A buys Emitter B's unused allowances to compensate for its higher-than-allowed emissions.

Figure 2. A Carbon Tax Scheme



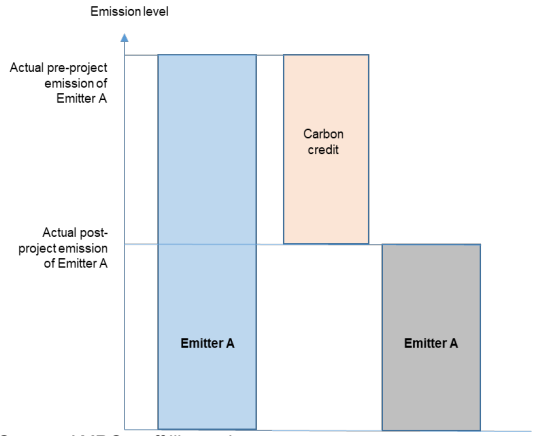
Source: AMRO staff illustration.
Note: Emitter A and Emitter B pay carbon taxes according to their emissions.

Figure 3. A Cap-and-Tax Scheme



Source: AMRO staff illustration.
Note: Emitter A purchases Emitter B's unused allowances and pays a carbon tax to compensate for its higher-than-allowed emissions.

Figure 4. A Carbon Crediting Mechanism

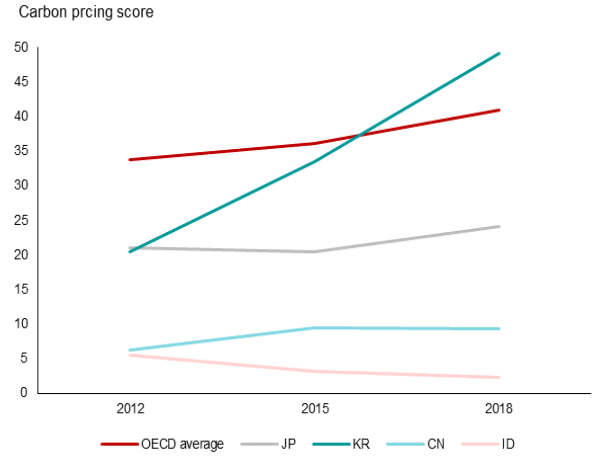


Source: AMRO staff illustration.
Note: Emitter A invests in a carbon reduction project. When the post-project emission is lower than the pre-project emission, Emitter A can claim carbon credit equal to the emission reduction.

6. **Indirect carbon pricing instruments include fuel and commodity taxes, and subsidies.** Fuel taxes are levied on fuel, the source of GHG emissions, rather than directly on the emissions. Meanwhile, a fuel subsidy is a negative carbon pricing instrument that encourages, rather than discourages, GHG emissions. OECD (2021) has developed an effective carbon rate (ECR) measure that values how countries price carbon emissions by

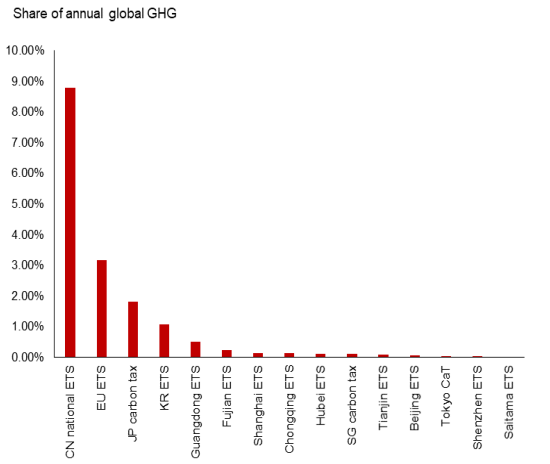
combining fuel excise taxes, carbon taxes, and ETS.[5] Only four ASEAN+3 member countries, i.e., Japan, Korea, China, and Indonesia, are included in the ECR database of OECD. All four countries are still below the benchmark value of EUR60 per tonne of CO_2, and only Korea is above the OECD average as of 2018 (Figure 5).

Figure 5. Carbon Pricing Scores of Selected ASEAN+3 countries



Source: OECD (2021).
Note: CN = China; ID = Indonesia; JP = Japan; and KR = Korea. The score covers six economic sectors: road, off-road, industry, agriculture & fisheries, residential & commercial, and electricity, Including emissions from biomass combustion.

Figure 6. Share of Global GHG Emission Covered by ETS and Carbon Taxes in ASEAN+3 Economies



Source: World Bank Carbon Pricing Dashboard (https://carbonpricingdashboard.worldbank.org/).

III. ETS and Carbon Taxes in the Region

7. **The European Union established the world's first ETS in 2005, and Finland introduced the first carbon tax in 1990**. The participants of the EU ETS include the 27 EU member states and three European Free Trade Association (EEA-EFTA) states (Iceland, Liechtenstein, and Norway).[6] The EU ETS covers electricity and heat generation, energy-intensive industries, and commercial aviation within the European Economic Area. There are currently 9,628 stationary installations and 349 aircraft operators participating in the EU ETS,[7] and the carbon price stood at EUR88.16 (USD91.53) per tonne of CO_2e emissions as of May 12, 2022.[8] Finland, meanwhile, was the world's first country to introduce a carbon tax in 1990, initially imposed on the carbon content of the fossil fuel at the rate of USD1.41 per tonne of CO_2e. The tax rate has since risen to USD73 per tonne for transport fuels and USD59 for other fossil fuels.

8. **Only four countries in the ASEAN+3 region have fully implemented either an ETS or a carbon tax (Table 2)**. Among ASEAN+3 economies, China and Korea have implemented an ETS, Singapore has adopted a carbon tax, and Japan has in place both an ETS and a carbon tax. These four countries with carbon pricing instruments together account for 13.2 percent of the global GHG emissions in 2022 (Figure 6). In the case of Indonesia, a law to introduce a cap–and–tax system in 2022 was enacted in 2021, but its implementation has been postponed due to the current high inflationary environment.

[5] OECD (2021) denoted this the *Carbon Pricing Score (CPS)*, measuring the extent to which countries have attained the goal of pricing all energy related carbon emissions at certain benchmark values for carbon costs or more.
[6] The UK left the EU ETS as the Brexit transition period ended on December 31, 2020. The UK then launched its own ETS on May 19, 2021.
[7] The EU ETS factsheet (https://icapcarbonaction.com/en/ets/eu-emissions-trading-system-eu-ets).
[8] Live Carbon Price Today (https://carboncredits.com/carbon-prices-today/).

9. **An ETS has been fully implemented in China, Japan, and Korea, while it is still under development in Indonesia, Malaysia, Thailand, and Vietnam**. Other member economies are still considering the implementation of ETS.

Fully implemented ETS:

- **China** has fully implemented eight regional ETSs and one national ETS. The regional ETSs are established in Beijing (2013), Chongqing (2014), Fujian (2016), Guangdong (2013), Hubei (2014), Shanghai (2013), Shenzhen (2013), and Tianjin (2013). The sectoral coverage of regional ETSs is not fully harmonized but mainly comprises transport, buildings, industry, domestic aviation, and power. The ETS carbon price varies widely, ranging from USD0.64 in Shenzhen to USD12.51 in Guangdong, with an average of USD6.37 per tonne of CO_2e emissions as of April 1, 2022. Meanwhile, the national ETS came into operation in 2021 and currently covers only the power sector, with an average secondary market price of USD9.20 per tonne of CO_2e emissions as of April 1, 2022. The allowance allocation is mostly free, but auctioning is also used in Chongqing, Fujian, Guangdong, Hubei, Shanghai, and Tianjin ETSs.
- **Japan** has fully implemented two regional ETSs: the Saitama Target Emission Trading System (2011) and the Tokyo Cap-and-Trade Program (2010). Both ETSs cover fuels, heat, and electricity consumption in commercial and industrial buildings. The average secondary carbon prices at the Saitama ETS and the Tokyo Cap-and-Trade Program were USD3.84 and USD4.42 per tonne of CO_2e emissions as of April 1, 2022, respectively. Japan is considering implementing either ETS or carbon tax at a national level.[9] The free allowance allocation method is currently used in both regional ETSs.
- **Korea** fully implemented a national ETS in 2015 that covers the waste, domestic aviation, buildings, industry, and power sectors, which together account for 74 percent of domestic emissions. The ETS carbon price in April 2022 stood at USD18.75 per tonne of CO_2e emissions. Korea plans to combine two allocation methods (free allocation and auctioning) with at least 10 percent of allocation through auctions in 2021-2025.

ETSs under development:

- **Indonesia.** The Ministry of Energy and Mineral Resources ran a voluntary ETS trial for the power sector from March 2021 to August 2021. Thirty-two coal-fired power plants—14 plants as buyers and 18 plants as sellers—participated in the trial to familiarize themselves with compliance procedures and offset mechanisms (Wanhar 2021). The average price in the trial was USD2 per tonne of CO_2e emissions. Carbon pricing in Indonesia will be voluntarily implemented in 2021-2024 and is scheduled to turn into a mandatory implementation by 2025 (IMEMR 2021). The Indonesia Commodities & Derivatives Exchange (ICDX) is also preparing a platform for mandatory and voluntary ETS markets to facilitate carbon allowance auctions.[10]
- **Malaysia.** The Ministry of Environment and Water published a National Guide on Voluntary Carbon Market Mechanism in 2021 as the primary reference and guidance for domestic voluntary carbon market mechanisms, including the roles and functions of various parties in the carbon market mechanisms.[11] The Ministry also proposed to develop the policy and framework of the domestic emissions trading mechanism. The Ministry of Finance and Bursa Malaysia are now following up on the proposal by

[9] Japan PM Suga eyes study on carbon pricing to cut emissions, Kyodo News (https://english.kyodonews.net/news/2020/12/88171766deba-japan-pm-suga-eyes-study-on-carbon-pricing-to-cut-emissions.html).
[10] ICDX: Organizing Carbon Markets in Indonesia (https://www.icdx.co.id/our-market/carbon).
[11] https://www.kasa.gov.my/resources/alam-sekitar/National-Guidance-on-Voluntary-Carbon-Market-Mechanisms.pdf.

developing a single transaction platform for domestic ETSs[12] and planning to launch a voluntary carbon market by the end of 2022.[13] The 12th Malaysia Plan (12MP) also highlighted a plan to develop enabling instruments for climate action, including carbon pricing.

- **Thailand.** The Greenhouse Gas Management Organization is drafting the Emission Trading System Law and is developing an ETS in the Eastern Economic Corridor region.[14] With the Climate Change Act under review for cabinet approval, Thailand is preparing climate change work plans comprising the climate change master plan, the GHG mitigation action plan, and the climate change adaptation plan.[15]
- **Vietnam.** The Ministry of Natural Resources and Environment and the Ministry of Finance have been mandated by the revised Law on Environmental Protection to establish an ETS. A pilot system will start by 2025 and will be fully implemented by 2027.[16]

ETSs under consideration:

- **Brunei Darussalam**. The National Carbon Climate Policy states that Brunei will introduce carbon pricing—either an ETS or a carbon tax—applicable to all industrial facilities and power utilities by 2025.[17]
- **Hong Kong, China.** In its Climate Action Plan 2050, Hong Kong assesses establishing a unified carbon market in the Guangdong-Hong Kong-Macao Greater Bay Area (GBA).[18]
- **Lao PDR.** As mandated by its National Green Growth Strategy, Lao PDR will utilize carbon pricing—either an ETS or carbon tax—to stimulate efficient and economical energy usage.[19]
- **The Philippines.** As mandated by the Low Carbon Economy Act, the Philippines will establish a cap-and-trade system for the industrial and commercial sectors.

10. **Carbon taxes have been fully implemented in Japan and Singapore and will be implemented in Indonesia soon**.

- **Japan was the first Asian country to implement a carbon tax, in 2012.** The carbon tax at a rate of USD2.36 per tonne of CO_2e emissions in 2022 is levied on petroleum, oil products, natural gas, and coal. Designed to be revenue neutral, the revenue generated by the carbon tax is used to finance renewable energy projects (Gokhale 2021).
- **Singapore was the first to implement a carbon tax in Southeast Asia in 2019**. From the current rate at USD3.69 (SGD5.00) per tonne of CO_2e emissions, the carbon

[12] Govt agrees for Voluntary Carbon Markets development, The Malaysian Reserve (https://themalaysianreserve.com/2021/09/20/govt-agrees-for-voluntary-carbon-markets-development/).
[13] Malaysia's bourse to launch voluntary carbon market by year-end (https://www.businesstimes.com.sg/asean-business/malaysias-bourse-to-launch-voluntary-carbon-market-by-year-end).
[14] Supporting Thailand's Climate Goals through the World Bank Partnership for Market Readiness (https://www.worldbank.org/en/results/2021/11/15/supporting-thailand-s-climate-goals-through-the-world-bank-partnership-for-market-readiness).
[15] Thailand's First Climate Change Bill to be Submitted for Approval (https://www.lexology.com/library/detail.aspx?g=07c23552-5798-47d4-b986-0dbc96690c9f).
[16] PM gives nod to carbon trading, VietNamNet Online Newspaper (http://english.vietnamnet.vn/fms/environment/53429/pm-gives-nod-to-carbon-trading.html).
[17] Brunei Darussalam National Climate Policy, Brunei Darussalam Secretariat 2020 (http://www.climatechange.gov.bn/SitePages/BNCCP/index.html#page=1).
[18] Hong Kong's Climate Change Action Plan 2050, October 2021 (https://www.climateready.gov.hk/files/pdf/CAP2050_booklet_en.pdf).
[19] National Green Growth Strategy of the Lao PDR till 2030, Secretariat for Formulation of National Green Growth Strategy of the Lao PDR (https://www.greengrowthknowledge.org/sites/default/files/downloads/policy-database//national_green_growth_strategy_of%20the_Lao_PDR_till_2030_government_of_Lao.pdf).

tax rate is scheduled to gradually increase to USD17.97 (SGD25.00) in 2024-2025 and USD32.35 (SGD45.00) in 2026-2027. Singapore is targeting to increase the tax rate further to USD36-50 (SGD50-80) by 2030.[20] The sectors subject to the carbon tax include all facilities that directly emit at least 25,000 tCO_2e GHG emissions annually.

- **Indonesia is the second country in Southeast Asia to implement a carbon tax**. Initially, a minimum carbon tax rate of USD2.10 per tonne of CO_2e emissions was proposed to be introduced by April 1, 2022. However, it was first postponed to July 1, 2022, and then postponed again due to the inflationary pressure from higher fuel and food prices. Despite delays, the Indonesian government is still committed to implementing it by the end of 2022. The carbon tax will first be imposed on coal-fired power generation plants exceeding a stipulated cap under a cap-and-tax scheme and will be expanded to cover other sectors according to the carbon tax roadmap (AMRO, 2021).

11. **Meanwhile, Malaysia, Thailand, and the Philippines are considering the adoption of carbon taxes.** The 12th Malaysia Master Plan 2021-2025 mentions a carbon tax. In the Budget 2023 speech, the Ministry of Finance stated its plan to introduce a carbon tax and to study the feasibility of a carbon pricing mechanism.[21] Meanwhile, Thailand's Excise Department is currently studying imposing a carbon tax on industrial sectors.[22] The Philippines' Department of Finance also announced in July 2022 that it is studying carbon tax or carbon pricing instruments, especially based on Indonesia's experience.[23]

12. **Four countries in the ASEAN+3 region have fully implemented carbon crediting mechanisms (Table 3)**. China and Japan have multiple crediting mechanisms at the national and sub-national levels. China has five sub-national (Beijing, Fujian, and Guangdong) and one national crediting mechanism. Japan has one national, one regional, and one sub-national mechanisms, alongside two ETSs (the Saitama Target Emission Trading System and the Tokyo Cap-and-Trade Program).[24] Meanwhile, Korea and Thailand have only single national carbon crediting mechanisms. Sectors covered by the carbon crediting mechanisms in this region are mostly forestry and renewable energy. In countries with multiple ETSs, the carbon credits of one mechanism are often accepted in another ETS. For instance, the China GHG Voluntary Emission Reduction Program accepts credits from other regional China ETSs, while the J-credit scheme and Saitama Forest Absorption Certification System accept credits from the Saitama ETS.

Table 3. Carbon Crediting Mechanisms in ASEAN+3 Economies

Name of Scheme	Country	Crediting Scheme	Sector Coverage	2020 Price Range (USD per tCO_2e)
Beijing Forestry Offset Mechanism	CN	Beijing Forestry Certified Emission Reductions	Forestry	2.1-9.28
Beijing Parking Offset Crediting Mechanism	CN	Parking Certified Emission Reductions	Transport	7-9
Chongqing carbon offset mechanism	CN	NA	NA	NA

[20] Carbon Tax, Strategy Group Prime Minister's Office (https://www.nccs.gov.sg/singapores-climate-action/carbon-tax/).
[21] Speech Budget 2023 (https://budget.mof.gov.my/pdf/2023/ucapan/ub23.pdf).
[22] Excise Considers Carbon Tax, Bangkok Post (https://www.bangkokpost.com/business/2191891/excise-considers-carbon-tax).
[23] DoF studies Indonesia's carbon tax system, Manila Times (https://www.manilatimes.net/2022/08/01/news/national/dof-studies-indonesias-carbon-tax-system/1852978).
[24] The Japan's national scheme is the J-Credit Scheme and the regional scheme is the Joint Crediting Mechanism. Meanwhile, the sub-national scheme is called the Saitama Forest Absorption Certification System.

Name of Scheme	Country	Crediting Scheme	Sector Coverage	2020 Price Range (USD per tCO_2e)
Fujian Forestry Offset Crediting Mechanism	CN	Fujian Forestry Certified Emission Reduction	Forestry	1-3
Guangdong Pu Hui Offset Crediting Mechanism	CN	Pu Hui Certified Emissions Reductions	Forestry, renewable energy	2[1)]
China GHG Voluntary Emission Reduction Program	CN	Chinese Certified Emission Reductions	Energy efficiency, forestry, fuel switch, renewable energy, waste	1.5-3
J-Credit Scheme	JP	J-credits	Forestry, energy efficiency, waste, renewable energy, industrial gases, agriculture, fuel switch, fugitive emissions, transport, manufacturing	20 (renewable energy) 13.5 (energy saving and others)
Join Crediting Mechanism	JP	JCM credits	Energy efficiency, renewable energy, transport	NA
Saitama Forest Absorption Certification System	JP	Forest Absorption Credits	Forestry	NA
Saitama Target Setting Emissions Trading System	JP	Offset credits	Renewable energy	4
Tokyo Cap-and-Trade Program	JP	Offset credits	Energy efficiency, renewable energy	1.62-8.12 (excess emission reductions) 43-58 (renewable energy credits)
Republic of Korea Offset Credit Mechanism and	KR	Korean Offset Credits	Energy efficiency, industrial gases, manufacturing, renewable energy, transport, waste	20-36
Thailand Voluntary Emission Reduction Program	TH	TVER	Energy efficiency, renewable energy, waste, transport, forestry, agriculture	0.64-9.46

Source: World Bank Carbon Pricing Dashboard (https://carbonpricingdashboard.worldbank.org/).
Note CN = China; JP = Japan; KR = Korea; and TH = Thailand. NA = Not Available. [1)] As of 2019.

IV. Indirect Carbon Pricing in the Region

13. **Environmental taxes and subsidies have also been implemented in the region.** In addition to direct carbon pricing mechanisms, environmental taxes and tax exemptions can be used (Table 4). Environmental taxes include taxes on energy, pollution, waste, plastic, and packaging. Tax exemptions include the exclusion of income or transactions from tax to promote activities that positively impact the environment, such as reducing water use and using renewable energy. The revenue collected from environmental taxes is substantial in Korea, Japan, and China (Figure 7), while revenue forgone from environmental tax exemptions is still not measured.

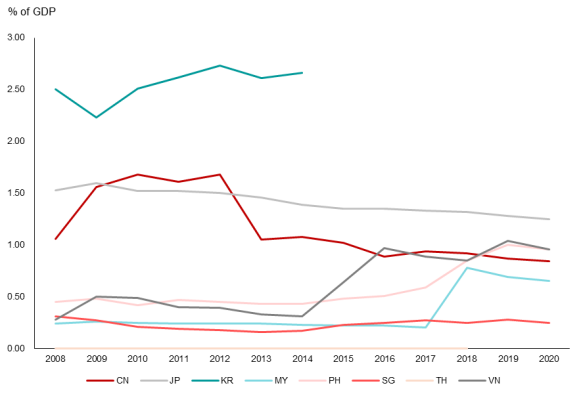
14. **Negative carbon pricing instruments still exist in the region in the form of subsidies and are still significant in some countries**. Parry, Black, and Vernon (2021) estimated that the average fossil fuel subsidy cost in the ASEAN+3 countries in 2021 was 7.5 percent of GDP, with China, Indonesia, Malaysia, and Vietnam spending more than 10 percent on fossil fuel subsidies (Figure 8). However, the fossil fuel subsidies were primarily in the form of implicit subsidies, i.e., environmental costs and foregone consumption taxes, rather than explicit subsidies such as producer subsidies.

Table 4. Environmental Taxes and Tax Exemptions in ASEAN+3 Economies

	Taxes				Tax Exemptions				
	Energy[1)]	Pollution[2)]	Waste[3)]	Plastic & packaging[4)]	Waste & water[5)]	Energy & fuel efficiency[6)]	Renewable energy[7)]	Generation[8)]	Plastic & packaging[9)]
CN	O	O	O	X	O	O	O	O	X
HK	O	O	O	O	X	O	X	X	X
ID	X	X	X	X	X	O	X	X	X
JP	O	O	O	X	O	O	X	O	X
KR	O	O	O	X	O	O	X	X	X
MY	O	X	O	O	X	X	X	X	X
PH	X	O	O	X	O	O	O	X	X
SG	X	X	X	X	X	X	X	X	X
TH	O	O	O	X	O	O	O	X	X
VN	O	O	O	O	O	O	O	X	X

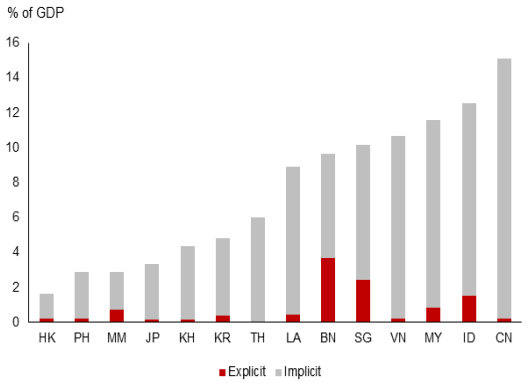
Source: EY Green Tax Tracker (2022).
Note: Data are unavailable for Brunei Darussalam; Cambodia; Laos, and Myanmar. CN = China; HK = Hong Kong, China; ID = Indonesia; JP = Japan; KR = Korea; MY = Malaysia; PH = Philippines; SG = Singapore; TH = Thailand; and VN = Vietnam. O: the tax/exemption is applicable. X: the tax/exemption is not applicable. [1)] Energy taxes include gasoline, coal, natural gas, other fuel taxes, aviation taxes, and electricity fees. [2)] Pollution taxes include water, pollution, and effluent charges; emissions and air pollution charges. [3)] Waste taxes include recycling, waste, and landfill fees; electronic waste disposal fees.[4)] Plastics and packaging taxes include single-use plastics and other product taxes. [5)] Waste and water tax incentives include water use reduction and thermal energy production, waste reduction/recycling, and electronic waste. [6)] Energy and fuel efficiency tax incentives include emission reduction, conventional and alternative fuel vehicles and equipment, efficiency in energy use in industrial and manufacturing processes, [7)] Renewable energy tax incentives include solar, wind, and geothermal. [8)] Generation tax invectives include on-site generation (cogeneration/waste heat/fuel cells/microturbines and conventional generation. [9)] Plastics and packaging tax incentives.

Figure 7. Environmental Taxes Revenue in ASEAN+3 Economies



Source: OECD (https://stats.oecd.org/Index.aspx?DataSetCode=ERTR).
Note: CN = China; JP = Japan; KR = Korea; MY = Malaysia; PH = Philippines; SG = Singapore; TH = Thailand; and VN = Vietnam.

Figure 8. Fossil Fuel Subsidies in ASEAN+3 Economies, 2021



Source: IMF Climate Change Indicator Dashboard (https://climatedata.imf.org/).
Note: BN = Brunei; CN = China; HK = Hong Kong, China; ID = Indonesia; JP = Japan; KH = Cambodia; KR = Korea; LA = Lao PDR; MY = Malaysia; PH = Philippines; SG = Singapore; TH = Thailand; and VN = Vietnam

V. Controversies around Carbon Pricing

15. **Carbon pricing can provide several environmental and economic benefits**. In addition to reducing emissions by internalizing the social cost of climate change, various benefits of carbon pricing have been discussed widely. For example, Baranzini *et al.* (2017) pointed out that carbon pricing can promote carbon-efficient technologies, reduce carbon rebound, and lower abatement costs, while reducing the information needs by the regulators. Given its wide-ranging benefits, the World Bank (2022) argued that carbon pricing is one of

the most effective instruments to steer economies on low-emission trajectories. Similarly, ADB (2021) stressed that carbon pricing is crucial in achieving longer-term goals toward net-zero emissions. It encourages countries to take action to achieve short-term climate mitigation targets, while it creates another critical benefit—a new revenue stream that can be used to support green recovery and growth.

16. **On the other hand, carbon pricing policy can increase energy and consumer prices, and affect economic activities**. Once implemented, carbon pricing will raise the marginal production cost of those affected, which will pass through to the prices of the products and services produced by the emitters, and eventually to the general consumer price level. For instance, Fabra and Reguant (2014) reported that the EU ETS resulted in higher electricity prices in Spain, and Erutku (2019) found that carbon prices imposed in Ontario and Quebec raised wholesale gasoline prices in both Canadian provinces. In the ASEAN+3 regional context, carbon pricing in Japan was found to impact electricity prices (Ding, 2022) as well as various consumer products, such as rice, wheat, and beef (Nakano and Yamagishi, 2021). Given the change in relative prices, carbon pricing will also affect economic activities by adjusting resource allocations. Kanzi (2021) claimed that carbon pricing disproportionately affects poorer households' consumption and income, causing a temporary decline in economic activities.[25] On the other hand, Metcalf and Stock (2020) argued that carbon pricing would have a modestly positive or potentially no impact on GDP and total employment growth rates. In addition, investment in carbon-intensive economies will decline, while investment and employment in renewable and cleaner energy sectors will increase, shifting resources from carbon-intensive to cleaner industries, which will affect the country's international competitiveness (Bems and Juvenal, 2022).[26] For instance, fossil fuel exporters will see demand for their products falling, and different carbon prices across countries can affect relative competitiveness among trading partners.

17. **Empirical evidence for the impact of carbon pricing on emission reduction is mixed**. Sen and Vollebergh (2018) reported a sizeable long-run impact—7.3 percent long-run emission reduction from an increase in effective carbon rate by EUR10 per tonne of CO_2. Meanwhile, Green (2021) conducted a meta-review of ex-post quantitative impacts of carbon pricing on emission reduction and concluded that the impacts of existing carbon pricing schemes were generally limited, with only a 0-2 percent emission reduction per annum, and the carbon tax tended to be more impactful than ETS.[27] While Green's conclusion is in line with the argument of Tvinnereim and Mehling (2018) that there is little evidence that carbon pricing alone, even at high prices, has led to effective emission reductions, some blamed the current carbon pricing systems' incomplete carbon cost pass-through, which may constrain the full internalization of the social cost of GHG emissions.[28] Neuhoff and Ritz (2019) presented a set of assumptions for a complete carbon cost pass-through, which current carbon pricing systems fail to meet:

(1) Carbon prices must be set based on the social cost of carbon.
(2) Carbon prices must apply to all companies competing in the same product market.
(3) Each company must face a full carbon price for their emissions without any dilution, such as free allowance allocation.
(4) All emitters must incorporate carbon pricing into their internal production and investment decision-making processes.

[25] With a higher energy share in their expenditure, higher energy prices tend to have more negative impact on the purchasing power of low-income households. Danzig (2021) also argued that targeted fiscal policies could be adopted to overcome the distributional impact of carbon pricing.
[26] For instance, Susantono *et. al.* (2021) estimated that USD290 billion is needed to reach regional renewable energy targets by 2025.
[27] Few empirical studies on ASEAN+3 economies are available and their results are mixed as well. Arimura and Abe (2021) estimated that Tokyo ETS reduced emissions by 6.9 percent, while Wakabayashi and Kimura (2018) found that energy savings triggered by the Great East Japan Earthquake had a greater impact on emission reduction than the ETS.
[28] For instance, Neuhoff et al. (2006) argued that free allowance fails to internalize emission externality into the EU electricity prices and creates disincentives for investment in energy efficiency, resulting in higher electricity consumption.

(5) Product markets must be perfectly competitive, where market prices must equal marginal producers' production and carbon costs.

18. **In this high inflationary pressure context, introducing carbon pricing instruments or increasing carbon tax rates could be a big challenge for policymakers**. The current average carbon price in ASEAN+3 economies of USD6.45 per tonne (Table 2) is still far below the average global price of USD31.18 (World Bank, 2022), as well as the recommended global carbon price of USD75, which is required to reduce emissions enough to keep the temperature increase below 2°C (Perry, Black, and Roaf, 2021).[29] Given the current low carbon prices, increasing the carbon tax rate, or introducing a carbon pricing if there is none, will become inevitable for all member economies to reach their net zero goals amid fast-rising global pressure on climate action. However, such a policy change in the midst of the current global economic uncertainty and high inflation is a difficult decision requiring wide public support, and must be calibrated carefully.

19. **Lower carbon prices may create carbon leakages and lead to the cross-border carbon price adjustment system**. The difference in carbon prices can lead to the strategic relocation of GHG emitters, seeking lower marginal production costs.[30] Aiming to create a level playing field for its manufacturers that are subject to higher carbon pricing, and to prevent carbon leakage by imposing an import levy on specific products, the EU has decided to introduce the carbon border adjustment mechanism (CBAM). The CBAM will impose a levy on EU importers starting in January 2026, requiring them to buy CBAM certificates on imports of non-EU products. The levy reflects the emissions from production and is calculated by deducting from the EU ETS any free allowances EU producers still receive[31] and any carbon price paid during production in the exporting country.[32] Countries with carbon pricing mechanisms equivalent to the EU ETS could be exempted from the CBAM, such as the EFTA member countries.

VI. Policy Considerations to Address the Challenges

20. **Policymakers need to provide a clear signal for emitters by adopting and announcing a credible carbon pricing policy as part of their post-pandemic fiscal adjustment plan.** Large-scale resource rebalancing in the post-pandemic era provides an excellent opportunity for policy intervention to maximize the positive impact of carbon pricing while curbing the impacts of adverse shocks resulting from it (Andriansyah and Hong, 2022). Despite mixed empirical evidence, the GHG emission reduction target in NDC should be followed by a rigorously assessed carbon pricing adoption plan with detailed design features.[33] Countries without carbon pricing can start by introducing environmental taxes and reducing fossil fuel subsidies. For those that already have established carbon pricing mechanisms, carbon prices need to be gradually increased until they reach the social cost of carbon, or at least, the globally suggested level.[34] The coverage of carbon pricing also needs to be expanded to economy-wide policies. In addition, it is also essential to have standardized

[29] The recommended global carbon price of USD75 is even below the theoretical carbon price that equals the social cost of carbon, i.e., USD80 to USD100 (Pindyck 2019).
[30] In case of Japan, Nakano and Yamagishi (2021) found that the introduction of carbon pricing led to carbon leakage in aluminum production and no price impact.
[31] Currently, 94 percent of industrial emissions are covered by free allowances (European Commission 2019).
[32] This means that those who are importing products from countries that already implement carbon pricing—either through an ETS or a carbon tax—can buy fewer CBAM certificates than those imported from countries with no carbon pricing mechanisms in place. Still, these importers may bear higher costs on top of the import levy due to administrative burden such as the cost of abiding the rules of origin in trade arrangement and the cost of emission verification by a third party.
[33] OECD and IMF (2015) listed the essential characteristics of carbon pricing design as fairness, alignment of policies and objectives, stability and predictability, transparency, efficiency and cost-effectiveness, and reliability and environmental integrity.
[34] For example, Gollier (2022) suggested that the prices can be increased gradually by about 3.75 percent per year, plus the inflation rate.

measurement, reporting, and verification to ensure that carbon pricing achieves its objective of reducing GHG emissions.

21. **Sectoral policies must supplement carbon pricing.** Given the limitations of current carbon pricing instruments, Tvinnereim and Mehling (2018) argued that other sectoral policy instruments must accompany higher carbon prices to effectively reduce emissions and also offset the aggregate losses from stranded assets in negatively affected sectors. Sectoral policies, especially those implemented in the power, manufacturing, transportation, and agriculture sectors, are essential to address sector-specific factors such as financing constraints and incomplete markets. Tax incentives presented in Table 4 are some examples of sectoral policies that can accelerate resource rebalancing across different sectors by affecting relative prices. Other non-tax sectoral policies are also commonly used, such as shifting from fuel fossil subsidies toward electronic vehicle subsidies and introducing feebate programs that provide rebates for more efficient vehicles and impose fees for less-efficient ones.

22. **Comprehensive growth and redistribution policy packages must accompany any carbon pricing policy.** As the imposition of carbon pricing will disproportionately affect specific economic segments more negatively than others, policymakers need to establish a comprehensive policy package to mitigate side effects on other policy priorities such as economic growth, sustainable development, and poverty. For example, the negative impact of higher energy prices on poorer households' consumption and income requires strengthening social safety nets to address rising poverty while effectively changing emitters' behavior.[35] Additional fiscal resources for such mitigating policy measures could be financed by earmarked revenues generated from carbon pricing instruments. For example, in addition to carbon tax revenue, the allowance auction can raise revenues while promoting fair distribution across different sectors.[36] Even though it is not the primary purpose, these revenues can also be used to reduce distortionary taxes and support other climate change actions, such as providing subsidies for clean technology and financing the green transition.

23. Strengthening international cooperation in implementing carbon pricing could help minimize carbon leakages and impact on global competitiveness. Due to the fear of losing their international competitiveness, countries tend to be reluctant to introduce carbon pricing policies or/and increase carbon prices ahead of other countries. These cross-country differences in carbon pricing implementation, including carbon prices, could lead to carbon leakages, by creating incentives for some polluters to relocate their production facilities. These issues could be solved through international climate change cooperation (Chateau et al. 2022). Nachtigall *et al.* (2021) highlighted the benefits of international coordination in carbon pricing and presented various types of potential coordination, such as carbon price harmonization, pricing schemes coverage extension, fossil fuel subsidy reduction, international sectoral agreements, and carbon leakage mitigation mechanisms. Among others, introducing a floor for international carbon prices is one of the most widely discussed forms of international cooperation that could speed up the global green transition. Perry, Black, and Roaf (2021) proposed an international carbon price floor (ICPF) where a small number of key large-emitting countries are subject to different price floors set according to the level of development.[37] Further developing the ICPF idea, Chateau et al. (2022) showed that a simultaneous ICPF could reduce emissions more effectively with limited impact on global economic growth and competitiveness, eliminating the need for a border carbon adjustment mechanism like the CBAM.

[35] This policy package could be strengthened by a rigorous incidence analysis to identify who bears the greatest burden of higher energy prices resulting from carbon pricing implementation.
[36] Selling allowances by auctions, either sealed bid or ascending clock, reflects the actual emission needs and gives emitters equal opportunity to buy allowances.
[37] This is to recognize that some countries with higher development needs and a heavier reliance on fossil fuels may set carbon prices low, and some countries may use alternative carbon pricing policies to reduce GHG emissions.

References

Asian Development Bank (ADB).2021. *Carbon Pricing for Green Recovery and Growth.* ADB, Manila. https://dx.doi.org/10.22617/TCS210403-2.

Andriansyah, and S. H. Hong. 20222. "Rebuilding Fiscal Buffers in the Post-Pandemic Era: Fiscal Normalization, Consolidation, and Structural Reform." AMRO's Policy Perspectives Paper, AMRO, Singapore. https://www.amro-asia.org/rebuilding-fiscal-buffers-in-the-post-pandemic-era-fiscal-normalization-consolidation-and-structural-reform/.

AMRO. 2021. The 2021 Annual Consultation Report on Indonesia. https://www.amro-asia.org/download/20382/.

Arimura, T.H., and Abe, T. 2021. "The impact of the Tokyo emissions trading scheme on office buildings: what factor contributed to the emission reduction?" *Environmental Economics and Policy Studies* 23, 517–533. https://doi.org/10.1007/s10018-020-00271-w.

Baranzini, A., van den Bergh, J.C.J.M., Carattini, S., Howarth, R.B., Padilla, E. and Roca, J. 2017, "Carbon pricing in climate policy: seven reasons, complementary instruments, and political economy considerations." *WIREs Climate Change*, 8:e462, https://doi.org/10.1002/wcc.462.

Bems, R., and L. Juvenal. 2022. "Climate Policies and External Adjustment." Chapter 2 of *the External Sector Report: Pandemic, War, and Global Imbalances*. International Monetary Fund, Washington, DC. https://www.imf.org/en/Publications/ESR/Issues/2022/08/04/2022-external-sector-report.

Chateau, J., F. Jaumotte, and G. Schwerhoff. 2022. "Economic and Environmental Benefits from International Cooperation on Climate Policies." IMF Research Department Paper DP/2022/007, International Monetary Fund, Washington, DC. https://www.imf.org/en/Publications/Departmental-Papers-Policy-Papers/Issues/2022/03/16/Economic-and-Environmental-Benefits-from-International-Cooperation-on-Climate-Policies-511562

Diana del Rosario, 2022. Box B. Malaysia's Climate Change Initiatives. The 2022 Annual Consultation Report on Malaysia. ASEAN+3 Macroeconomic Research Office. https://www.amro-asia.org/amros-2022-annual-consultation-report-on-malaysia/.

Ding, D., 2022, "The impacts of carbon pricing on the electricity market in Japan." *Humanities and Social Science Communications* 9, 353. https://doi.org/10.1057/s41599-022-01360-9.

European Commission. 2019. Adoption of the Delegated Decision on the Carbon Leakage List for 2021-2030. Directorate-General for Climate Action. https://ec.europa.eu/clima/news-your-voice/news/adoption-delegated-decision-carbon-leakage-list-2021-2030-2019-02-15_en).

EY. 2022. EY Green Tax Tracker. https://www.ey.com/en_gl/tax-guides/keeping-pace-with-sustainability-incentives-carbon-regimes-and-environmental-taxes.

Erutku, C. 2019. "Carbon pricing pass-through: Evidence from Ontario and Quebec wholesale gasoline markets." *Energy Policy* 132, 106-112. https://www.sciencedirect.com/science/article/abs/pii/S0301421519303301.

Fabra, N., and M. Reguant. 2014. “Pass-Through of Emissions Costs in Electricity Markets.” *American Economic Review*, 104 (9): 2872-99. https://www.aeaweb.org/articles?id=10.1257/aer.104.9.2872.

Ganapati, S., J. S. Shapiro, and R. Walker. 2020. “Energy Cost Pass-Through in US Manufacturing: Estimates and Implications for Carbon Taxes.” *American Economic Journal: Applied Economics*, 12 (2): 303-42. https://www.aeaweb.org/articles?id=10.1257/app.20180474.

Gokhale, H. 2021. “Japan’s carbon tax policy: Limitations and policy suggestions.” *Current Research in Environmental Sustainability*, Vol. 3, pp. 1-15. https://doi.org/10.1016/j.crsust.2021.100082.

Gollier, C. 2021, “The Cost-Efficiency Carbon Pricing Puzzle.” CEPR Discussion Paper No. DP15919, Available at SSRN: https://ssrn.com/abstract=3805342.

Green, J. F. 2021. “Does carbon pricing reduce emissions? A review of e-post analyses.” *Environmental Research Letters*, Vol. 16, No. 4. https://iopscience.iop.org/article/10.1088/1748-9326/abdae9.

Indonesia Ministry of Energy and Mineral Resources (IMEMR). 2021. Press Release on Socialization of Carbon Tax and Trading Implementation in Power Sector. December 2, 2021.https://www.esdm.go.id/id/media-center/arsip-berita/kementerian-esdm-sosialisasikan-penerapan-pajak-karbon-dan-perdagangan-karbon-bidang-ketenagalistrikan.

Känzig, D. R. 2021. The Unequal Economic Consequences of Carbon Pricing (February 15, 2021). Available at SSRN: https://ssrn.com/abstract=3786030.

Masayo, W., and O. Kimura. 2018. “The impact of the Tokyo Metropolitan Emissions Trading Scheme on reducing greenhouse gas emissions: findings from a facility-based study,” *Climate Policy*, Vol. 18, Issue 8, pp. 1028-1043, https://doi.org/10.1080/14693062.2018.1437018.

Metcalf, G. E., and J. H. Stock. 2020. “Measuring the Macroeconomic Impact of Carbon Taxes.” *AEA Papers and Proceedings*,110 (May): 101–6. https://doi.org/10.1257/pandp.20201081.

Nachtigall, D., J. Ellis, S. Peterson, and S. Thube. 2021. *The economic and environmental benefits from international coordination on carbon pricing: Insights from economic modelling studies.* OECD Publishing, Paris, https://dx.doi.org/10.1787/d4d3e59e-en.

Nakano, K., and K. Yamagishi. 2021. “Impact of Carbon Tax Increase on Product Prices in Japan.” *Energies*. 14(7):1986. https://doi.org/10.3390/en14071986.

Neuhoff, K., and Ritz, R. A. 2019. *Carbon cost pass-through in industrial sectors*. Energy Policy Research Group, University of Cambridge. http://www.jstor.org/stable/resrep30282.

Neuhoff, K., and M. Sato. 2006. “Allocation, incentives, and distortions: the impact of EU ETS emissions allowance allocations to the electricity sector.” *Climate Policy* 6:1, 73-91. https://www.tandfonline.com/doi/abs/10.1080/14693062.2006.9685589.

OECD. 2021. *Effective Carbon Rates 2021: Pricing Carbon Emissions through Taxes and Emissions Trading*, OECD Publishing, Paris, https://doi.org/10.1787/0e8e24f5-en.

OECD and IMF. 2015. The FASTER Principles for Successful Carbon Pricing: An Approach Based on Initial Experience. https://documents.worldbank.org/en/publication/documents-reports/documentdetail/901041467995665361/the-faster-principles-for-successful-carbon-pricing-an-approach-based-on-initial-experience.

Parry, I.W.H, S. Black, and N. Vernon. 2021. "Still Not Getting Energy Prices Right: A Global and Country Update of Fossil Fuel Subsidies." IMF Working Paper No. 2021/236, International Monetary Fund, Washington, DC. https://www.imf.org/en/Publications/WP/Issues/2021/09/23/Still-Not-Getting-Energy-Prices-Right-A-Global-and-Country-Update-of-Fossil-Fuel-Subsidies-466004.

Parry, I.W.H., S. Black, and J. Roaf. 2021. "Proposal for an International Carbon Price Floor among Large Emitters." IMF Staff Climate Notes 2021/001, International Monetary Fund, Washington, DC. https://www.imf.org/en/Publications/staff-climate-notes/Issues/2021/06/15/Proposal-for-an-International-Carbon-Price-Floor-Among-Large-Emitters-460468.

Pindyck, R.S. 2019. "The social cost of carbon revisited," *Journal of Environmental Economics and Management*, Vol. 94, pp. 140-160, https://doi.org/10.1016/j.jeem.2019.02.003.

Sen, S., and H. Vollebergh. 2018. "The effectiveness of taxing the carbon content of energy consumption." *Journal of Environmental Economics and Management*, 92, 74-99. https://doi.org/10.1016/j.jeem.2018.08.017.

Susantono, B., Y. Zhai, R. M. Shrestha, and L. Mo. 2021. *Financing Clean Energy in Developing Asia. Volume 1*. Asian Development Bank, Manila, Philippines. https://dx.doi.org/10.22617/TCS210206-2.

Tvinnereim, E., and M. Mehling. 2018. "Carbon pricing and deep decarbonisation," *Energy Policy*, Vol. 121, pp. 185-189, https://doi.org/10.1016/j.enpol.2018.06.020.

Wakabayashi, M., and O. Kimura. 2018. "The impact of the Tokyo Metropolitan Emissions Trading Scheme on reducing greenhouse gas emissions: findings from a facility-based study," *Climate Policy*, https://www.tandfonline.com/doi/abs/10.1080/14693062.2018.1437018.

Wanhar. 2021. *Uji Coba Perdagangan Karbon Pada PLTU Batubara*. Presented at the Webinar on Implementation of Carbon Economic Value at the Power Subsector. December 2, 2021. https://gatrik.esdm.go.id/assets/uploads/download_index/files/b334f-bahan-ditjen-ketenagalistrikan.pdf.

World Bank. 2022. *State and Trends of Carbon Pricing 2022*. Washington DC, https://openknowledge.worldbank.org/handle/10986/37455.

Appendix: Emission Reduction Targets of ASEAN+3 Economies

	Baseline year/scenario[1)]	Emission as of baseline year/scenario ($MtCO_2e$)	Reduction target (from baseline)[2)]	Emission target in 2030 ($MtCO_2e$)[5)]	NDCs document version
BN	BAU	29.50	20%	23.60	2020
KH	BAU	155.00	42%	90.37	2020
CN	2005	20,307.69	35%	13,200.00	2021
ID	BAU	2,869.00	31.89%	1,954.08	2022
JP	2013	1,408.00	46%	760.32	2021
KR	2018	727.60	40%	436.56	2021
LA	BAU	104.00	60%	41.60	2021
MM	NA	NA	244.52[3)]	NA	2021
MY[4)]	2005	245.80	45%	531.62	2021
PH	BAU	3,340.30	2.71%	3,249.78	2021
SG	2005	101.56	36%	65.00	2020
TH	BAU	555.00	20%	444.00	2020
VN	BAU	927.90	9%	844.39	2020

Source: NDC Registry (https://unfccc.int/NDCREG).

Note: BN = Brunei; CN = China; ID = Indonesia; JP = Japan; KH = Cambodia; KR = Korea; LA = Lao PDR; MY = Malaysia; PH = Philippines; SG = Singapore; TH = Thailand; and VN = Vietnam. No NDC is available for Hong Kong, China. 1) BAU is a business-as-usual scenario 2) it only covers the unconditional target. A conditional reduction target is higher than the unconditional one but requires international support for finance, technology transfer and development, and capacity building. 3) Myanmar sets its reduction target in terms of the absolute value of 244.52 million tCO_2e. 4) Malaysia sets the reduction target in terms of economy-wide carbon intensity against GDP. The absolute emission in 2030 is based on Diana (2022). 5) Emission target is the remaining emission in 2030 after the emissions in the baseline are adjusted by the reduction target. The emission is considered in the form of million tonnes of carbon dioxide equivalent ($MtCO_2e$).