The Asia Foundation

THE STATE OF CARBON PRICING IN SOUTHEAST ASIA

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Glossary of Key Terms

Article 6.4 emissions reductions (A6.4ERs)

Carbon credits generated through collaborative actions between public and/or private sector actors assisting a host nation to avoid, reduce, or remove greenhouse gas (GHG) emissions. International trade in these credits is permitted subject to the approval of the host country and application of corresponding adjustments. These can be used to meet the purchasing country or corporation's climate targets. If not traded internationally, credits can be used to meet the host country's climate targets or corporations' domestic regulatory requirements, such as compliance market carbon pricing instruments (CPIs) or voluntary targets.

Carbon Credit

A tradeable financial instrument that represents a single ton of avoided, reduced, or removed GHGs as a result of a particular offsetting project (e.g., reforestation).

Carbon dioxide-equivalent, CO_2(e)

A commonly used unit of measurement that converts the global warming potential (GWP) of various GHGs, including methane (CH_4) and nitrous oxide (N_2O) into units of CO_2.

Carbon Offset

Refers to the avoidance, reduction, or removal of GHGs resulting from an intervention used to compensate for emissions from other, typically difficult-to-abate activities.

Carbon Pricing Instrument(s), CPI(s)

Economic instruments, usually referring to compliance market instruments such as carbon taxes and emissions trading schemes, which associate a price or cost to GHG emissions. Can be defined to also encompass carbon credits.

Corresponding Adjustment(s)

An accounting correction required to be made to the GHG inventory of a host country authorizing the sale of Internationally Transferred Mitigation Outcomes (ITMOs) or Article 6.4 Emissions Reduction (A6.4ERs) to prevent the double-counting of emissions reductions by both host and purchasing nations.

Greenhouse Gas(es), GHG(s)

Heat-trapping gases such as CO_2, CH_4, and N_2O, whose increasing atmospheric concentrations increase surface-level temperatures and exacerbate climate change.

Internationally Transferred Mitigation Outcomes (ITMOs)

A type of carbon credit which can be traded between countries and used towards the achievement of the purchasing nation's Nationally Determined Contributions (NDCs), provided the application of corresponding adjustments in the host nation's GHG inventory.

Nationally Determined Contribution(s), NDC(s)

The targets set by individual nations party to the Paris Agreement regarding the mitigation of GHG emissions and adaptation to the consequences of climate change. These are updated every five years.inventory.

Social Cost of Carbon, SCC

A measurement of the costs of each metric ton of GHG emissions, based on scientific evidence of the projected physical impacts of climate change; the translation of these physical impacts into economic damages; and the conversion of future damages into present-day economic costs.

EXECUTIVE SUMMARY

Carbon pricing is rapidly emerging as a popular policy tool to support low-carbon economic transitions and reduce greenhouse gas (GHG) emissions. Since 2012, the number of carbon tax or emissions trading systems in place globally has risen from under 12 to over 70, complemented by rapid growth in carbon crediting activities encompassing both voluntary and regulatory markets. Several factors explain the contemporary popularity of carbon pricing instruments (CPIs).

Despite widespread use of industry-, sector-, or technology-focused policies and policy instruments to support decarbonization, scientific evidence paints a picture of worsening climate change. Reports published since 2021 under the Intergovernmental Panel on Climate Change (IPCC)'s Sixth Assessment Report call for global GHG emissions to peak by 2025 in order to limit global heating to no more than 1.5°C above the pre-industrial average, in contrast to existing policies and targets which put the world on track for an increase in average surface-level temperatures closer to 3°C. It is clear that stronger action is needed. Carbon pricing, long proposed by economists and scientists as a necessary component of climate action, can provide incentives for an economy-wide low-carbon transition.

Many CPIs implemented today complement an ecosystem of climate change policies and policy instruments already in place to support decarbonization. Fundamentally, they associate a direct cost with the GHG emissions arising from fossil fuels or other "climate bads" (for example, deforestation), making activities which emit GHGs less financially appealing. This complements the approach of many existing policy instruments, which incentivize low-carbon practices and technologies, such as energy efficiency and renewable energy.

Beyond these immediate impacts, CPIs can become an important source of public revenue to boost climate efforts or support other economic needs and priorities. Climate finance being in short supply, particularly in the developing world, adds weight to the importance of implementing national CPIs. In 2022, carbon taxes and emissions trading systems generated some USD 95 billion in revenue globally; 40% of which was redirected towards low-carbon investment and spending. Prevailing global macroeconomic conditions only enhance the attractiveness of this alternative source of public finance.

National-level movement towards CPI adoption is also hastened by a rising global appetite for climate action itself. Progress towards the operationalization of Paris Agreement's Article 6 mechanism, which will support and facilitate collaborative approaches towards emissions reductions across public and private sectors, will continue at COP28 in November 2023.

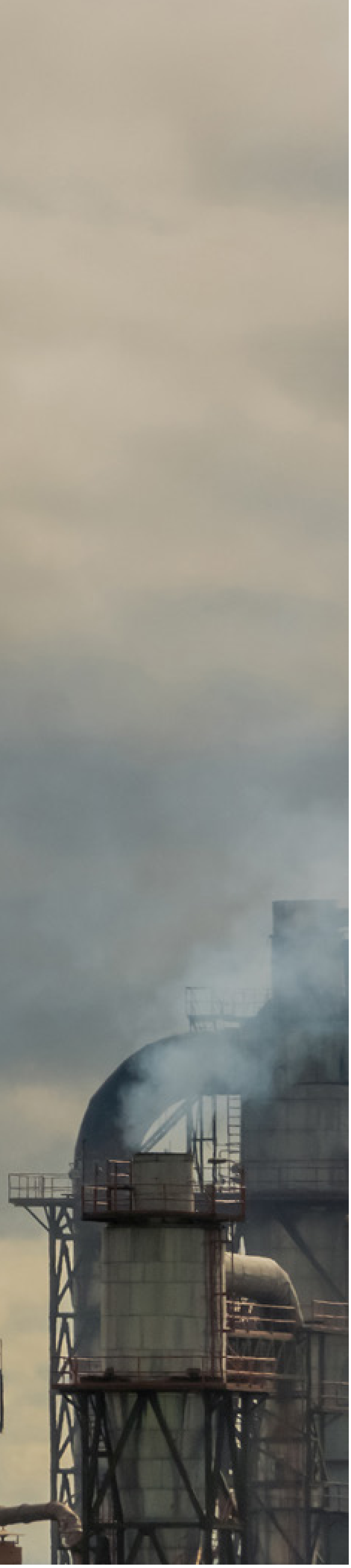
This is likely to drive another wave of attention towards carbon pricing. Recent private sector efforts, typically expressed in the form of net-zero emissions targets, has added to demand for carbon credits. One way for governments to regulate and legitimize these activities, while ensuring they do not compromise upon national-level climate priorities and targets, is to envelop them within the framework of an overarching compliance market CPI. Beyond crediting, the proliferation of CPIs can itself be a self-sustaining cycle. Countries that have adopted carbon taxes or ETS' have strong incentives to apply these same regulations on imports, to address carbon leakage and competitiveness concerns, through the application of border carbon adjustments (BCAs). BCAs incentivize exporters to themselves implement CPIs, in order to capture revenues otherwise lost to their trading partners.

All these pressures are increasingly felt across Southeast Asia, a region highly vulnerable to a host of climate-related impacts. There is strong evidence of rising climate ambition and action across the region, with all ASEAN Member States (AMS, with the exceptions of Cambodia, Laos, and Myanmar) presently either assessing, designing, implementing, or having already implemented compliance market CPIs. In all cases, these CPIs would serve to complement a raft of existing low-carbon initiatives and policies.

The two operational CPIs across ASEAN as of August 2023 are Indonesia's ETS, which was launched in February 2023 and currently covers only emissions from state-owned coal-fired power plants; and Singapore's carbon tax, launched in 2019 and which covers emissions from its 50 largest emitters, accounting for roughly 80% of national emissions. Thailand, meanwhile, is planning to launch a carbon tax over the coming years, covering activities within the energy, transport, and industrial sectors. Brunei, Malaysia, the Philippines, and Vietnam are all considering the implementation of carbon taxes or ETS, and are currently assessing their feasibility and practicality for adoption, as well as designing these instruments. Carbon crediting programs or initiatives have been ongoing across all AMS except Brunei, largely since the establishment of the Clean Development Mechanism (CDM).

At the regional level, a number of platforms have been established to support climate change activities and carbon pricing implementation. These operate through several institutions, including the ASEAN Secretariat, specifically the ASEAN Working Group on Climate Change; the United Nations Framework Convention on Climate Change (UNFCCC)'s Collaborative Instruments for Climate Action, or CiACA, and Article 6 mechanisms moving forward; multilateral development agencies, such as the Asian Development Bank and the World Bank; or through bilateral channels, such as the Enhanced Regional EU-ASEAN Dialogue Instrument (E-READI). Within this highly-dynamic policy arena, the coming years will be crucial as many AMS continue ongoing processes of designing and establishing compliance market CPIs. Combined with expected progress towards finalizing Article 6 of the Paris Agreement, rising private sector action, and the establishment of a number of national-level carbon marketplaces, it is likely that the current focus across AMS governments on carbon pricing will continue strongly throughout the 2020s.

1. INTRODUCTION



From an economic perspective, the worsening of climate change is the result of several market failures. The most prominent of these are greenhouse gas (GHG) emissions, negative externalities arising primarily from the combustion of fossil fuels and through chemical and natural processes. These emissions contribute to the rising atmospheric concentration of GHGs and lead to an increase in average surface-level temperatures. Rising temperatures are in turn the chief cause of sea-level rise, extreme changes to weather patterns, and a host of other related consequences (IPCC, 2021).

Without regulation, GHGs are both theorized to be and are in reality 'overproduced' (Metcalf, 2019), manifesting in climate change. Additionally, a lack of regulation indirectly causes an 'underproduction' of positive externalities, evidenced by long-term underinvestment in low-carbon technology, as well as the unsustainable use of natural capital and factors of production.

Carbon pricing has its origins as a theoretical solution to the premise that climate change reflects a lack of market-correcting interventions accurately recognizing the damages caused by GHG emissions. By making emissions-intensive activities more costly, carbon pricing promotes the adoption of low-carbon technologies ahead of fossil fuels, or conservation ahead of exploitation, wherever it is most profitable.

As a solution to the market failure, carbon pricing instruments (CPIs), such as carbon taxes and emissions trading schemes, are considered to be a foundational step towards addressing climate change. The potentially far-reaching impacts of CPIs mean it could even enhance economic efficiencies beyond just the scope of climate policy, making it an attractive policy lever in general.

Governments are increasingly taking note. Since 2010, the number of carbon taxes or emissions trading systems (ETS) globally has risen from under a dozen, concentrated in Europe, to over 70 today (World Bank, 2023). Voluntary carbon market activities have also seen significant growth in recent years. While carbon crediting and trading has a long 'effective' history through the Clean Development Mechanism (CDM) and later Reducing Emissions from Deforestation and Forest Degradation (REDD+), growth has been spurred by the growing establishment of corporate net-zero targets, development of the Paris Agreement's Article 6 rulebook, and increasing consciousness of the risks of climate change as well as the need for immediate action. Growth continues to play out in compliance markets, with 19 jurisdictions currently in various stages of considering, designing, and implementing a carbon tax or emissions trading scheme, including many ASEAN member states (AMS).

An assessment of the evidence suggests that climate change is increasingly becoming a key policy priority across AMS. First, Southeast Asia remains highly vulnerable to the impacts of climate change (Eckstein et al., 2021; Kompas et al., 2018; ND-GAIN, 2021), necessitating action across climate change mitigation and adaptation. As this report later highlights, all AMS have in recent years enhanced international commitments to the UNFCCC by setting more stringent emissions reductions targets. Eight of 10 AMS have set a target to achieve net-zero emissions, by 2050 or later. This has been accompanied by a raft of targets to improve energy efficiency, deploy renewable energy, reduce deforestation, and policies that will serve towards the region's low-carbon development.

Against this dynamic scientific and policy landscape, it is important for regional actors to build an understanding of carbon pricing and CPIs, their rationale, risks, and challenges, and the roles they play – and may continue to play – in enhancing regional efforts to address climate change. Developing this fundamental understanding of carbon pricing will allow for a more balanced assessment of ongoing efforts across AMS to introduce carbon pricing, a fast-moving space likely to be a centerpiece of economic and climate policy over the coming decades.

1.1 OBJECTIVES AND STRUCTURE OF THIS REPORT

Amidst a rapidly evolving and complex carbon pricing landscape, the ambition of this study is to provide a review of carbon pricing frameworks across the 10-member Association of South East Asian Nations (ASEAN).

This study considers the state of two broad categories of carbon pricing instruments: compliance markets and voluntary market instruments. The former is comprised of carbon taxes and emissions trading schemes, and the latter domestic and international voluntary carbon markets, that have either been implemented or are in the process of implementation across ASEAN member states (AMS). Overlapping both categories are carbon credits and offsetting. Recognizing that not only do these instruments vary greatly, but that the national contexts differ too, our assessment will answer the following seven prompts:

1. Which AMS have implemented or are in the process of implementing either voluntary or compliance market carbon pricing instruments?
2. What is the extent of the regulatory frameworks and legislation designed to support carbon pricing implementation in these countries?
3. Which countries have timelines and budgets earmarked for the implementation of CPIs?
4. How are countries designing and implementing CPIs?
5. What are the key political, economic, and social drivers and constraints for countries seeking to implement CPIs?
6. What regional or global platforms exist to support the implementation of CPIs across countries, particularly in the developing world?
7. How can CPI frameworks avoid greenwashing?

To efficiently answer these questions while providing sufficient context and contributing to a complete review of carbon pricing efforts across ASEAN, the remainder of this report is structured as follows:

We begin with a discussion on the fundamental rationale behind CPIs, their roles in the economics of climate change, and the various compliance and voluntary market instruments commonly employed. This is followed by an assessment of the state of the climate across ASEAN; carbon pricing is primarily a tool for mitigation, and so it is important to understand the sources of the chief cause of climate change: GHGs. With much of these emissions the result of energy use, an appreciation of changes in the use of fossil fuels and renewable energy technologies is key to understanding how policy priorities are shifting across the region. To round off this foundational assessment, we provide a brief review of key climate policy responses and targets across AMS. Finally, we present national-level assessments of the status of CPI implementation across AMS, covering direct and indirect, compliance and voluntary market activities.

2. UNPACKING CARBON PRICING INSTRUMENTS

2.1 WHAT ARE CPIs AND WHAT ARE THEY TRYING TO SOLVE?

Climate change is primarily caused by the increase in the atmospheric concentration of GHGs (National Oceanic & Atmospheric Administration, 2018). From an economic perspective, it is the result of several market failures (as discussed in The Asia Foundation, 2023). Most prominently, in the absence of regulation covering GHG emissions, GHGs are theorized to be 'oversupplied'. This is evidenced by observed growth in GHG emissions since the Industrial Revolution, and particularly since the 1940s (Friedrich and Damassa, 2014). It is clear that these emissions will cause significant current and future economic damage through the intensification of climate change (IPCC, 2021). While estimates of the magnitude of these damages remain uncertain, they will be significant. Kahn et al. (2019), for example, estimate potential average annual losses equivalent to around 5.4% of global GDP with each 1°C of warming.

A secondary market failure related to climate change is that the atmosphere is a shared, global public good. Indeed, GHG sinks, such as forests and soils, can in this context also be classed as public goods[1]. In the absence of regulatory action or policy, these are theorized to be overexploited, since all environmental, social, and other non-private costs of exploitation are not absorbed by the benefitting party(ies). This is evidenced by the rapidly increasing concentration of GHGs in the atmosphere and the conversion of forested land for agriculture or development.

Without tangible climate- or environmental-related costs attached to natural capital exploitation or 'use' of the atmosphere, emissions reductions and the conservation of GHG sinks are less appealing to any individual or nation. Without appropriate measures to correct for these imbalanced incentives, individual economic actors do not face the full costs of their actions, relative to their impacts. Increases in both emissions and the atmospheric concentration of GHGs are therefore predictable results of market failures.

Carbon pricing is simply a means to enforce a price upon the negative externality and internalize the costs of 'using' the atmosphere (or 'carbon budget'[2]), forcing economic actors to re-optimize profit- or utility-maximizing behavior by embedding the costs of GHG emissions into decision-making, thus addressing these market failures. This can be achieved through the use of CPIs.

In practice, CPIs vary greatly across instrument type, price, quantity, scope, incidence, and rules over revenue use, amongst other factors. There is no one-size-fits-all policy, and countries tend to take a range of localized economic, socioeconomic, and environmental factors into consideration in designing and implementing CPIs. To illustrate this, consider the wide variety in carbon prices under carbon taxes or emissions trading systems across the world, from roughly USD 1 per ton of CO_2 in Kazakhstan and Shenzen, China, to over USD 130/tCO_2 in some European countries and in Uruguay. Closer to home, Singapore's carbon tax rate is currently just under USD 4/tCO_2, with plans for this tax to rise to over USD 35/tCO_2 by 2030. Indonesia had previously planned to tax coal power plant emissions at a rate of just over USD 2/tCO_2, before opting to implement an ETS instead. Presently, the highest carbon prices in Asia can be found in South Korea, where ETS prices averaged USD 19/tCO_2 during the first quarter of 2023 (World Bank, 2023). The use of CPIs in ASEAN is detailed in greater depth in Chapter 4.

[1] This is because everyone benefits from a particular GHG sink's capacity to absorb carbon, and thus contribute to the mitigation of climate change, whereas their exploitation would generate economic rents only for the private actors responsible for their removal.

[2] The carbon budget is a term used to reflect the remaining quantity of GHGs that can be 'safely' emitted into the atmosphere while ensuring that, with some significant probability, a particular temperature-limit will not be breached. IPCC (2018), for instance, estimated the then-remaining carbon budget to be 1,170 billion tons of CO_2 should we strive to limit warming to no more than 2°C.

Carbon credit and offset activities, meanwhile, largely support private actors' attainment of internal or voluntary climate targets. In some limited cases, they can be used to meet specific regulatory requirements and also play a role within compliance market CPI ecosystems. Voluntary carbon marketplaces specifically allow private actors to buy and sell carbon credits generated by project developers whose interventions have led to the quantified and verified avoidance, removal, or reduction of GHG emissions[3].

These credits must be registered and certified by verification bodies as being legitimate and having met specific qualifying criteria[4]. Purchasers can then use these to 'offset' firm-level emissions that are hard to otherwise abate. Some compliance market instruments allow the use of carbon credits to 'offset' liabilities under a carbon tax or ETS regime as well. Through the combination of these voluntary and compliance CPI approaches, much of the demand for credits presently comes from the private sector.

The carbon credit ecosystem as a whole comes with its own set of nuances and complexities, and ongoing developments within this space are likely to havesignificant implications for voluntary and compliance carbon market activities in the future. Most importantly, the Paris Agreement's Article 6, in the process of finalization, seeks to provide a platform and order to the international trade of credits between nations. It should be noted that some countries have yet to issue formal positions on their intended use of Article 6 mechanisms, and this remains an ongoing matter of consideration for the respective governments. Countries will need to balance the meeting of their own national and international climate objectives with the potential benefits of collaborative approaches towards low-carbon outcomes. For now, this situation remains fluid given the nascency of the regional and global policy focus on carbon pricing and the roles CPIs may play in AMS climate efforts moving forward, and ongoing progress towards the operationalization of Article 6 itself. More clarity is expected by COP28 in November 2023. Box 2 of Chapter 2.2.2 provides a more detailed review of the key concepts, terms and recent developments within the carbon credit ecosystem.

[3] Projects contributing to the avoidance, reduction, or removal of GHGs are all eligible to generate carbon credits. Avoided or reduced emissions are those not emitted as a direct result of interventions that contribute to a lowering of a particular activity's GHG emissions. Such interventions may include technology-switching, improvements to energy efficiency (EE), or changes in land-use practices that contribute to reduced deforestation, amongst others. These avoidances or reductions in emissions are reported relative to a baseline that establishes counterfactual emissions trajectories in the absence of the intervention. Removed emissions, on the other hand, are those resulting from interventions which remove GHGs from the atmosphere and store them in terrestrial or marine GHG sinks, or through technological means. Such interventions may include afforestation and reforestation efforts, the improvement of forest and agricultural management, direct air capture, or carbon capture-and-storage (CCS).

[4] This encompasses satisfying the criteria of:
1) Additionality, meaning the project from which credits are generated must contribute towards emissions reductions that would otherwise not have occurred;
2) Permanence, meaning the project from which credits are generated must contribute towards emissions reductions for a prespecified period of time without being reversed; and
3) Accurate reporting, meaning the project from which credits are generated must rigorously estimate and report baseline emissions, actual emissions, and emissions leakages, as well as ensure that credits or emissions reductions are not double-counted or -claimed.

2.2 HOW ARE CPIs USED?

This assessment has identified two broad sets of CPIs through which prices can be 'enforced' on carbon: compliance market instruments and voluntary market mechanisms. This section delineates between these two groups, diving deeper into the basic concepts underpinning the various CPIs. The most commonly used compliance market instruments are carbon taxes and emissions trading systems, while carbon border adjustment taxes are increasingly under considered today, particularly by countries who already have in place domestic CPIs. Under voluntary market instruments, we discuss domestic and international carbon trading as well as the concept of internal carbon pricing. We present clear, consistent definitions of key concepts such as carbon 'crediting' and 'offsetting', which have implications across both compliance and voluntary market mechanisms.

2.2.1 COMPLIANCE MARKET INSTRUMENTS

CPIs can take many forms. The two most commonly used, direct forms of compliance market CPIs are carbon taxes and emissions trading schemes (ETS). By directly targeting GHG emissions, these CPIs can, in theory, fully internalize their negative externality costs. Other mechanisms such as fuel, congestion, 'polluter-pays' or environmental taxes or charges, and fossil fuel subsidy rationalization provide indirect (albeit incomplete) avenues towards such internalization.

Carbon taxes are the most straightforward, setting an explicit price per unit of carbon emitted, with each unit represented by a ton of CO_2-equivalent[5]. The incidence of carbon taxes tends to fall on either GHG emissions directly (downstream), or the carbon content of fossil fuels or other products (upstream), depending on the nature and structure of particular industries or sectors (see Foramitti et al., 2021 for a discussion on incidence).

In some cases, additional costs from carbon taxation may be passed through to consumers, although it is possible for safeguards to be put in place to either limit such cost pass-through or to 'make up' for rising consumer costs through improved social protection transfers or other similar mechanisms. Beyond this, empirical evidence finds lower rates of cost pass-through in the presence of international trade and in concentrated markets where industry players exert their market power (Neuhoff and Ritz, 2019). Decarbonization itself, whether as a result of the CPIs in question or other climate policy measures, further dampens such pass-through costs in the longer-term.

This carbon price signal, which incentivizes the adoption and deployment of less carbon-intensive technologies and practices, ultimately determines the extent of emissions reductions achieved across economic activities subjected to the regulation. In this regard, carbon taxes are not necessarily a guarantee of emissions reductions. Economic actors engage in emissions reductions activities (such as RE deployment or the enhancement of EE measures) only if the marginal costs imposed by the carbon tax exceed the marginal costs of an abatement activity; in other words, if adopting low-carbon technology is cheaper than paying a tax. Extending this logic further, as the price of carbon rises, a larger set of abatement activities fulfil these criteria.

Nevertheless, emissions reductions can be better guaranteed through 'target-based' approaches to carbon price selection. This can be achieved by identifying minimum required carbon prices to stimulate market shifts towards meeting specific emissions reductions targets, such as to peak emissions — as has been set in Singapore, or reach net-zero — a common target across all but two of AMS. This is discussed further in Chapter 3. For examples of this approach, CPLC (2017) estimates that a carbon price of USD 40—80/tCO_2e is required to meet the Paris Agreement's target of keeping the average global surface temperature increase to 'well below' 2°C. IMF (2019) estimates the country-level emissions reductions achieved through carbon prices of USD 35/tCO_2e and USD 70/tCO_2e, assessing how these can deliver emissions reductions necessary to meet national-level Paris targets.

[5] The various GHGs have different 'global warming potentials' (GWP), a measure of their energy-absorption potential. CO_2, the 'reference' gas, has a GWP of 1. CH_4 has a GWP of between 27 and 30, while N_2O has a GWP of 273. This reflects the greater impact of a marginal ton of methane or nitrous-oxide emitted over that of carbon-dioxide. CO_2-equivalence, or simply CO_2e, converts all GHGs to a single basic unit of measurement by taking into account the varying GWPs.

around the world do 'control' prices, by imposing floor and ceiling prices for carbon, to ensure that broader macroeconomic conditions and other exogenous factors do not hinder the effectiveness of these instruments (e.g., by limiting carbon price volatility). Such a stable and predictable carbon price would better facilitate an orderly low-carbon transition.

Theoretical assessments of the taxes and ETS find that outcomes through the two instruments can be broadly similar or even equivalent. Stavins (2019) argues that such equivalence can occur 'in terms of emission reductions, abatement costs, possibilities for raising revenue, costs to regulated firms when revenue-raising instruments are employed, distributional impacts, and effects on competitiveness'. Carbon taxes and ETS share many similarities and differences, as explained in greater detail by Stavins (2019). The key points are summarized below:

1. Both instruments incentivize the adoption of low-carbon practices, technologies, and other means of production by enforcing a price on GHG emissions. Incentives in favor of emissions abatement work equivalently across mechanisms: firms maximize profits by decarbonizing up to the point where marginal abatement costs are equal to the prevailing carbon price. The distinction is that carbon prices are 'set' differently under the two mechanisms – under a tax, this is set directly by the administering authority, while under an ETS this is variable and set through the ETS market.

2. All else being equal, both instruments shift comparative advantages in favor of economies with weaker carbon regulation, such as countries with less stringent CPIs (or none at all), thus promoting emissions 'leakage'. This is the case regardless of the type of CPI used and is a driver of growing consideration of border carbon adjustments as a supplement to domestic-level CPIs. Both instruments have implications for international competitiveness, though there is little to suggest which mechanism would create more adverse implications than the other.

3. While both determine prices and generate revenues differently, the pricing of carbon itself serves the same purpose: enforcing an accounting of the costs of GHGs. Carbon tax revenues are the product of the prevailing carbon price and the quantity of emissions subject to regulation, while ETS revenues are generated through the auctioning of emissions allowances, with the carbon price dependent on matching supply and demand.

4. Both support the deployment of low-carbon technology, and in doing so pose challenges to future growth within carbon-intensive industries and sectors. Further, both can have broader economic consequences if not accompanied by mechanisms to limit any adverse impacts arising from the pricing of emissions. A just transition plan needs to accompany the implementation of any CPI.

5. Both require stringent regulatory oversight, beginning with the measurement, reporting and verification (MRV) of GHG emissions. Wider safeguards would be needed to prevent ETS market misconduct and manipulation, whether financial or technological, and against carbon tax evasion or arbitrage.

6. ETS are typically more complex to both design and administer, leading to higher costs particularly in the process of establishing the instrument and marketplace. Additional transaction costs arise in the process of allowance trading, such as through enlisting the services of trade brokers. These costs are much reduced in carbon tax systems.

7. Carbon tax systems offer certainty in prices and uncertainty in emissions reductions, while ETS systems offer certainty in emissions reductions and uncertainty in prices. Uncertainties around rates of technological progression also impact the clarity of market signals created by either instrument. There are advantages and drawbacks to each instrument solely on this basis.

8. Carbon tax systems generally complement other climate-related policies well, and can assist in driving further emissions reductions sans the establishment of emissions caps. This may not necessarily be the case under an ETS, which offer little incentives for emissions reductions beyond what is established by the emissions cap.

Traditionally, compliance market CPIs encompass carbon taxes and emissions trading systems. This ecosystem is expanding, however. First, the role of carbon credits is evolving, as highlighted in Box 2, under Chapter 2.2.2. Second, as more countries implement national- or subnational-level CPIs, border carbon adjustments (BCAs) are growing in prominence in climate policy debates. The objectives of these BCAs include mitigating the impacts of carbon pricing on the international competitiveness of firms located within these jurisdictions, and addressing 'carbon leakage' which occurs when countries shift production from jurisdictions with strict climate regulation to those with a laxer set of regulations. Box 1 digs deeper into the history of BCAs, which are taxes levied on the carbon content or intensity of products imported into a jurisdiction, as well as the current status of BCAs and the roles they may play within the global climate policy ecosystem moving forward.

Box 1: The rationale of 'border carbon adjustments'

Recent years have seen renewed interest in the carbon taxes, or 'adjustments', that are applied to imports within a particular jurisdiction that already has in place its own compliance market CPI. This requirement for a domestic-level CPI is a key aspect of determining the legality of such mechanisms. Much of the recent attention on border carbon adjustments or BCAs is driven by the European Commission's July 2021 announcement that it intends to impose a Carbon Border Adjustment Mechanism (CBAM) on carbon-intensive imports into the European Union (EU) across select economic activities (European Commission, 2021).

There are several reasons countries may impose BCAs. The most important rationale includes: 1) avoiding carbon leakage; 2) addressing the impacts of carbon pricing on the relative competitiveness of domestic producers; and 3) encouraging greater climate ambition across trading partners. This section explores the interactions between this rationale and begins by highlighting the academic origins of BCAs, their legality, and the roles they play within the framework of global climate economics and policy more broadly.

We begin with economic fundamentals. Chapter 2 introduced the two key market failures driving climate change: the role GHGs play as a negative externality of productive economic activity, and the nature of the atmosphere as a global public good. Pricing GHGs is a step towards forcing an 'internalization' of the externality costs of emissions: through CPIs, economic actors are forced to take into account the costs of their GHG emissions in investment and production decisions. In doing so, both market failures are addressed to a degree, depending on the carbon price used as well as the scope of the CPI. Yet a complication arises from the nature of the atmosphere as a 'global' public good. If GHG emissions are reduced in one jurisdiction but increase equivalently in another, any net effect in addressing global climate change is nullified. To properly address global incentives to decarbonize, GHG emissions need to be priced uniformly to equalize incentives across all jurisdictions. However, this is infeasible for a number of economic and political reasons (discussed in greater depth in Chapter 2.3).

This is where BCAs enter the picture. BCAs are applied to imports into a particular jurisdiction that already has its own CPI, and can be a way for nations to enforce the ambition of their climate regulations upon trading partners. In doing so, BCAs can serve towards the attainment of carbon price equalization across countries. For example, qualifying imports from a particular country to the EU would under CBAM face additional costs based on: 1) the carbon content of these imports, and 2) the difference in the prevailing carbon price between the EU and the country of origin. As more countries implement CBAM-style BCAs, a greater proportion of global emissions would be subject to some form of compliance-market CPI, and more countries would face incentives to begin applying CPIs in their own jurisdictions as well.

While only gaining mainstream traction in recent years, BCAs have a long academic history and have been discussed extensively in the context of global carbon pricing and climate change. For more detailed early-stage assessments of BCAs, see Condon & Ignaciuk, 2013; Cosbey, 2008; and Metcalf & Weisbach, 2009. Indeed, there is little within the remit of BCAs that have yet to be explored, from a theoretical standpoint. This includes assessments of: their roles within global climate policy; their legality (see Pauwelyn, 2012 and Trachtman, 2016); their design (Kortum & Weisbach, 2016; Mehling et al., 2019); their potential impacts (Branger & Quirion, 2014); as well as general guidance for their implementation (Cosbey et al., 2019).

It is the legality of such mechanisms that is most often called into question. Yet both Pauwelyn and Trachtman, as well as other studies in the literature, identify avenues for the implementation of BCAs to ensure compliance with World Trade Organization (WTO) rules. While there are many nuances to consider, it is generally found that BCAs could have a strong legal basis given requirements under the WTO's General Agreement on Tariffs and Trade (GATT). As long as imported goods are not taxed in excess of similar domestically-produced goods (or substitutable domestic products), the BCA will likely be deemed valid. In other, simpler words, it must be shown that domestically-produced goods and imported goods face the same prevailing carbon price. At a fundamental level, the legality of BCAs is then contingent on the application of a CPI within the host (i.e., importing) jurisdiction, such as in the EU.

BCAs themselves are designed to serve three key purposes, as previously briefed. The most important of these is that it addresses 'carbon leakage', which occurs when emissions-intensive activities shift from jurisdictions with strict climate regulation to those with laxer regulations. The rationale for such leakage is simple; if there are no rules in place to limit the relocation of production, there is a clear fiscal incentive in favor of such relocation to avoid additional costs incurred as a result of CPIs. BCAs circumvent this issue by ensuring that anyone seeking to access a particular market are bound by the same rules, whether they are a domestic producer, a foreign producer, or a domestic producer domiciled overseas. This limits the possibility of leakage.

A second driver for the utilization of BCAs is the impact of CPIs on the relative global competitiveness of domestic firms, particularly those in emissions-intensive, trade-exposed (EITE) industries. CPIs place a progressive burden based on a firm's emissions: those with higher emissions face higher regulation costs, meaning EITE firms are likely to face the hardest knocks to their competitiveness against foreign or foreign-based firms. The imposition of a BCA therefore represents an attempt to equalize the stringency of regulations applying to EITE firms and their competitor importers.

Finally, the third and final driver for the implementation of BCAs is that they can serve to 'export climate ambition'. Recall that BCAs would in theory (and from limited evidence based on the EU's planned CBAM) levied on the basis of the carbon price differential between two jurisdictions; if there is no differential, there is no adjustment to be made. In this way, countries whose exports would be subject to regulation at the border of the importing nation would benefit from equalizing the stringency of their domestic regulations with that of the relevant trading partner. Indeed, the exporting country would benefit directly simply by virtue of collecting CPI revenues domestically rather than have these revenues accrue to the importing country via the BCA.

From a practical standpoint, BCAs are in their infancy. The EU's CBAM will not be fully enforced until 2026, and it may be the case that certain design aspects of the CBAM as it is presently planned are later adjusted in response to consultations with trading partners. Regardless, it will likely be designed in a manner that addresses the EU's carbon leakage and EITE industry competitiveness. More importantly, however, is that beyond the EU, every country that has in place its own CPIs faces the same incentives to address carbon leakage and competitiveness concerns. This means it is possible for BCAs to become an important feature of domestic climate regulation moving forward, especially if their legality can be clarified formally at the international level as more countries implement CPIs.

2.2.2 VOLUNTARY CARBON PRICING MECHANISMS

To address climate change, there is a need for a broad range of interventions to reduce emissions and preserve GHG sinks. Carbon pricing also plays a critical role by enabling voluntary market activities, largely through projects which contribute to the avoidance, reduction, or removal of GHG emissions. Such efforts are given recognition in the form of 'carbon credits'. Carbon credits are tradeable instruments, each representing a certified avoidance, reduction, or removal of one ton of CO_2e. Carbon credits lay at the heart of all voluntary carbon market activities, while also playing an important and growing role in compliance markets.

The generation and trade of carbon credits has a long effective history, with a key development being the adoption and enforcement of the Kyoto Protocol and the Clean Development Mechanism (CDM) between 1997 and 2005. The CDM supports international collaboration in the delivery of low-carbon outcomes across the developing world, encouraging industrialized nations to invest in activities and projects in less-developed countries which contribute to the avoidance, reduction, or removal of GHG emissions. Developed nations would be able to claim these emissions reductions as part of their efforts to mitigating climate change, with developing nations benefitting from greater investment and technology transfer. REDD+ operates in a similar fashion, but focuses exclusively on promoting actions leading to the reduction in emissions associated with deforestation and other unsustainable land-use policies.

Today, as countries adopt CPIs and efforts to address climate change broaden in their scope, the role of carbon credits – and the carbon credit ecosystem more broadly – is rapidly expanding. New terminologies are periodically introduced, and existing terms periodically revisited, especially as recent COP gatherings have seen significant progress on Article 6 mechanisms under the Paris Agreement. Box 2 provides an overview of the carbon credit ecosystem, focusing on credits and how they are used.

Box 2: Demystifying the carbon credit ecosystem

<u>Definitions of Key Terms</u>

1. **Carbon credit:** A tradeable financial instrument that represents a single ton of avoided, reduced, or removed GHGs as a result of a particular offsetting project (e.g., reforestation).

2. **Carbon offset:** Refers to the avoidance, reduction, or removal of GHGs resulting from an intervention used to compensate for emissions arising from other, typically difficult-to-abate activities.

3. **Internationally transferred mitigation outcomes (ITMOs):** Carbon credits which can be traded between countries and used towards the achievement of the purchasing nation's Nationally Determined Contributions (NDCs) provided the application of corresponding adjustments in the host nation's GHG inventory.

4. **Article 6.4 emissions reductions (A6.4ERs):** Carbon credits generated through collaborative actions between public and/or private sector actors assisting the host nation in avoiding, reducing, or removing GHGs. International trade in these credits is permitted subject to the approval of the host country and subsequent application of corresponding adjustments, and can be used to meet the purchasing country or corporation's climate targets. If not traded internationally, these credits can be used to meet the host country's climate targets or used by corporations to meet domestic regulatory requirements, such as compliance market CPIs, if applicable, and/or voluntary targets.

5. **Corresponding adjustments:** An accounting correction required to be made to the GHG inventory of a host country authorizing the sale of ITMOs or A6.4ERs to prevent the double-counting of emissions reductions by both host and purchasing nations.

*

Carbon credit activities are becoming an increasingly important component within the CPI landscape. Historically used in large part to support voluntary activities by fostering collaboration between state actors, their roles now cut across both voluntary and compliance market instruments, formal and informal processes, and public and private sectors. In a sense, credits support a broad set of activities contributing to emissions avoidance, reduction, or removal, which come together to bridge lingering gaps within the global climate change response and carbon pricing ecosystem. They achieve this by, for instance, supporting emissions reduction projects in difficult-to-abate sectors, such as forestry, or in sectors not covered by compliance market CPIs.

Carbon credits are tradeable financial instruments or assets representing a single ton of avoided, reduced, or removed GHGs, usually measured in terms of CO_2e. These are generated through projects which contribute to emissions reductions. There are several ways that these credits can be 'utilized'. At present, and through voluntary market processes, credits are most commonly purchased by corporations to 'offset' firm-level emissions, i.e., counting them against emissions arising from a firm's operations in carbon accounting and reporting processes, and thus towards the achievement of net-zero targets.

Carbon offsetting refers to the process of a given economic actor utilizing credits to compensate for emissions arising as a result of their activities. Once these credits have been used to offset emissions from an activity (or set of activities, as would be the case if used to offset a firm's annual emissions from disparate sources), they are 'retired'. As a result of the ongoing operationalization of Article 6 of the Paris Agreement, which strives to facilitate cooperative international approaches towards achieving emissions reductions and provide order and structure to these processes, the carbon credit ecosystem is undergoing an evolution as well as an expansion to its nomenclature. This has given rise to new ways that credits may be utilized moving forward.

First, Article 6.2 allows countries to trade credits known as internationally transferred mitigation outcomes (ITMOs) through bilateral or multilateral arrangements and count them towards the achievement of the purchasing country's NDCs or towards other purposes. In order to ensure these emissions reductions are not double-counted, i.e., counted towards meeting the NDCs of both buying and selling countries, corresponding adjustments have to be applied to the selling country's GHG inventory that account for the ITMO. Generally, ITMOs have broader implications for compliance market CPIs and the achievement of NDCs than they do on voluntary markets.

Second, Article 6.4 creates a marketplace for both public and private sector actors to participate in collaborative approaches towards achieving emissions reductions. This process begins with a project developer who has generated 'Article 6.4 emissions reductions', known as A6.4ERs, through activities in a host country. If the host country permits the international trade of the A6.4ER credit, it can be purchased by another country to meet its own NDC, or used to offset overseas firm-level or 'international' emissions. This means A6.4ERs may be used towards meeting net-zero targets or international targets such as those enforced within international aviation upon signatories to the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA). On the other hand, if the host country does not permit the international trade of the A6.4ER, it can either be used to meet the host's NDC outright, or sold within domestic compliance markets to offset a firm's liabilities within a carbon tax or emissions trading system, for example.

It remains to be seen how Article 6.2 and 6.4 mechanisms will impact voluntary carbon markets moving forward. But through the operationalization of Article 6, it is clear that carbon credit activities will have a significant role to play in the global climate change response, by enabling international cooperation towards the achievement of mitigation outcomes, as well as unlocking financing for low-carbon development across the developing world.

2.3 ENABLERS AND CONSTRAINTS TOWARDS CPI IMPLEMENTATION

2.3.1 SCIENTIFIC RATIONALE AND ECONOMIC THEORY

The basis for carbon pricing is fundamentally drawn from scientific and economic realities. First, scientific evidence has made it clear that climate change is primarily driven by carbon-intensive anthropogenic activities that contribute to the increasing atmospheric concentration of GHGs. This viewpoint essentially puts carbon (the core 'ingredient' of these GHGs) at the center of the issue of climate change. Recognizing that these GHGs are ultimately the cause of climate change-linked economic damages in the present and the future, the social costs of emitting GHGs today have to be greater than zero.

The question is what exactly the social costs of GHG emissions are. This in turn has implications on whether existing and mooted CPIs 'fully' address the market failures previously introduced, by pricing carbon appropriately. From an economic perspective, this would only happen if the carbon price introduced fully accounts for the social costs of current and future damages from climate change. Determining this social cost of carbon (SCC), a scientific measure of the cost of each ton of CO_2e emitted, involves complex modeling and analysis, considering factors such as climate sensitivity, the time horizon of damages, discount rates, and socioeconomic impacts (Interagency Working Group on Social Cost of Greenhouse Gases, 2021). While different approaches and studies may produce differing values for the SCC, there is a general consensus among scientists and economists that the SCC is positive, indicating a net cost imposed on society by each additional ton of CO_2 emitted.

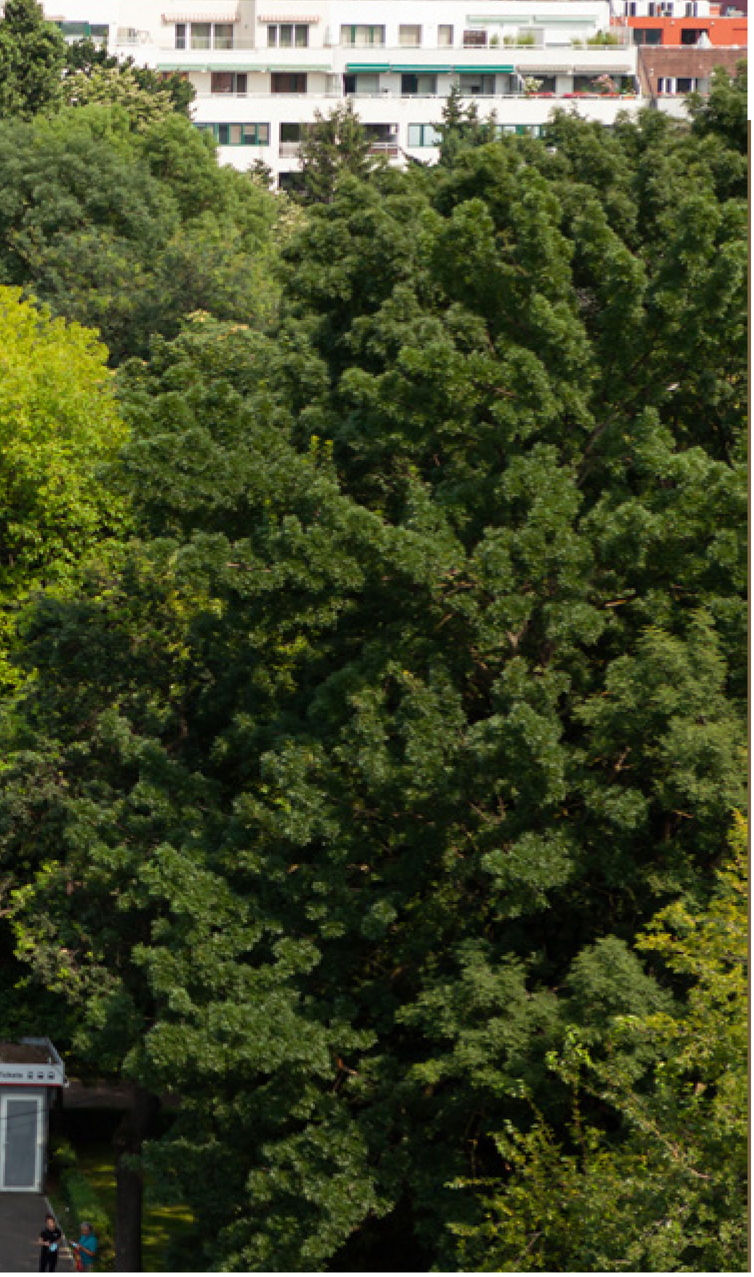
Yet, as highlighted in this report, the imposition of a high and scientifically-accurate SCC as the prevailing carbon price for compliance market instruments can have damaging economic and political consequences in the short-term. Nevertheless, the act of pricing carbon itself through the implementation of CPIs is a step in the right direction in itself.

Taking this perspective further, scientific evidence also makes it clear that in order to limit the extent of climate change and consequent economic damages, significant actions have to be taken across countries towards decarbonization. Recognition of this need is noticeable through the growing ambition of national and subnational efforts to reduce emissions and shift towards less carbon-intensive practices and technologies. Carbon pricing fits seamlessly into this overarching policy aspiration, because it provides fiscal incentives in favor of a broad range of lower-carbon practices and technologies ahead of more carbon-intensive business-as-usual practices.

[6] This is in reference to the Paris Agreement's call to nations to pursue efforts towards limiting the average surface-level temperature increase over pre-industrial levels to 1.5ºC.

For these reasons, carbon pricing is routinely recommended by economists and scientists as a fundamental component of the solution to climate change. In 1997, over 2,600 economists, including 19 Nobel laureates, signed the Economists' Statement on Climate Change, calling for the introduction of market-based policies as 'the most efficient approach to slowing climate change' (see Arrow et al., 1997). The Statement specifies emissions trading agreements and carbon taxes as possible mechanisms that would allow the achievement of 'climatic objectives at minimum cost' while instilling a necessary cooperative approach among nations. In 2019, over 3,500 economists, including 45 Nobel laureates and former Federal Reserve chairs were signatories to the Economists' Statement on Carbon Dividends (see Climate Leadership Council, 2019). This declaration is more strongly-worded than the 1997 Statement, referring to carbon taxes as 'the most cost-effective lever to reduce carbon emissions at the scale and speed that is necessary [...] by correcting a well-known market failure'. The 2019 Statement further expands on the economists' ideal carbon pricing policy: a carbon tax that features a gradually-rising carbon price, combined with carbon border adjustment taxes to protect domestic industries and reduce leakage, and a system of lump-sum rebates to households to account for any inflationary impacts of the tax itself.

The favor held towards CPIs by economists extends to the scientific community as well. IPCC (2018) states that 'policies reflecting a high price on emissions are necessary [...] to achieve cost-effective 1.5°C pathways.' Grubb et al. (2014) suggests that 'explicit carbon pricing [...] (is) critical for deep decarbonization pathways.' IPCC (2022), in a special report on climate change mitigation as part of its Sixth Assessment Report cycle, is even more strident about the potential roles of CPIs, stating that 'economic theory suggests carbon pricing policies [...] are more cost-effective than regulations or subsidies at reducing emissions', with 'high agreement that carbon taxes can be effective in reducing CO_2 emissions'. Extending this theoretical approach, IPCC (2022) further identifies that countries with CPIs show slower emissions growth rates, with higher carbon prices leading to greater 'carbon-efficiency'. With this evidence, the position of economics and science towards climate change and the potential roles of CPIs in addressing the causes of climate change are both clear.



2.3.2 POLITICAL ECONOMY

The political economy of carbon pricing is less straightforward than the economic and scientific perspective described previously. Indeed, political realities often obstruct effective carbon pricing policy design and implementation, as evidenced by unsuccessful attempts at introducing or maintaining carbon pricing instruments across the world in recent years (in Australia and the United States, for example) as well as the generally low carbon prices observed under existing mechanisms (see World Bank, 2023, and the Chapter 2.1 discussion on carbon prices around the world).

Generally speaking, there are a few reasons that the political economy of carbon pricing can be a deterrent towards the implementation of CPIs. The first and most fundamental form of opposition to CPIs arises from the lack of acknowledgement that climate change is caused by human activities, and is instead a result of natural processes beyond human control. This, for instance, is a chief point behind United States' Republican opposition to the implementation of CPIs. Indeed, while the Obama administration had in 2012 established the use of the SCC for regulatory cost-benefit analysis, one of the first acts of the Trump administration upon taking office in 2017 was to zero the SCC, in effect rendering it toothless in terms of serving its intended purpose.

Another challenge lies in the highly uncertain nature of projections of future damages and economic growth likely to result from climate change itself. This tends to fuel further skepticism about climate change as an issue in need of rectification in the first place.

This has essentially culminated in climate change becoming a partisan issue in some countries, rather than the existential threat that scientific evidence suggests it is with great certainty. This much is apparent in the United States, where there is an evident disparity in the attitudes of Democrats and Republicans towards climate change and the subsequent need for ambitious climate action. Stokes et al. (2015) found that such partisanship in the climate arena even extends to countries such as Australia, Canada, Germany, and to a lesser extent the UK. More recently, Pew Research Center (2021) finds that although concern over the impacts of climate change is growing across many advanced economies, there still remains a divide in the perceptions of the ideological left and right, with leftists significantly more likely to change their behaviors to address climate change across many countries. Further differences are apparent when considering the age of respondents; age is inversely correlated with concern over climate change. Interestingly, and surprisingly, this disparity is most pronounced in Sweden, very much a left-leaning society where climate action has been an important policy consideration for a long time. Sweden, after all, was one of the first adopters of carbon pricing in the 1990s and currently has one of the highest effective carbon tax rates globally. This reflects widespread attitudes towards climate policy in a broader sense – that persuading economic actors to forgo some degree of short-term material comfort in exchange for (very) long-term payouts is a tough sell.

Beyond domestic-level considerations, attention must also be given to the international context when considering climate change and carbon pricing, due to the global public good nature of the atmosphere. Action in one country or region towards reducing emissions is ineffective if matched by similar increases in emissions in other countries or regions; this is the basis for the need for cooperative approaches towards addressing climate change. And it is in considering the international dimension of climate action that further challenges towards the adoption of CPIs arise; this is deliberated upon next.

2.3.3 MACROECONOMIC IMPLICATIONS

A third feasibility test for the implementation of CPIs comes from the practical, rather than theoretical, side of economics: how these might affect economic growth and the distribution of wealth and economic rents more broadly. While carbon pricing can stimulate low-carbon development, it is still likely to cause short-term increases in the costs of living – particularly in jurisdictions that are beginning their carbon pricing journey with a high carbon price or with a highly emissions-intensive economy. For this reason, there is serious concern particularly amongst the developing world that the adoption of CPIs today would come at the expense of cost-effective growth, given that generating economic development through the use of fossil fuels is still usually cheaper and more practical than through the use of low-carbon energy and other technologies.

There is also the climate justice angle to carbon pricing. This perspective argues against the immediate adoption of CPIs amongst the developing world on the basis that the developed world reached today's levels of wealth by using cheap, emissions-intensive energy and technology. Why should developing nations not benefit from the same tools that worked before? This is a valid viewpoint widely held across the developing world. It also contributed, for instance, to the provision within the 1992 UNFCCC Treaty on Climate Change that all nations will act towards addressing climate change 'in accordance with their common but differentiated responsibilities (towards climate change) and respective capabilities (towards addressing climate change) [...] developed country Parties should take the lead in combating climate change and the adverse effects thereof.' Over 20 years since the treaty was enshrined, this principle still bears weight today. Article 2 of the 2015 Paris Agreement repeated similar language around the concept of 'common but differentiated responsibilities', maintaining that developed nations should 'take the lead' across both mitigation and climate financing efforts. Expectations that developing nations would show similar levels of ambition in climate policy as developed counterparts are by this definition unrealistic.

Yet at the same time, in reality we are starting to see increasing CPI adoption or, at the very least, consideration, across the developing world. This is highlighted by dynamism in this space not just amongst AMS, but in developing countries across Europe, South America, Africa, and Asia more broadly. In part, this is due to acknowledgement of the threat of climate change, with developing nations in sub-Saharan Africa, South Asia, and Southeast Asia are predicted to be amongst the most hard-hit by rising temperatures. Sometimes, CPI implementation can even be driven by economic considerations.

While CPIs are generally theorized to have short-run inflationary impacts, evidence is growing that these impacts are first of all limited in their extent[7], particularly in terms of headline inflation. Moessner (2022), for instance, assess the impacts of carbon pricing on inflation, finding that a USD 10/tCO_2e rise in ETS prices increases indexed energy costs by 0.8%, with insignificant effects on food or headline inflation rates. The effects of carbon taxes are found to be even more muted. These findings are widely corroborated by others in the economic literature.

Further, any inflationary or broader macroeconomic impacts can be assuaged by careful instrument design. This includes imposing initial limitations on scope and price that are later relaxed, as well as a system of 'rebates' to compensate lower-income households for any increases in costs of living. Many CPIs imposed over recent years feature such stipulations, aimed at managing potential macroeconomic implications. CPIs also have the potential to generate significant public revenue that can be reinvested towards achieving broader economic objectives, which can have positive repercussions for the economy at large, in addition to

financing climate change mitigation and adaptation efforts. To illustrate this, in 2022, the 68 implemented compliance market mechanisms generated revenues of some USD 95 billion despite covering only under a quarter of global emissions, up from USD 84 billion the year before. In this way, careful instrument design can play an important role managing and mitigating any possible negative short-term macroeconomic implications of carbon pricing.

One final point worth noting is that across AMS, fossil fuel use is very much prevalent today. While there is little evidence to suggest deep, long-term negative effects of CPIs on the health of the economy, it is likely that these negative impacts will be concentrated in emissions-intensive sectors in which abatement actions are costly, infeasible, or impractical. Given swift movement in ambitions to decarbonize supply and value chains, the intersection of emissions-intensive and trade-exposed sectors becomes a critical area for policymakers to consider in the design of CPIs. Support mechanisms are needed to help companies and workers adapt to a 'new normal' where the use of fossil fuels and carbon-intensive practices cannot go on unchecked as before. Existing studies on the impacts of CPIs are largely focused on developed nations starting from a lower-carbon intensity baseline than AMS would, and so it is possible that without careful management of the scope and price of carbon under a CPI, macroeconomic impacts may be larger than expected. It is refreshing to note, then, that all existing and mooted CPIs across ASEAN do impose limitations on their scope; Singapore taxes only the largest-emitting facilities, while Indonesia presently applies its ETS only to state-owned coal-fired power plants. Thailand will apply its carbon tax only to three sectors initially; and it is possible that other schemes currently being assessed or designed, including in Malaysia, Philippines, and Vietnam, will introduce carbon pricing in a similarly gradual manner.

[7] Moessner (2022) assess the impacts of carbon pricing on inflation, finding that a USD 10/ton increase in ETS prices increases indexed energy costs by 0.8%, with insignificant effects on food or headline inflation rates, while effects of carbon taxes are even more muted.

2.3.4 THE DEVELOPING WORLD: CHALLENGES TO CPI IMPLEMENTATION

Data and MRV

A strong MRV ecosystem is an inescapable foundational component of effective CPI implementation, but can be challenging to implement with great authority without the appropriate finance, infrastructure, labor, and technology. Steps are being taken to address these gaps, through national and regional efforts catered towards capacity-building centered around MRV. Indeed, collaborative efforts at the ASEAN and UNFCCC levels have included a strong emphasis on MRV. It is likely that such support will have to be scaled up in the coming years as more CPIs are designed and implemented across the region. On a related note, steps are needed to enhance data collection and harmonization, across industries, sectors, and geographic regions. The immediate impact of these actions may be felt more keenly at the national level by supporting the development of robust national emissions inventory accounting practices. In the longer-term, these efforts could form the foundations for the development of an ASEAN-level CPI.

Informal Economy

ILO (2018) reports that close to four-fifths of the employed population of the ASEAN region operate within the informal economy. The aggregated, regional-level assessment obscures variations across countries, the rural/urban divide, age, and gender. In less-developed AMS, the rural population, the youngest and the oldest age groups, and women are more likely to have a higher degree of involvement within the informal economy. Applying blanket, economy-wide CPIs can be both impractical and possibly detrimental to the socioeconomic status of many who operate within the informal sectors, disadvantaging them and even encouraging noncompliance due to either a lack of awareness or capacity to minimize any adverse effects of carbon pricing. Careful policy design is one avenue towards ameliorating this issue, but a clear understanding is needed of the challenges associated with decarbonization within the informal economy, as well as potential solutions. The interrelatedness of modern supply chains in an open region such as ASEAN poses further challenges, intensifying the need to formalize certain economic activities to best regulate GHG emissions.

Heavy Fossil Fuel Dependency

AMS rely heavily on fossil fuels to support energy use needs, particularly across the electricity and transport sectors. Transitioning away from heavy fossil fuel use poses a few challenges for the still developing countries in the region. Most importantly, the low-carbon energy transition will require substantive changes to each nation's energy sector infrastructure. Successfully deploying renewable energy (RE) at the scale that is required necessitates significant funding as well as technology advancement. Existing infrastructure catered towards the use of coal and gas mainly will need to be upgraded and modernized to best accommodate the use of solar, hydro, wind, biofuels, and other RE.

A further complicating factor arises as many AMS rely on the contributions of fossil fuels and fossil fuel industries towards economic growth. The application of carbon pricing can threaten the prospects of these industries if steps are not taken to ensure an equitable and just transition, including providing support towards companies and workers it 'leaves behind'. Any energy transition will have to be carefully managed to minimize these risks. Further, addressing the concerns of the (usually large) companies in the fossil fuel industry can be an important avenue towards bringing them on board with the need for nations to pursue aggressive emissions reductions and develop policy instruments to achieve these goals, such as carbon pricing.

Finally, while ASEAN has taken significant steps to address energy poverty, there is a risk that current plans and initiatives may threaten overall energy security. In the short-term, the shift towards RE could involve dependencies being introduced upon imported technology or resources, such as solar panel components, which can engender broader economic (or even political and geopolitical) concerns. The swift ramping down of fossil fuel power generation may also introduce further energy security risks.

Balancing Economic and Climate-related Needs

A long-time constraint to effective climate action is that it has historically been considered to be at odds with achieving economic objectives. In particular, climate or environmental action is associated with the introduction of additional costs, whether through charges, fees, or taxes. CPIs fall into this bracket as well. These additional costs could act as a drag on profits, reducing the scope for further investment and wage growth, which have broader economic implications.

Another concern, particularly pertinent to fossil fuel-producing and fossil fuel-intensive economies, is the emphasis on emissions reductions can lead to negative outcomes for these industries and its workforce. Not only could this hamper overall economic growth, but it could also contribute to rising unemployment if plans are not in place to retrain these workers to support their transition to low-carbon industries.

A third and final concern relates to international competitiveness. This reflects the challenges of unilateral climate action; first-movers on the climate agenda risk making their industries less competitive on the international arena due to the increased costs of doing business in the relevant domestic market. Not only do local industries lose out to exports that do not face the same climate or environmental costs, but there is also a risk of these industries relocating entirely to jurisdictions with less stringent rules. This is one of the driving factors for the EU's decision to consider the implementation of border carbon adjustments.

3. ASEAN: THE STATE OF CLIMATE CHANGE

CPIs associate a cost to the GHG emissions externality and the processes that cause emissions to accumulate in the atmosphere. At the same time, CPIs often co-exist with other climate or environmental instruments, to enable broad avenues of support for low-carbon development across industries and sectors. This chapter aims to provide some context on the 'state of climate change' across AMS in relation to carbon pricing. This chapter identifies the chief sources of GHG emissions within ASEAN, the region's fossil fuel and renewable energy use, and also reviews key low-carbon efforts across AMS to understand common objectives and targets across the region.

3.1 GREENHOUSE GAS EMISSIONS

GHG emissions are byproducts of a wide range of economic activities. National-level circumstances – a function of varying cultural, economic, nature-based, social, and technological factors – can play important roles in determining how these activities contribute to emissions. To manage the scope of this section of the analysis, this assessment considers only a subset of national-level emissions: those arising from energy use and non-energy use across seven sectors[8] (7S) and land-use change and forestry (LUCF). Emissions from energy use are straightforward: these are the result of fossil fuel combustion. Non-energy use emissions are the result of a number of factors, including land-use changes, and chemical and natural processes.

On the side of energy use emissions, the 7S reviewed include Electricity and heat; Fugitive emissions; Manufacturing and construction (M&C); and Transport. For non-energy use emissions, the 7S include Agriculture; Industrial processes and product use (IPPU); and Waste. In terms of gases, our emissions assessment covers key GHGs, including carbon-dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). Fluorinated gases, such as hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulfur hexafluoride (SF_6), and nitrogen trifluoride (NF_3) are excluded in large part due to inconsistencies in reporting capacities – and thus data availability – across AMS. Nevertheless, these are small in quantity, accounting for just 102 $MtCO_2e$, or roughly 3.8% of total non-LUCF emissions of some 2.7 $GtCO_2e$, in 2019.

The LUCF sector is treated separately to the 7S in this report. Emissions within the sector are attributable to changes in land management; for instance, the removal of GHG sinks through deforestation, land development, or natural disasters are reported as increases in emissions. In some cases, emissions reductions from ecosystem restoration efforts exceed emissions associated with less sustainable practices, leading to net emissions removals within the sector. There is further concern about the robustness of LUCF sector emissions reporting across AMS, as reported by ASEAN Secretariat (2021a), causing caution with drawing substantial conclusions from the LUCF data reported by Climate Watch.

Table 1 highlights how limiting the sectoral scope to the 7S still allows for an assessment covering the majority of non-LUCF emissions across AMS. While there is variation in the extent to which national-level emissions accrue to the 7S, particularly in the case of Laos[9], this narrowed focus still allows for an appreciation of at least 90% of AMS emissions sources. Note that where changes in emissions shares are positive, a greater proportion of national-level emissions has accrued to the 7S than previous time period, and vice versa.

[8] These are based on sector- or activity- level GHG emissions as per UNFCCC categorizations. The data is reported by Climate Watch.
[9] This is largely because Laos generated electricity through 2015 solely from hydropower, with the use of coal commencing only then. This explains much of the increase in Laos' emissions coverage under the 7S approach between the two time periods.

Table 1: Average Shares of Total Non-LUCF Emissions Accruing to 7S

COUNTRY	AVG SHARES OF NON-LUCF EMISSIONS		
	2000-2009	2010-2019	CHANGE
Brunei	98.9%	98.6%	-0.3%
Cambodia	95.8%	95.5%	-0.3%
Indonesia	92.1%	95.2%	3.1%
Laos	39.9%	78.7%	38.8%
Malaysia	97.5%	97.4%	-0.1%
Myanmar	94.9%	93.1%	-1.7%
Philippines	94.7%	94.8%	0.1%
Singapore	98.9%	99.0%	0.2%
Thailand	94.3%	94.9%	0.6%
Vietnam	91.8%	94.6%	2.8%
Average	**89.9%**	**94.2%**	**0.5%**

Source: Author's calculations, using data from Climate Watch (2023)

Table 2 considers aggregate sector-level AMS emissions across the 7S and LUCF, identifying key aspects of the climate change mitigation challenge across the bloc. Emissions from LUCF are highest in absolute terms, comprising roughly a third of the total across the two time periods assessed.

Table 2: GHG Emissions in ASEAN, by Sector

	ACTIVITY	TOTAL (in MtCO2e)			AVG ANNUAL GROWTH RATES		
		2000-2009	2010-2019	CHANGE	2000-2009	2010-2019	CHANGE
Energy Use	Electricity and Heat	362.4	599.3	236.9	4.8%	6.3%	1.5%
	Fugitive Emissions	70.8	93.9	23.1	3%	1.8%	-1.3%
	M&C	201.9	277.4	75.5	5.6%	4.7%	-0.9%
	Transport	222	341.4	119.4	3.2%	4.7%	1.5%
TOTAL ENERGY USE		**857.1**	**1,312**	**454.9**	**4.3%**	**5.1%**	**0.8%**
Non-energy Use	Agriculture	441.9	494.6	52.7	1.7%	0.5%	-1.2%
	IPPU	85.7	169.5	83.8	5%	8.9%	3.9%
	Waste	219.5	199.6	-19.8	-2%	0.7%	2.7%
	LUCF	847.9	977.4	129.5	13.2%	5.2%	-8%
TOTAL NON-ENERGY USE		**1,595**	**1,841.1**	**246.2**	**5.0%**	**2.8%**	**-2.21%**
	TOTAL EXCL. LUCF	**1,604.2**	**2,175.8**	**571.6**	**4.1%**	**3.5%**	**-0.6%**
	TOTAL INCL. LUCF	**2,452.1**	**3,153.2**	**701.1**	**2.7%**	**3.8%**	**1.1%**

Source: Author's calculations, using data from Climate Watch (2023)

Emissions from electricity generation grew the most in absolute terms between the 2000s and 2010s. It is now the second-largest source of emissions across AMS, followed closely by agriculture. The next largest contributors are transport (which exhibits a rising emissions trend); M&C (falling); and IPPU (rising). While agriculture continues to be a significant contributor to total emissions, the sector's emissions growth rate is slowing and its share of non-LUCF emissions is falling (as further evidenced by Table 3). This is caused in part by economic diversification across AMS, which is instead driving emissions growth in other key sectors, as well as the adoption of sustainable agricultural and sectoral land-use practices that contribute towards outright reductions in agriculture sector emissions.

Table 3, which presents sectoral shares of total non-LUCF emissions across AMS, further highlights the increasing significance of electricity sector emissions, largely a result of economic development and rising demand for electricity. These economic conditions are also likely drivers of increased emissions accruing to IPPU, M&C, and transport sector activities.

Table 3: Sectoral Shares of Total Non-LUCF Emissions Across ASEAN

Activities		2000-2009	2010-2019	CHANGE
Energy Use	Electricity and Heat	22.0%	27.6%	5.6%
	Fugitive Emissions	4.7%	4.1%	-0.6%
	M&C	8.5%	9.5%	1.0%
	Transport	11.6%	13.0%	1.4%
	Total Energy Use	**46.7%**	**54.3%**	**7.6%**
Non-energy Use	Agriculture	31.9%	27.1%	-4.8%
	IPPU	5.0%	7.7%	2.7%
	Waste	6.2%	5.2%	-1.0%
	Total Non-energy Use	**43.2%**	**39.9%**	**-3.3%**

Source: Author's calculations, using data from Climate Watch (2023)

The aggregated approach taken so far is useful in determining regional trends and challenges vis-à-vis climate change mitigation, but may obscure national-level nuances in the data. Table 4 presents a more detailed approach, focusing on GHG emissions in 2019 across the 7S within each country. The highest emitting sectors in each country are highlighted in gold, followed by the second-highest in silver, and third-highest in bronze.

Table 5, meanwhile, presents the same information in terms of shares of total emissions accruing to each sector. Excluding LUCF, the largest sectoral sources of emissions across AMS in 2019 are electricity generation, followed by agriculture and transport[10]. Across all member countries, electricity is the largest source of GHGs, except in Cambodia (3rd highest) and Myanmar (2nd highest).

Agricultural activities are the largest sources of emissions in Cambodia and Myanmar, the second-largest in Indonesia, Laos, and the Philippines, and third-largest in Vietnam, broadly correlating with expectations based on the comparatively high shares of agricultural activity within employment and GDP across these countries. For instance, Myanmar generates 22% of GDP from agricultural activities, and Cambodia over 17%. In contrast, Malaysia and Thailand rely on the sector for just 7.1% and 6.3% of GDP respectively.

The transport sector is another important regional contributor to emissions; only in Myanmar, Singapore, and Vietnam does transport not feature as one of the three most emissions-intensive sectors. Fugitive emissions are largest in oil and gas-producing countries, including Brunei, Indonesia, Malaysia, Thailand, and Vietnam, while waste sector emissions are highest in Indonesia, accounting for over 60% of the AMS' waste sector total. Finally, much of AMS' LUCF emissions are the result of activities in Indonesia, and to a lesser extent, Myanmar and Malaysia.

[10] In fact, this ordering, of the three most emissions-intensive sectors, persists even when considering average emissions from 2010 to 2019.

Table 4: Sectoral Emissions by AMS, 2019

Country	**Energy Use** (in $MtCO_2e$)				**Non-energy Use** (in $MtCO_2e$)			
	Elec.	Fugitive Emissions	M&C	Transport	Agri.	IPPU	Waste	*LUCF*
Brunei	4.8	1.8	0.4	1.4	0.1	0.6	0.2	*0.3*
Cambodia	4.7	-	1.1	5.9	21.3	4.3	0.6	*31.7*
Indonesia	258.2	54.2	149.5	154.7	176.9	38.9	136.0	*957.4*
Laos	14.1	0.0	0.7	2.5	9.6	1.7	0.2	*10.2*
Malaysia	130.0	15.7	37.1	65.3	14.4	22.9	21.0	*83.1*
Myanmar	12.6	0.2	8.9	6.6	86.9	1.6	5.2	*109.7*
Philippines	72.9	1.1	14.8	37.8	60.3	20.0	14.0	*2.5*
Singapore	26.1	1.0	14.0	7.0	0.0	15.2	3.3	*0.0*
Thailand	109.4	8.4	54.7	75.9	65.5	78.5	12.8	*15.1*
Vietnam	155.2	14.1	73.9	42.7	69.3	60.7	20.6	*(12.0)*
TOTAL	**788.1**	**96.5**	**355.0**	**399.8**	**504.4**	**244.4**	**213.9**	***1,197.9***

Source: Author's calculations, using data from Climate Watch (2023)

Legend: Sectors highlighted in Gold generate the most emissions in the respective country, Silver the second-most, and Bronze the third-most.

Table 5: Sectoral Emissions Shares by AMS, 2019

Country	**Energy Use**				**Non-energy Use**			
	Elec.	Fugitive Emissions	M&C	Transport	Agri.	IPPU	Waste	*LUCF*
Brunei	**51.4%**	19.2%	4.4%	14.6%	1.3%	6.2%	1.8%	*3.7%*
Cambodia	11.7%	0.0%	2.8%	14.7%	**53.3%**	10.7%	1.4%	*79.2%*
Indonesia	**25.8%**	5.4%	14.9%	15.4%	17.7%	3.9%	13.6%	*95.5%*
Laos	**48.0%**	0.0%	2.3%	8.6%	32.8%	5.7%	0.8%	*34.7%*
Malaysia	**41.5%**	5.0%	11.9%	20.9%	4.6%	7.3%	6.7%	*26.5%*
Myanmar	9.5%	0.2%	6.7%	5.0%	**65.2%**	1.2%	3.9%	*82.3%*
Philippines	**31.1%**	0.5%	6.3%	16.1%	25.7%	8.5%	6.0%	*1.1%*
Singapore	**38.9%**	1.5%	20.8%	10.4%	0.0%	22.7%	4.9%	*0.0%*
Thailand	**25.9%**	2.0%	13.0%	18.0%	15.5%	18.6%	3.0%	*3.6%*
Vietnam	**34.5%**	3.1%	16.4%	9.5%	15.4%	13.5%	4.6%	*-2.7%*
AVERAGE	**29.2%**	**3.6%**	**13.1%**	**14.8%**	**18.7%**	**9.0%**	**7.9%**	***44.4%***

Source: Author's calculations, using data from Climate Watch (2023)

Finally, Table 6 focuses specifically on energy use, focusing on GHG emissions by energy source across all sectors beyond 7S and energy use categories from Climate Watch data. This is useful in highlighting differences between AMS vis-à-vis the sources of fossil fuel energy used, as well as trends observed across AMS between the 2000s and 2010s.

Table 6: Average Shares of Emissions by Energy Source Across AMS

Country	Natural Gas		Coal		Oil		Biofuels and Others	
	2000-2009	*2010-2020*	*2000-2009*	*2010-2020*	*2000-2009*	*2010-2020*	*2000-2009*	*2010-2020*
Brunei	**74.4%**	**68.3%**	0.0%	3.1%	25.6%	28.6%	0.0%	0.0%
Cambodia	0.1%	18.9%	**79.1%**	**71.7%**	20.8%	9.4%	0.0%	0.0%
Indonesia	16.8%	15.6%	26.3%	37.3%	**52.2%**	**44.7%**	4.8%	2.4%
Laos	0.0%	0.0%	7.3%	**52.7%**	**66.3%**	38.8%	26.4%	8.5%
Malaysia	40.0%	29.1%	16.2%	33.5%	**43.7%**	**37.3%**	0.1%	0.1%
Myanmar	21.4%	25.1%	11.8%	9.9%	**39.2%**	**46.7%**	27.5%	18.3%
Philippines	7.6%	7.4%	29.2%	**45.8%**	**61.4%**	44.7%	2.7%	2.2%
Singapore	26.8%	42.9%	0.0%	3.0%	**71.2%**	**51.3%**	2.0%	2.7%
Thailand	29.9%	32.6%	24.1%	27.1%	**44.8%**	**39.1%**	1.1%	1.2%
Vietnam	10.8%	10.9%	40.6%	**58.6%**	**43.0%**	28.6%	5.5%	1.9%
AMS AVG	**22.8%**	**25.1%**	**23.5%**	**34.3%**	**46.8%**	**36.9%**	**7.0%**	**3.7%**

Source: Author's calculations, using data from IEA (2021)
Legend: The largest source of emissions in each time period in each country are highlighted in gold.

Across much of ASEAN, oil remains the largest contributor to GHG emissions due to its widespread use across the transport and industrial sectors (IEA, 2022). The 2010s also witnessed large increases in the region's use of coal; accordingly, the share of emissions accruing to coal combustion are observed to have increased over the decade prior across all AMS except Cambodia and Myanmar. It is worth noting that almost three-quarters of Cambodia's emissions are the result of coal use, while reductions in the coal emissions share in Myanmar are minimal. Indeed, the shares of emissions accruing to coal rose significantly between 11% and 45% in Indonesia, Laos, Malaysia, Philippines, and Vietnam, almost exclusively the result of a sharp increases in electricity demand and in the use of coal in electricity generation across AMS.

Finally, while natural gas is widely considered to be an effective 'transition fuel' because it is roughly half as emissions-intensive as coal, there is little evidence to suggest that a shift from coal or oil to gas is apparent across ASEAN, though this may be the result of policy lag given the nascency of low-carbon energy transition efforts. Only in Cambodia, Myanmar, Singapore, and Thailand have natural gas emissions increased by a tangible degree, showing increased usage in the 2010s.

3.2 LOW-CARBON ENERGY DEVELOPMENT

The assessment of GHGs has thus far has affirmed that energy use plays a significant role in determining the region's emissions. Within this subcategory, electricity generation, fugitive emissions, manufacturing and construction (M&C) and transport contributed to over 1,630 $MtCO_2e$ of the ASEAN-level total of just over 2,700 $MtCO_2e$ in 2019. Projections of rising electrification across industries and sectors, including M&C and transport makes it important for AMS to continue enhancing energy efficiency (EE) measures and investing in the development and deployment of low-carbon energy technologies, such as renewable energy (RE).

This section aims to take stock of the key low-carbon targets and outcomes across AMS, focusing on the past decade of climate-related activity. This will allow readers to understand key ongoing national-level climate efforts and targets that are relevant to carbon pricing and GHG emissions reductions.

Table 7 provides an overview of RE use across AMS, focusing on two key metrics: the share of RE in total installed electricity generation capacity as well as the share of RE in actual electricity generation. The purpose of highlighting both metrics is to establish that targets to increase the installed capacity of RE do not necessitate increases in the use of RE to generate electricity. This is dependent on matching supply and demand for electricity, the source(s) of baseload power and the cost-effectiveness of utilizing each energy source at a particular time. This, in turn, has implications on sectoral GHG emissions.

To illustrate this, consider the examples of Cambodia, Malaysia, Philippines, Thailand, and Vietnam. In these countries, the share of RE in total installed capacity overshadows that of RE in actual electricity generation. This is likely due to the fact that to meet excess demand at any given time, there are cheaper energy sources such as coal or natural gas available to electricity market operators than RE sources. To reduce actual emissions, however, it is not just the capacity share of RE that has to increase but the generation share as well.

Nevertheless, it remains clear that AMS are taking steps towards enhancing the contributions of RE relative to fossil fuels (as expressed by Table 8). Across all countries except Indonesia, Laos, and the Philippines, the share of installed capacity accruing to RE has risen, signaling that many AMS are successfully deploying RE. The continuous enhancement of these targets, as overviewed later in Table 9, makes it clear that this will remain a policy priority across the region in the future.

Table 7: RE Shares of Electricity Capacity and Generation Across AMS, 2000–2019

Countries	RE: Installed Capacity		RE: Electricity Generation	
	2000–2009	*2010–2020*	*2000–2009*	*2010–2020*
Brunei	0.0%	0.1%	0.0%	0.0%
Cambodia	6.1%	51.2%	5.1%	42.2%
Indonesia	18.4%	15.8%	17.5%	16.1%
Laos	100.0%	87.0%	100.0%	94.1%
Malaysia	12.0%	19.9%	7.9%	12.1%
Myanmar	42.5%	64.4%	51.3%	64.4%
Philippines	30.1%	28.1%	33.9%	24.4%
Singapore	1.7%	2.2%	3.4%	4.0%
Thailand	15.0%	19.9%	6.7%	15.8%
Vietnam	41.6%	43.4%	40.9%	41.3%

Source: Author's calculations, using data from IRENA (2022 and 2023)

Table 8: Total Installed Capacity of Various RE Sources Across ASEAN, 2000–2019

RE Source	Average Installed Capacity (MW)		Growth Rate
	2000–2009	*2010–2019*	
Hydropower	17,000	38,681.5	128%
Wind	18.4	879	4,671%
Solar	21.1	2,888.3	13,622%
Bioenergy	2,980	6,536.3	119%
Geothermal	2,711.1	3,426.7	26%
TOTAL	**22,730.5**	**52,411.8**	**131%**
Source: Author's calculations, using data from IRENA (2022) and IRENA (2023)			

3.3 CLIMATE CHANGE MITIGATION IN ASEAN

3.3.1 NATIONAL NDCS AND KEY LOW-CARBON TARGETS

Table 9: Summary of NDCs and Key Low-Carbon Targets Across AMS

Country	Scope of NDC	2030 NDC Targets: GHGs	Other Key Low-Carbon Targets
Brunei	Agri., Elec., IPPU, LUCF, Transport, Waste	**GHG Emissions:** 20% reduction relative to BAU	**Energy Intensity of GDP:** 45% reduction by 2035, relative to 2005 **RE:** 30% of installed electricity capacity by 2035 **Net-Zero Target**: 2050
Cambodia	Agri., Elec., IPPU, LUCF, Transport, Waste	**GHG Emissions:** 41.7% reduction, with a 59% reduction from LUCF, relative to BAU	**Total Final Energy Consumption (TFEC):** 20% reduction by 2035, relative to BAU **LUCF:** 50% reduction in deforestation rates by 2026; achieve 60% forest cover by 2030
Indonesia	Agri., Elec., IPPU, LUCF, Transport, Waste	**GHG Emissions:** 31.89% reduction (unconditional), 43.2% reduction (conditional), relative to BAU	**TFEC:** Reductions of 17% for IPPU; 20% for Transport; 15% for Residential, 15% for Commercial, by 2025, relative to BAU **RE:** 31% of installed capacity by 2030 **LUCF:** Net-sink by 2030 **Emissions Peak:** 2030 **Net-Zero:** 2060
Lao PDR	Agri., Elec., IPPU, LUCF, Transport, Waste	**GHG Emissions:** 60% reduction (unconditional), i.e., roughly 62 $MtCO_2e$, between 2020 and 2030	**RE:** 30% of total energy consumption by 2025, excl. large hydropower **LUCF:** 70% forest cover, conditional, by 2035 **Net-Zero:** 2050
Malaysia	Agri., Elec., IPPU, LUCF, Transport, Waste	**GHG Emissions:** 45% reduction in GHG intensity of GDP, relative to 2005 baseline	**RE:** 40% of installed capacity by 2035; 70% by 2050 **Net-Zero:** 2050
Myanmar	Agri., Elec., LUCF	**GHG Emissions:**Cumulative 244.52 $MtCO_2e$ unconditional reduction, 414.75 million $MtCO_2e$ conditional reduction between 2021 and 2030	**Electricity Consumption:** 20% reduction by 2030 **RE:** 47% of installed capacity by 2030.
Philippines	Agri., Elec., IPPU, Transport, Waste	**GHG Emissions:**75% reduction, of which 2.71% reduction is unconditional and 72.29% reduction is conditional.	**Energy Intensity of GDP:** 40% reduction by 2040, relative to 2005 **Emissions Peak:** 2030 **RE:** 15.2 GW of installed capacity by 2030

Country	Scope of NDC	2030 NDC Targets: GHGs	Other Key Low-Carbon Targets
Singapore	Agri., Elec., IPPU, LUCF, Waste	**GHG Emissions:** Reduce absolute emissions to 60 $MtCO_2e$ economy-wide	**Emissions Peak:** Before 2030 **Net-Zero:** 2050
Thailand	Agri., Elec., IPPU, Transport, Waste	**GHG Emissions:** 20% unconditional reduction, 25% conditional reduction, relative to 2005 baseline	**Energy Intensity of GDP:** 30% reduction by 2036, relative to 2010 **RE:** 30% of total energy consumption by 2036 **Carbon Neutrality:** 2050 **Net-Zero:** 2065
Vietnam	Agri., Elec., IPPU, LUCF, Transport, Waste	**GHG Emissions:** 15.8% unconditional reduction, additional 43.5% conditional reduction, relative to BAU	**RE:** 30.9% of generation mix by 2030; 67.5% by 2050, with specific targets by technology **Methane:** 30% reduction by 2030 relative to 2020 **Net-Zero:** 2050

Table 9 overviews all key current climate-related targets across AMS, including GHG emissions targets specified in national NDCs and key low-carbon targets that will likely be implicated by and have implications for CPIs, and how they are designed and implemented. This remains a highly dynamic space, with AMS upwardly revising their climate ambitions on a regular basis.

Since 2020, all AMS have submitted 'enhanced' NDCs to the UNFCCC, consisting of more ambitious targets and coverage than NDCs previously submitted (in most cases, this refers to those set during the passage of the Paris Agreement). In terms of sectoral coverages, all AMS NDCs cover activities across a broad range of economic sectors, including key emissions-intensive activities such as agriculture, electricity generation, IPPU, LUCF, transport, and waste. The least coverage is in Myanmar, whose NDC applies only to agriculture, electricity, and LUCF activities.

Further, all AMS have imposed targets to guide energy use, either in the form of targets applied to energy consumption broadly, or renewable energy specifically. Cambodia, Indonesia, and Laos have set explicit targets for the LUCF sector. 7 of 10 AMS have set targets to achieve net-zero emissions by 2050. The exceptions are Indonesia, whose net-zero target is set for 2060; Cambodia, which does not have such a target; and Thailand, which aims to achieve carbon-neutrality by 2050 and net-zero emissions by 2065.

In terms of absolute emissions, however, only Indonesia and Singapore have set targets for emissions to peak by 2030. This remains a pertinent gap within ASEAN: IPCC (2022) calls for a global peaking of emissions by as early as 2025 in order to ensure a greater likelihood of limiting the climate change-linked average global surface temperature increase to no more than 2ºC above pre-industrial levels.

3.3.3 PLATFORMS FOR REGIONAL CLIMATE ACTION AND CARBON PRICING SUPPORT

Addressing climate change necessitates global efforts to mitigate emissions, enhance resilience, and improve the adaptive capacity of individual nations and regions. Recognizing the diverse need for such support across nations, an increasing number of regional platforms aim to support and promote cooperation towards achieving climate targets. In this section, we aim to briefly overview some of the key regional climate change and carbon pricing support platforms relevant to AMS.

1. ASEAN Working Group on Climate Change (AWG-CC)

Established in 2009, the AWG-CC acts a platform for regional cooperation towards addressing climate change. It reports to the ASEAN Senior Officials on Environment (ASOEN), alongside six other topic-focused environmental working groups[11], which serve to facilitate coordination and collaboration across sectoral bodies and AMS. The AWG-CC's work encompasses key activities and sectors that include agriculture, energy, forestry, and transport, amongst others, with the view of enhancing integration of climate responses across member nations. Chairmanship of the AWG-CC, which convenes on an annual basis, rotates between AMS every three years. Malaysia is the current chair, having assumed the role for the period of 2022 to 2025.

The AWG-CC is responsible for the development of key guiding documents on climate change for the region. This includes overarching frameworks and guidance, such as the ASEAN Climate Change Strategic Action Plan that is currently in development; the ASEAN Climate Vision 2050, included as a component of the ASEAN State of Climate Change Report; and bloc-level communiques at the international stage, through the ASEAN Joint Statement on Climate Change made annually at UNFCCC Conferences of Parties, for instance[12]. The AWG-CC's activities encompass eight core themes, including long-term planning and NDC assessments; MRV and GHG stocktaking; and climate financing. Some of this has deep relevance to carbon pricing. For example, MRV is a foundational component towards the adoption of CPIs, which themselves can form an important part of domestic and regional climate finance frameworks. The AWGCC is explicitly working on carbon pricing through UNFCCC initiatives and mechanisms, including Collaborative Instruments for Ambition Climate Action (CiACA) and Regional Dialogues on Carbon Pricing (REdiCAP), as described next.

2. Collaborative Instruments for Ambitious Climate Action (CiACA)

The CiACA initiative was established by the UNFCCC following COP22 in 2016, assisting Parties to the Paris Agreement in the development of CPIs to implement their NDCs[13]. CiACA operates alongside individual Parties, subnational jurisdictions, as well as through Regional Collaboration Centres (RCCs), primarily by providing technical support and expertise, capacity-building, and financing. These RCCs represent partnerships between the UNFCCC and leading regional institutions. In ASEAN, work under the CiACA initiative takes place in close collaboration with the AWGCC under the RCC in Bangkok, Thailand.

[11] This includes the ASEAN Working Groups on Nature Conservation and Biodiversity (which is also supported by the ASEAN Center for Biodiversity); Coastal and Marine Environment; Water Resources Management; Environmentally Sustainable Cities; Chemicals and Waste; and Environmental Education.
[12] The latest such joint statement was made at COP 27 in November 2022 (ASEAN Secretariat, 2022).
[13] See UNFCCC (2019a).

CiACA's first phase culminated in a study assessing options and assistance provided to develop facility-level MRV across AMS, with a view that these form the basis for a potential regional carbon market (UNFCCC, 2019b). This study proposed exploring the possibility of a regional ETS, though it is more likely that support is directed to develop domestic CPIs. Further work is ongoing in the areas of capacity building support and the development of a five-year roadmap for ASEAN-level cooperation on MRV and carbon pricing, together with the UN Economic and Social Commission for Asia and the Pacific (UN-ESCAP). Through CiACA, the UNFCCC also organizes Regional Dialogues on Carbon Pricing (REdiCAP), which facilitates cross-country discussions on CPIs and experience-sharing.

3. Enhanced Regional EU-ASEAN Dialogue Instrument (E-READI)

E-READI is an EU-funded development program supporting cooperation between the EU and ASEAN towards promoting inclusive and sustainable growth (Koty, 2021). It is an expansion of its predecessor program, READI, which operated between 2011 and 2015. Nine of the 34 identified policy areas for cooperation towards the achievement of the ASEAN Community Blueprints fall under a thematic pillar on 'Environment and Climate Change'; one of these focuses explicitly on CPIs in ASEAN. Under E-READI, a scoping study was launched in 2021, aimed at supporting the development of long-term strategies towards low-carbon development across AMS, in close collaboration with the AWGCC and ASOEN (ASEAN Secretariat, 2021b). This study identified that regional cooperation efforts have thus far focused on carbon pricing and MRV, amongst others. It recommends the development of a regional network for carbon pricing, as well as the commencement of discussions across AMS with the view of creating regional carbon market mechanisms, either within or beyond the scope of Article 6 of the Paris Agreement. Indeed, CPIs are recommended numerous times in this study as a potential tool to aid the region's energy transition and long-term decarbonization strategies.

Other studies have also been conducted under the remit of E-READI, including work on identifying gaps in AMS approaches towards circular economy and reducing the environmental footprint of waste, which are beyond the scope of this study.

4. Partnership for Market Implementation (PMI), World Bank

The PMI is a World Bank program assisting countries in the study, design, piloting, and implementation of CPIs. It commenced in 2021, as the successor program to the Partnership for Market Readiness, which in the decade from 2011 provided funding and technical assistance to 23 nations to support the development and deployment of CPIs. Over its planned 10-year life cycle, the PMI aims to support capacity-building in 30 jurisdictions through implementing best international practices, facilitating multilateral sharing discussions with other partner countries, and providing technical support for the operationalization of the Paris Agreement's Article 6 mechanisms. At present, the PMI is also providing carbon pricing readiness support to Malaysia, as well as implementation support to Indonesia and Vietnam.

4. CARBON PRICING ACROSS ASEAN

4.1 OVERVIEWING THE STATE OF PLAY

This chapter overviews the various compliance market and voluntary market CPIs in place across ASEAN. These are summarized in Table 10, which considers a broad range of instruments within the carbon pricing ecosystem. Specifically, it covers the following:

1. Legal instruments, such as acts, laws, and regulations;
2. Compliance market instruments, namely carbon tax or emissions trading systems;
3. Carbon credit activities, which encompass compliance and voluntary markets;
4. Indirect carbon pricing instruments, such as fuel taxes; and
5. Fossil fuel subsidies, which counteract CPIs.

Table 10: The State of Play of Carbon Pricing Across ASEAN, June 2023

Countries	Carbon Pricing Instruments					
	Law or Act	Tax	ETS	Crediting$^{\alpha}$	Indirect$^{\beta}$	FF Subsidies$^{\chi}$
Brunei	Under Consideration	Under Consideration	Under Consideration	In Development	Inactive	Active
Cambodia	Inactive	Inactive	Inactive	Active	Inactive	Inactive
Indonesia	Active	Under Consideration	Active	Active	Active	Active
Laos	Inactive	Inactive	Inactive	Active	Active	Inactive
Malaysia	Under Consideration	Under Consideration	Under Consideration	Active	Inactive	Active
Myanmar	Inactive	Inactive	Inactive	Active	Inactive	Inactive
Philippines	Under Consideration	Under Consideration	Under Consideration	Active	Active	Inactive
Singapore	Active	Active	Inactive	Active	Active	Inactive
Thailand	Under Consideration	In Development	Under Consideration	Active	Active	Active
Vietnam	Under Consideration	Under Consideration	Under Consideration	Active	Active	Inactive

Notes:
$^{\alpha}$ Includes carbon credit programs and voluntary market activities. See Table 11 for a detailed assessment.
$^{\beta}$ Includes indirect carbon pricing instruments, i.e., fossil fuel taxes and related environmental taxes.
$^{\chi}$ Includes only explicit subsidies to final consumers, as reported by Parry et al. (2021b)

Legend:
♦ Active
♦ In Development
♦ Under Consideration
♦ Inactive

Sources: AMRO (2022), Parry et al. (2021a), Parry et al. (2021b), So et al. (2023), World Bank (2023)

All AMS, except Cambodia and Myanmar, are either assessing, designing, implementing, or have implemented compliance market CPIs. The only implemented compliance market CPIs across AMS as of June 2023 are Indonesia's ETS, launched in February 2023 and which currently covers only emissions from coal-fired power plants; and Singapore's carbon tax, launched in 2019 and which covers emissions from its largest emitters.

Thailand is planning to launch a carbon tax over the coming years, covering activities within the energy, transport, and industrial sectors, and is currently engaged in studies to develop this mechanism. Brunei, Malaysia, the Philippines, and Vietnam are all considering the implementation of carbon taxes or ETS, and are currently in various stages of assessing their feasibility and practicality for adoption. Carbon crediting programs or initiatives are ongoing across all AMS except Brunei. These are detailed further in Table 11.

This study notes a distinction between direct and indirect carbon pricing instruments. Direct CPIs are defined as those levied on a unit of CO_2e; indirect CPIs those levied on (typically fossil) fuels, or the source of CO_2e emissions, not emissions themselves. Indirect CPIs[14], commonly target carbon-intensive fuels such as gasoline, are present in six of 10 AMS, and absent only in Brunei, Cambodia, Malaysia, and Myanmar. Although these are not strictly CPIs, they are levied on sources of emissions that would otherwise be taxed under a CPI regime and so are defined as relevant to the context of this study.

Finally, fossil fuel subsidies, which essentially counteract CPIs by subsidizing the very fuels they tax the emissions of, are still employed in Brunei, Indonesia, Malaysia, and Thailand. In preparation for the adoption of CPIs, consideration should be given towards the rationalization and removal of these subsidies. Recent years have seen the removal of fossil fuel subsidies in Thailand (to some extent) and Vietnam, offering a template to other AMS striving towards the same objective.

Next, we turn our attention to carbon crediting activities, overviewed in Table 11, which presents data published by the Berkeley Carbon Trading Project (see So et al., 2023). This database covers only carbon offset projects listed by the American Carbon Registry (ACR), Climate Action Reserve (CAR), Gold Standard, and Verra (VCS), while projects under the CDM are included only if they have been transitioned into one of the aforementioned registries. A total of over 173 million issued carbon credits (notionally covering some 173 $MtCO_2e$) have originated from AMS since 2004, with 99% of these generated through activities in the agriculture, forestry, and other land-use (AFOLU) and energy sectors.

Table 11: Overview of Carbon Credit Activities Across AMS, 2004–2023

Countries	No. of Projects	Issued Credits	Share of Credits Retired	AFOLU[15]: Share of Issued Credits	Energy: Share of Issued Credits
Brunei	0	N/A	N/A	N/A	N/A
Cambodia	26	47,437,139	34%	92%	4%
Indonesia	47	94,811,267	50%	81%	18%
Laos	29	1,450,456	38%	6%	82%
Malaysia	15	520,232	100%	98%	2%
Myanmar	36	436,381	85%	38%	62%
Philippines	16	691,571	87%	2%	98%
Singapore	5	1,285,477	10%	0%	100%
Thailand	81	17,200,902	60%	2%	43%
Vietnam	122	9,653,077	44%	0%	56%
ASEAN (Aggregated)	**377**	**173,486,502**	**47%**	**70%**	**29%**

Source: Author's calculations, based on data from So et al. (2023).

In the absence of integration with compliance market CPIs, carbon credit activities are largely voluntary in nature, and allow economic actors to offset emissions to meet internal, or non-CPI based regulatory targets. Singapore is the only AMS with a compliance market CPI that has been in place for a significant period of time. For this reason, it is inferred that carbon credit activities in other AMS to date have been voluntary in nature.

[14] For a more complete discussion of direct and indirect carbon pricing, their application globally, and arguments in favor of one, the other, and combined approaches, see Pryor et al. (2023).
[15] In the nomenclature of Chapter 3, AFOLU comprises activities under the Agriculture and LUCF sectors.

4.2 NATIONAL STATUS OF CARBON PRICING ACROSS ASEAN

4.2.1 BRUNEI

Table 12: Brunei – Carbon Pricing and Climate Policy Ecosystem

Brunei	**Carbon Pricing**	Legal Basis	Tax	ETS	Crediting	Indirect	FF Subsidies
		♦ (Under Consideration)	♦ (Under Consideration)	♦ (Under Consideration)	♦ (In Development)	♦ (Under Consideration)	♦ (Active)
	Climate Change	Institutional Structure	National Policy	Mitigation Policy	Adaptation Policy	Sectoral Policies	Budget Tagging
		♦ (Active)	♦ (Active)	♦ (Active)	♦ (In Development)	♦ (Under Consideration)	♦ (Inactive)

Legend: ♦ Active ♦ In Development ♦ Under Consideration ♦ Inactive

Sources: AMRO (2022), Parry et al. (2021a), Parry et al. (2021b), So et al. (2023), World Bank (2023)

- Amongst Brunei's key climate targets are its NDC, to reduce GHG emissions by 20% by 2030, relative to BAU projections. Beyond this, Brunei is seeking to reduce the emissions intensity of its GDP by 45% by 2035, relative to 2005, by when it also aims to increase the share of RE in installed electricity capacity to 30%. A target to achieve net-zero by 2050 has also been imposed.
- Brunei's intentions to introduce CPIs are highlighted in both its NDC as well as its National Climate Change Policy (NCCP) (BCCS, 2020).
- The NCCP delineates ambitions for the Brunei's carbon pricing strategy, stating that the implemented CPI would be introduced by 2025 and cover high-emitting industrial facilities that meet or exceed a specified GHG threshold. It also cites ambitions to develop a mechanism for the redistribution of carbon revenues towards meeting national climate change mitigation and adaptation priorities.
- In order to achieve these ambitions, Brunei plans to conduct assessments to determine optimal design features of the mooted CPI, covering aspects such as instrument choice, emissions thresholds, and carbon price levels. It is anticipated that this assessment will necessitate a close working relationship between Government and industry players.
- Brunei also seeks to establish a robust monitoring, reporting, and verification (MRV) system for GHG emissions, based on international best practices, to ensure the accuracy and veracity of the nation's baseline emissions as well as future emissions projections.
- Steps are being taken further carbon credit activities by establishing carbon trading as a tool to support Brunei's efforts to address climate change. The mooted Domestic Voluntary Carbon Offset mechanism is being presently established (Abdul Ghani, 2023).
- Brunei does not currently utilize any form of indirect carbon pricing.
- Brunei subsidizes the use of fossil fuels, including gasoline, diesel, kerosene, liquefied petroleum gas (LPG), and natural gas (Parry et al., 2021a; Parry et al., 2021b).
- IMF (2019) estimates that a carbon price of USD 35/tCO_2e would reduce Brunei's emissions by 6% below BAU by 2030, while a price of USD 70/tCO_2e would reduce emissions by 11%.

4.2.2 CAMBODIA

Table 13: Cambodia – Carbon Pricing and Climate Policy Ecosystem

Cambodia	**Carbon Pricing**	Legal Basis	Tax	ETS	Crediting	Indirect	FF Subsidies
		♦ (Inactive)	♦ (Inactive)	♦ (Inactive)	♦ (Active)	♦ (Inactive)	♦ (Inactive)
	Climate Change	Institutional Structure	National Policy	Mitigation Policy	Adaptation Policy	Sectoral Policies	Budget Tagging
		♦ (Active)	♦ (Active)	♦ (Active)	♦ (Active)	♦ (Active)	♦ (Inactive, Active outline)
Legend: ♦ Active ♦ In Development ♦ Under Consideration ♦ Inactive							
Sources: AMRO (2022), Parry et al. (2021a), Parry et al. (2021b), So et al. (2023), World Bank (2023)							

- At present, Cambodia has no plans to introduce compliance-market CPIs.
- The nation has nevertheless imposed relatively ambitious climate targets, with its NDC aiming for a 41.7% reduction in GHG emissions by 2030, relative to BAU, with a 59% reduction in LUCF emissions. Supplementing the NDC are targets to reduce total final energy consumption (TFEC) by a fifth by 2035, again relative to BAU, as well as to reduce deforestation rates by 50% and achieve total forest cover of 60% by 2030 (Government of Cambodia, 2020).
- Cambodia remains an active participant in carbon credit activities, accounting for over a quarter of credits issued across AMS since 2004[16]. The vast majority of these credits are the result of emissions avoided, reduced, or removed from the agriculture, forestry, and land-use (AFOLU) sector.
- Cambodia does not utilize indirect forms of carbon pricing, nor does it provide subsidies for fossil fuels (OECD, 2022; Parry et al., 2021a; Parry et al., 2021b).
- IMF (2019) estimates that a carbon price of USD 35/tCO_2e would reduce Cambodia's emissions by 16% below BAU by 2030, while a price of USD 70/tCO_2e would reduce emissions by 25%.

[16] Do note that this is not representative of all credit activities, only those that are covered by So et al. (2023) as described in Chapter 4.1.

4.2.3 INDONESIA

Table 14: Indonesia – Carbon Pricing and Climate Policy Ecosystem

Indonesia	**Carbon Pricing**	Legal Basis	Tax	ETS	Crediting	Indirect	FF Subsidies
		♦ Active	♦ Under Consideration	♦ Active	♦ Active	♦ In Development	♦ Active
	Climate Change	Institutional Structure	National Policy	Mitigation Policy	Adaptation Policy	Sectoral Policies	Budget Tagging
		♦ Active	♦ Active	♦ Active	♦ Active	♦ Active	♦ Active

Legend: ♦ Active ♦ In Development ♦ Under Consideration ♦ Inactive

Sources: AMRO (2022), Parry et al. (2021a), Parry et al. (2021b), So et al. (2023), World Bank (2023)

- Indonesia has imposed a wide range of climate-related targets in recent years. Its NDC aims for an unconditional 32% decrease in absolute emissions by 2030, relative to BAU, rising to 43.2% conditional upon the receipt of international mitigation assistance. Other key targets include reducing TFEC by up to a fifth across IPPU, transport, residential, and commercial sector activities, as well as increasing installed RE capacity to 31% and peaking absolute emissions by 2030. Beyond this, Indonesia seeks to achieve a net-sink LUCF sector (i.e., one which sequesters more carbon than it emits) by 2030 and net-zero emissions economy-wide by 2060 (Government of Indonesia, 2022).

- Indonesia has shown high levels of activity in the context of establishing a regulatory framework to support the implementation of CPIs. In 2017, the government issued a regulation on environmental economic instruments, mandating the implementation of an emissions or waste permit trading system by 2024[17] (Government of Indonesia, 2017).

- Since 2021, a further four regulations have been issued with implications for carbon pricing. The first of these, launched in 2021, provides a national framework for CPIs, highlighting their envisioned roles towards the achievement of Indonesia's NDC and GHG emissions reductions (Government of Indonesia, 2021a). The second regulation, launched in October 2022, presents guidelines for CPI implementation, provides the legal basis for a cross-sectoral ETS. It covers a broad range of topics such as carbon trading and offsetting, institutional arrangements, and MRV procedures (Government of Indonesia, 2022b). The third regulation, launched in December 2022, focuses specifically on guidelines for CPI implementation across the power sector and provides the legal basis for the implementation of an ETS covering power generation activities (Government of Indonesia, 2022c).

- With this strong legislative basis for CPIs, Indonesia launched an ETS in February 2023 that covers power generation activities (Reuters, 2023). Indonesia's ETS is comprised of three phases: the first, currently ongoing phase runs through end-2024 and covers emissions arising from 99 state-owned coal-fired power plants that account for over 80% of Indonesia's electricity generation capacity. During the second and third phases, scheduled to be in effect from 2025–2027 and 2028–2030 respectively, Indonesia plans to extend ETS coverage to encompass the use of natural gas and oil in power generation, as well as other coal plants not owned by the state-owned utility Perusahaan Listrik Negara (PLN).

- Indonesia has concurrently been considering the implementation of a carbon tax. It was initially planned that this tax would be launched in April 2022, following the 2021 passage of a law governing the harmonization of tax regulations, under which one of the clauses introduces plans to enact a carbon tax (Government of Indonesia, 2021b). This planned carbon tax has since been postponed to 2025.

[17] Recall the high levels of emissions from Indonesia's waste sector, both at the national level and compared against AMS peers.

- In actuality, Indonesia's plans can be more accurately described as a carbon cap-and-tax scheme – the carbon tax would only apply, at least in its initial phases, to the same activities covered by the ETS, namely coal-fired power generation. Economic actors who exceed emissions allowances under the ETS are liable to pay the carbon tax for each unit of GHGs emitted beyond their stipulated limit. The law cites a minimum carbon tax rate of roughly USD 2/tCO_2e, in line with prices under the ETS. Should ETS prices fall below this threshold, this stipulated carbon tax rate shall act as a minimum carbon price. Indonesia intends to extend the coverage of the carbon tax at a later date.
- Indonesia has also launched regulation on the 'Implementation of CCS and CCUS in Upstream Oil and Gas Business Activities', which is likely to have implications for carbon credit activities within the sector (Government of Indonesia, 2023).
- Indonesia has also implemented indirect forms of carbon pricing, including fuel excise duties that covered roughly 14% of emissions in 2021 (OECD, 2022).
- Indonesia still utilizes fossil fuel subsidies extensively. These cover roughly a third of national GHG emissions, incentivizing the use of gasoline, kerosene, and LPG, as well as natural gas and coal in power generation (Parry et al., 2021a; Parry et al., 2021b).
- Indonesia is an active player in carbon credit markets, accounting for over half of all credits issued by AMS since 2004. Over four-fifths of these originate from AFOLU activities, with most of the remainder the result of low-carbon energy projects.
- IMF (2019) estimates that a carbon price of USD 35/tCO_2e would reduce Indonesia's emissions by 16% below BAU by 2030, while a price of USD 70/tCO_2e would reduce emissions by 24%.

4.2.4 LAOS

Table 15: Laos – Carbon Pricing and Climate Policy Ecosystem

Laos	Carbon Pricing	Legal Basis	Tax	ETS	Crediting	Indirect	FF Subsidies
		◆ (Inactive)	◆ (Inactive)	◆ (Inactive)	◆ (Active)	◆ (Active)	◆ (Inactive)
	Climate Change	Institutional Structure	National Policy	Mitigation Policy	Adaptation Policy	Sectoral Policies	Budget Tagging
		◆ (Active)	◆ (Active)	◆ (Active)	◆ (Active)	◆ (Active)	◆ (Inactive)

Legend: ◆ Active ◆ In Development ◆ Under Consideration ◆ Inactive

Sources: AMRO (2022), Parry et al. (2021a), Parry et al. (2021b), So et al. (2023), World Bank (2023)

- Laos has implemented a number of key climate-related targets, led by its NDC to achieve a 60% reduction in absolute emissions (i.e., some 62 MtCO_2e) by 2030, relative to 2020 levels. It aims for RE to contribute 30% of total energy consumption by 2025 excluding large-hydropower, while a target to achieve 70% forest cover by 2035 has also been set, conditional upon the receipt of international support. Like a number of its ASEAN peers, Laos also strives to achieve net-zero emissions by 2050 (Government of Laos, 2021).
- Though reported by AMRO (2022) that Laos is considering the implementation of CPIs, no other evidence suggests that the republic is currently doing so. The National Green Growth Strategy of Lao PDR indicates the consideration of transport fuel taxes and other measures to discourage the use of private vehicles, though in any case these are defined in the context of this study as indirect CPIs.

- Laos has engaged in carbon credit activities, through 29 listed projects with emissions reductions amounting to just under 1.5 $MtCO_2e$. Over 80% of these credits originate from low-carbon energy programs.
- Laos imposes taxes on transport fuels, namely gasoline and diesel, and does not subsidize the use of fossil fuels (OECD, 2022; Parry et al., 2021a; Parry et al., 2021b).
- Through its NDC, Laos has requested international support in the development of MRV mechanisms and processes, its GHG inventory, and on carbon credit activities (Government of Laos, 2021). All can be considered precursors to the implementation of compliance market CPIs should the government choose to pursue such a course in the future.

4.2.5 MALAYSIA

Table 16: Malaysia – Carbon Pricing and Climate Policy Ecosystem

Malaysia							
	Carbon Pricing	Legal Basis	Tax	ETS	Crediting	Indirect	FF Subsidies
		♦ Under Consideration	♦ Under Consideration	♦ Under Consideration	♦ Active	♦ Inactive	♦ Active
	Climate Change	Institutional Structure	National Policy	Mitigation Policy	Adaptation Policy	Sectoral Policies	Budget Tagging
		♦ Active	♦ Active	♦ Active	♦ In Development	♦ Active	♦ Inactive

Legend: ♦ Active ♦ In Development ♦ Under Consideration ♦ Inactive

Sources: AMRO (2022), Parry et al. (2021a), Parry et al. (2021b), So et al. (2023), World Bank (2023)

- Through its NDC, Malaysia aims to reduce the GHG emissions intensity of GDP by 45% by 2030, relative to 2005. In 2023, Malaysia revised its RE targets and is now aiming for RE to comprise 40% of the total installed electricity capacity by 2035, rising to 70% by 2050. A net-zero target has also been set for 2050, at the earliest (Government of Malaysia, 2021a).
- In 2021, the government launched the 12th Malaysia Plan, which introduced Malaysia's intention to assess the feasibility of implementing CPIs to support the achievement of its domestic climate targets as well as its NDC (Government of Malaysia, 2021b). This was the first public signal from the Government of Malaysia that such instruments are being considered.
- Malaysia has since been reported to be considering the use of both a carbon tax and ETS. Studies assessing the feasibility of adopting a carbon tax are being led by the Ministry of Finance with support from the World Bank's PMI, while work on the ETS is led by the Ministry of Natural Resources, Environment, and Climate Change (Aziz, 2021; Bernama, 2023; Ministry of Economy, 2023).
- Bursa Malaysia, the national stock-exchange regulator, launched Malaysia's voluntary carbon exchange, the Bursa Carbon Exchange (BCX) in December 2022 (Bursa Malaysia, 2022). BCX held its inaugural auction in March 2023, which saw the trade of 150,000 credits across the energy and AFOLU sectors (Hazim, 2023). Credits sold were all generated through international carbon offset projects.

- Beyond this, Malaysia had previously engaged in carbon credit activities with 15 registered projects covering over 0.5 $MtCO_2e$. All these credits have been retired, i.e., used to 'offset' emissions either domestically or elsewhere, and almost all originated from AFOLU sector activities (So et al., 2023).
- IMF (2019) estimates that a carbon price of USD 35/tCO_2e would reduce Malaysia's emissions by 14% below BAU by 2030, while a price of USD 70/tCO_2e would reduce emissions by 21%.

4.2.6 MYANMAR

Table 17: Myanmar – Carbon Pricing and Climate Policy Ecosystem

Myanmar	**Carbon Pricing**	Legal Basis	Tax	ETS	Crediting	Indirect	FF Subsidies
		Inactive	Inactive	Inactive	Active	Inactive	Inactive
	Climate Change	Institutional Structure	National Policy	Mitigation Policy	Adaptation Policy	Sectoral Policies	Budget Tagging
		Active	Active	Active	Active	Active	Inactive

Legend: ♦ Active ♦ In Development ♦ Under Consideration ♦ Inactive

Sources: : AMRO (2022), Parry et al. (2021a), Parry et al. (2021b), So et al. (2023), World Bank (2023)

- Myanmar has set its NDC purely in terms of absolute emissions reductions targets, aiming for an unconditional decrease in emissions of roughly 245 $MtCO_2e$ by 2030, relative to 2021 levels, with this target rising to 415 $MtCO_2e$ conditional upon the receipt of international support. Myanmar also aims for a reduction in total electricity demand of 20%, and for RE to account for 47% of total installed electricity capacity, by 2030 (Government of Myanmar, 2021).
- Myanmar is not considering the implementation of CPIs, nor does it use indirect CPIs to advance environmental objectives (OECD, 2022).
- Additionally, Myanmar does not utilize fossil fuel subsidies (Parry et al., 2021a; Parry et al., 2021b).
- Myanmar has had some exposure to carbon credit activities, through 36 listed projects amounting to emissions reductions of just under 500,000 tCO_2e since 2004. All these credits have been issued as a result of activities across the AFOLU and energy sectors, with the majority having already been retired (So et al., 2023).
- IMF (2019) estimates that a carbon price of USD 35/tCO_2e would reduce Myanmar's emissions by 10% below BAU by 2030, while a price of USD 70/tCO_2e would reduce emissions by 17%.

4.2.7 PHILIPPINES

Table 18: Philippines – Carbon Pricing and Climate Policy Ecosystem

Philippines	**Carbon Pricing**	Legal Basis	Tax	ETS	Crediting	Indirect	FF Subsidies
		♦ (Under Consideration)	♦ (Under Consideration)	♦ (Under Consideration)	♦ (Active)	♦ (Active)	♦ (Inactive)
	Climate Change	Institutional Structure	National Policy	Mitigation Policy	Adaptation Policy	Sectoral Policies	Budget Tagging
		♦ (Active)	♦ (Active)	♦ (Active)	♦ (Active)	♦ (Active)	♦ (Active)

Legend: ♦ Active ♦ In Development ♦ Under Consideration ♦ Inactive

Sources: AMRO (2022), Parry et al. (2021a), Parry et al. (2021b), So et al. (2023), World Bank (2023)

- The Philippines' NDC calls for a 75% reduction in the nation's GHG emissions by 2030, relative to a decade-long BAU scenario. Only 2.71% of this total represents an unconditional target, with the remainder contingent on the receipt of international assistance for its mitigation efforts. This is augmented by separate targets to peak emissions by 2030, increase the capacity of RE to 15.2GW by 2030, and reduce the energy intensity of GDP by 40% by 2040, relative to 2005.
- The Philippines is currently considering the implementation of compliance market CPIs. It is studying the viability of a carbon tax as a measure to meet climate and environmental needs and obligations, as well as support broader fiscal consolidation efforts (Simeon, 2022). Philippines is also reported by ADB (2021) and ICAP (2020) to have been considering the implementation of an ETS, which is reportedly the preferred tool of the nation's Department of Finance (DOF).
- Further, the Low-Carbon Economy Act of 2023 was proposed to the Philippine Senate Committee on Environment, Natural Resources, and Climate Change in March 2023 (Legarda, 2023). It sets provisions for a national emissions trading system covering industrial and commercial sectors, as well as broader low-carbon directives.
- It has also been reported by Jocson (2023) that any recommended carbon tax proposal submitted by the DOF would likely be taken up by the country's legislature, indicating broad recognition across government of the need for the Philippines to enact such instruments.
- The Philippines, which does not subsidize fossil fuel consumption, already imposes indirect CPIs (OECD, 2022; Parry et al., 2021a; Parry et al., 2021b). These are in form of taxes levied upon five categories of fossil fuels: coal, LPG, diesel, gasoline, and bunker fuels, at varying rates, through its Tax Reform for Acceleration and Inclusion (TRAIN) Law. Under TRAIN, indirect carbon tax rates are estimated to range from between USD 1.60/tCO_2 for coal to USD 95/tCO_2 for gasoline (Oposa, 2018).
- Philippines has had some exposure to carbon credit activities, with 16 listed projects since 2004. Much of these have been credits issued from activities within the energy sector, and in total cover emissions reductions of just under 700,000 tCO_2e (So et al., 2023).
- IMF (2019) estimates that a carbon price of USD 35/tCO_2e would reduce the Philippines' emissions by 20% below BAU by 2030, while a price of USD 70/tCO_2e would reduce emissions by 29%.

4.2.8 SINGAPORE

Table 19: Singapore – Carbon Pricing and Climate Policy Ecosystem

Singapore	**Carbon Pricing**	Legal Basis	Tax	ETS	Crediting	Indirect	FF Subsidies
		♦ Active	♦ Active	♦ Inactive	♦ Active	♦ Active	♦ Inactive
	Climate Change	Institutional Structure	National Policy	Mitigation Policy	Adaptation Policy	Sectoral Policies	Budget Tagging
		♦ Active	♦ Active	♦ Active	♦ Active	♦ Active	♦ Inactive

Legend: ♦ Active ♦ In Development ♦ Under Consideration ♦ Inactive

Sources: : AMRO (2022), Parry et al. (2021a), Parry et al. (2021b), So et al. (2023), World Bank (2023)

- Singapore's NDC calls for reductions in its absolute emissions to 60 $MtCO_2e$. This is augmented by targets to peak emissions before 2030 and reach net-zero emissions by 2050 (Government of Singapore, 2022a).
- In 2018, Singapore issued the Carbon Pricing Act stipulating the implementation of a carbon tax covering facilities with annual emissions of over 25$ktCO_2e$ (essentially the 50 largest emitters), at a rate of approximately USD 3.72/tCO_2e (Government of Singapore, 2018). The carbon tax commenced in 2019, encompassing over 80% of Singapore's annual emissions.
- An Amendment to Singapore's carbon tax legislation was passed in 2022, formalizing the government's intention to progressively raise the price of carbon three times by 2028 (Government of Singapore, 2022b). Under the new regime, carbon prices will reach roughly USD 18.60/tCO_2e in 2024, USD 33.50/tCO_2e in 2026, and between USD 37/tCO_2e and USD 60/tCO_2e by 2028.
- The Amendment to the Act included provisions for emissions-intensive, trade-exposed industry players to offset a portion of their carbon tax liabilities by using transitory allowances. To further cushion the impacts of rising carbon prices, this allows companies to use internationally-purchased carbon credits to offset up to 5% of annual emissions.
- In June 2023, Singapore launched its own carbon exchange market, Climate Impact X (CIX). Jointly established by its stock market regulator (SGX), sovereign wealth fund (Temasek), and financial institutions (DBS and Standard Chartered), it seeks to scale voluntary carbon market activities by facilitating carbon credit transactions catered towards institutional investors and multinational corporations.
- Singapore utilizes indirect CPIs in the form of fuel excise taxes that cover the transport sector, and does not subsidize the use of fossil fuels (OECD, 2022; Parry et al., 2021a; Parry et al., 2021b).
- IMF (2019) estimates that a carbon price of USD 35/tCO_2e would reduce Singapore's emissions by 4% below BAU by 2030, while a price of USD 70/tCO_2e would reduce emissions by 8%.

4.2.9 THAILAND

Table 20: Thailand – Carbon Pricing and Climate Policy Ecosystem

Thailand	**Carbon Pricing**	Legal Basis	Tax	ETS	Crediting	Indirect	FF Subsidies
		♦ (Under Consideration)	♦ (In Development)	♦ (Under Consideration)	♦ (Active)	♦ (Active)	♦ (Active)
	Climate Change	Institutional Structure	National Policy	Mitigation Policy	Adaptation Policy	Sectoral Policies	Budget Tagging
		♦ (Active)	♦ (Active)	♦ (Active)	♦ (Active)	♦ (Active)	♦ (Inactive)

Legend: ♦ Active ♦ In Development ♦ Under Consideration ♦ Inactive

Sources: AMRO (2022), Parry et al. (2021a), Parry et al. (2021b), So et al. (2023), World Bank (2023)

- Thailand's NDC calls for an unconditional 20% decrease in its absolute GHG emissions relative to a 2005 baseline, with a further 5% decrease conditional on international assistance. Supplementing its NDC are targets to reduce the energy intensity of GDP by 30% by 2036, by when the nation also strives to have 30% of total energy consumption met through the use of RE. Finally, Thailand has imposed a carbon neutrality target for 2050 and a net-zero target for 2065, though the implied distinction between neutrality and net-zero remains unclear.
- Thailand's Excise Department has announced plans to implement a carbon tax covering activities across the energy, transport, and industrial sectors at some point in the coming years, with studies currently ongoing to assist in the development of this mechanism (Chantanusornsiri, 2022).
- The Ministry of Natural Resources and Environment has indicated that details on the proposed carbon tax as well as on carbon credit activities will be included within the nation's upcoming Climate Change Act. This move has its origins in the 12th National Economic and Social Development Plan 2017-2021, which stipulated that the Thai government begin to develop economic instruments to incentivize GHG emissions reductions (Government of Thailand, 2017). Concurrently, the government is also preparing the Greenhouse Gas Reporting Law and the Emissions Trading System Law (World Bank, 2021).
- Thailand has an extensive system in place to support domestic carbon credit activities across a wide range of sectors. Notably, despite accounting for a tenth of credits issued by AMS, it is the only nation where the majority of these credits originate from low-carbon activities outside the AFOLU and energy sectors.
- Since 2009, the Thailand GHG Management Organization (TGO) has been working towards the development of the Thailand Voluntary Emissions Trading Scheme (T-VETS), which aims to reduce GHG emissions through domestic voluntary carbon market activities (TGO, 2020). At the same time, it is working towards establishing robust MRV systems in line with international standards.
- T-VETS has been in place since 2015, in multiple phases, across a number of carbon-intensive industrial activities, with targets set to reduce the emissions intensity of activities from a 2012/13 baseline.
- T-VETS allows participating organizations to 'offset' emissions through the nation's domestic crediting program, the Thailand Voluntary Emissions Reduction (T-VER) program (TGO, 2016). T-VER also strives to achieve emissions reductions by promoting participation in voluntary carbon market activities across domestic firms.

- Thailand has announced that credits issued for a host of low-carbon activities, predominantly across the energy and waste sectors, are eligible for use to meet international objectives. This is provided that specific project characteristics are met and these sales do not compromise its own international climate commitments.
- In 2023, Thailand launched a carbon credit trading platform, FTIX, jointly developed by the TGO and the Federation of Thai Industries, which will incorporate the T-VER and serve to facilitate domestic trade in carbon credits and renewable energy certificates (The Nation, 2023). International trading may be permitted in the future.
- Thailand has in place a variety of taxes covering the consumption of fossil fuels, as well as automobile taxes designed to penalize the use of low fuel-efficiency private vehicles (OECD, 2022).
- Thailand also subsidizes fossil fuels, particularly for natural gas and petroleum products. Retail prices for transport fuels are also capped (Parry et al., 2021a; Parry et al., 2021b).
- IMF (2019) estimates that a carbon price of USD 35/tCO_2e would reduce Thailand's emissions by 9% below BAU by 2030, while a price of USD 70/tCO_2e would reduce emissions by 16%.

4.2.10 VIETNAM

Table 21: Vietnam – Carbon Pricing and Climate Policy Ecosystem

Vietnam	**Carbon Pricing**	Legal Basis	Tax	ETS	Crediting	Indirect	FF Subsidies
		♦ (Under Consideration)	♦ (Inactive)	♦ (Active)	♦ (Active)	♦ (Active)	♦ (Inactive)
	Climate Change	Institutional Structure	National Policy	Mitigation Policy	Adaptation Policy	Sectoral Policies	Budget Tagging
		♦ (Active)	♦ (Active)	♦ (Active)	♦ (Active)	♦ (Active)	♦ (Inactive)

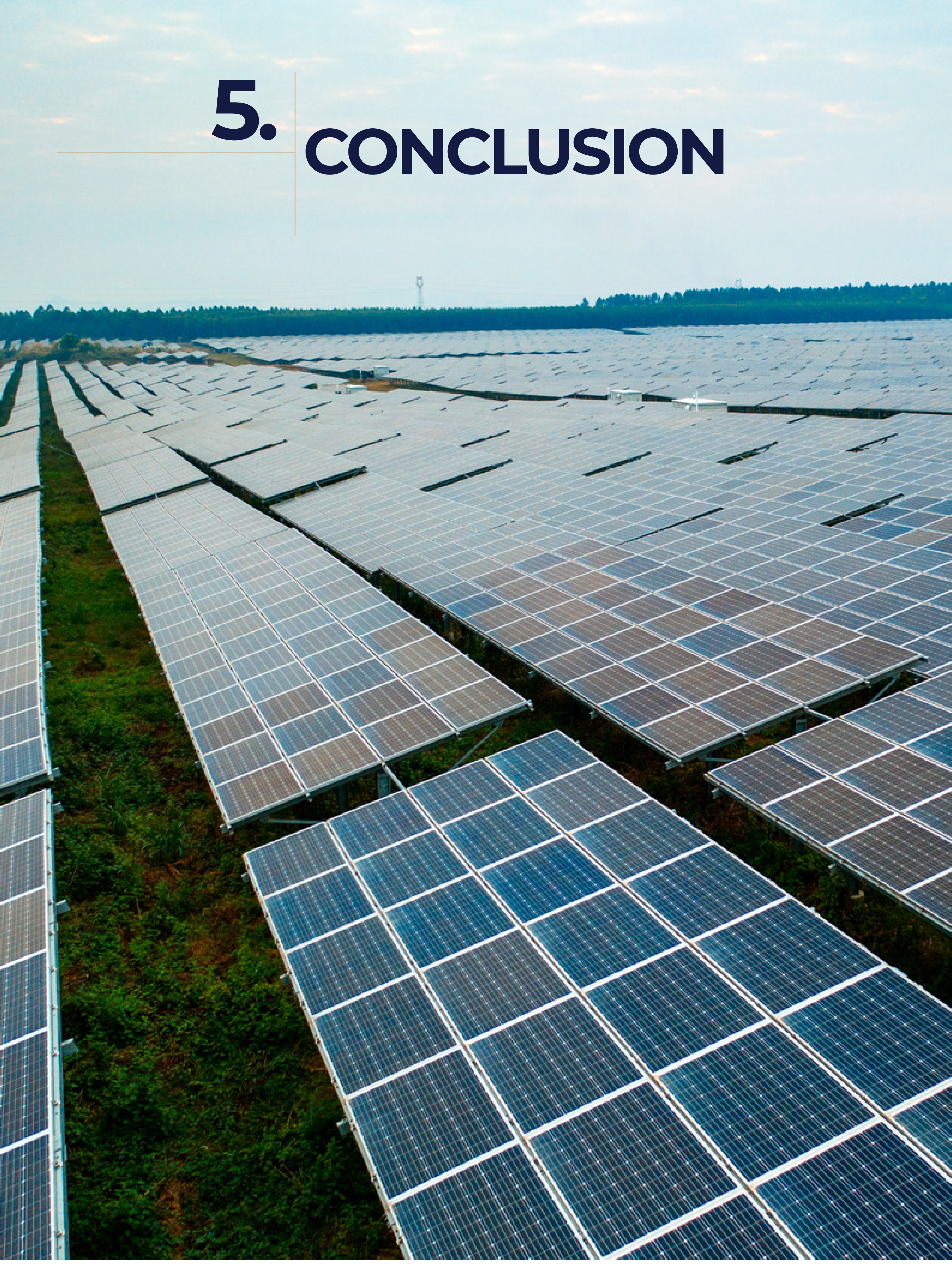
Legend: ♦ Active ♦ In Development ♦ Under Consideration ♦ Inactive

Sources: : AMRO (2022), Parry et al. (2021a), Parry et al. (2021b), So et al. (2023), World Bank (2023)

- Vietnam is aiming for an unconditional reduction in GHG emissions of roughly 16% by 2030, relative to its BAU scenario, with a further 43.5% decrease conditional upon international mitigation assistance. It has imposed ambitious and detailed targets for RE deployment, aiming for RE to comprise almost 31% of the electricity generation mix by 2030 and over two-thirds by 2050. Vietnam has also imposed a target to reduce methane emissions by 30% by 2030 relative to 2020 levels, and a net-zero target for 2050.
- Vietnam is currently in the process of assessing and designing an ETS, which has its legislative origins in the 2022 revision of Vietnam's Law on Environmental Protection. This Law empowers the Ministry of Finance and the Ministry of Natural Resources and Environment to design a domestic ETS. The system is mooted to allow for the inclusion of domestic and international offsets to mitigate liabilities, as well as a national crediting mechanism (NCM) (Government of Vietnam, 2022b).

- This has since been followed up with a decree establishing regulations under the Law on Environmental Protection as well as a roadmap towards ETS and NCM implementation (Government of Vietnam, 2022c). The pilot NCM is slated for launch in 2024, initially targeting the transport and waste sectors (World Bank, 2023). It is expected to support the full operationalization of Article 6 crediting mechanisms by 2026. The pilot ETS, meanwhile, will be launched on a voluntary basis in 2026 with full, mandatory operationalization by 2028.
- To support the implementation of the ETS, facilities with annual emissions of over 3,000 tCO_2e are required to submit biennial GHG inventory reports.
- The ETS will feature a declining emissions quota that corresponds to emissions reductions targets under Vietnam's NDC. It will initially cover carbon-intensive sectors such as steel, cement, and thermal power generation before being expanded to cover further sectors.
- Despite the fact that the NCM remains under development, Vietnam has previously participated in carbon credit activities. It accounts for almost a third of the 377 listed projects across AMS, although the size of emissions reductions achieved through these projects is rather small; Vietnam accounts for just over 5% of the region's issued credits since 2004. None of Vietnam's carbon credit projects to date cover emissions reductions activities in its AFOLU sector (So et al., 2023).
- Vietnam does not subsidize the consumption of fossil fuels, and imposes indirect CPIs in the form of environmental taxes which are levied on the import and production of fossil fuels (OECD, 2022; Parry et al., 2021a; Parry et al., 2021b).
- IMF (2019) estimates that a carbon price of USD 35/tCO_2e would reduce Vietnam's emissions by 21% below BAU by 2030, while a price of USD 70/tCO_2e would reduce emissions by 31%.

5. CONCLUSION



Over the past decade, carbon pricing has become an increasingly popular policy measure used to support growing global efforts to address the causes of climate change and adapt to its consequences. While historically the domain of climate policy in the developed world, evidence shows that CPIs are now being seriously considered across the developing world too. This trend extends to Southeast Asia, where seven of 10 ASEAN member states are either considering, implementing, or have implemented a mandatory carbon tax or emissions trading system, and all AMS have been involved in carbon crediting activities in some capacity in recent decades.

While individual countries may have specific objectives in mind through the application of CPIs, part of the impetus towards the development of domestic regulation on GHG emissions is driven by international developments. Particularly important in this context are the finalization of Article 6 under the Paris Agreement, which serves to facilitate international cooperation in the achievement and trade of GHG mitigation outcomes, as well as the possible implications of other cross-border instruments and mechanisms such as border carbon adjustments. These international developments, coupled with the global nature of the issue of climate change, put international cooperation and coordinated efforts at the center of successfully navigating this challenge.

With the growing intensity of the climate challenge, the carbon pricing agenda will likely continue to progress across AMS over the coming decade. At present, such efforts remain in their nascency. This is in part due to the fact that CPIs are complex, multidimensional policy instruments that can have implications across a wide range of economic activities across many sectors. While general guidelines exist for their implementation, rooted in both theory as well as practical experience – largely in the developed world – unique national and subnational circumstances mean that there cannot be a one-size-fits-all approach towards CPIs. What works in Europe may not work as well in Southeast Asia, owing to varying underlying economic and social conditions, political structures, and energy systems.

This creates great scope for regional actors, including international development organizations, to provide support and guidance to national-level governments in the development of their CPIs, including ensuring the necessary foundational elements of CPI implementation are in place. Indeed, much of the support AMS have received at national and regional levels have thus far focused on the development of robust MRV mechanisms for emissions, and studies to better understand the potential impacts of pricing carbon, including direct and indirect economic impacts.

Such work will need to continue so that AMS have a clear understanding of what is required in ongoing efforts to implement and administer CPIs, and how to design CPIs to ensure environmental objectives can be met without compromising on bread-and-butter economic needs. In laying out the landscape of the climate change challenge and the carbon pricing ecosystem across ASEAN, it is hoped that this desk review provides regional actors with a basic understanding of climate change economics, carbon pricing instruments, and the state of climate change and low-carbon policy across AMS, using this information to facilitate engagements with AMS governments in their ongoing and present endeavors towards implementing CPIs.

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7. APPENDIX

Table 22: RE Capacity Across ASEAN by Source, 2000–2019 (Climate Watch, 2023)

Country	RE Source	Avg Installed Capacity	
		2000–2009	*2010–2019*
Brunei	Hydropower	0.0	0.0
	Wind	0.0	0.0
	Solar	0.0	1.2
	Bioenergy	0.0	0.0
	Geothermal	0.0	0.0
	TOTAL	**0.0**	**1.2**
Cambodia	Hydropower	12.3	755.7
	Wind	0.0	0.3
	Solar	0.8	23.9
	Bioenergy	2.0	33.7
	Geothermal	0.0	0.0
	TOTAL	**15.1**	**813.6**
Indonesia	Hydropower	3,510.3	5,070.9
	Wind	0.1	30.6
	Solar	3.7	62.3
	Bioenergy	994.6	1,837.8
	Geothermal	864.1	1,535.7
	TOTAL	**5,372.9**	**8,537.2**
Laos	Hydropower	676.9	3,995.9
	Wind	0.0	0.0
	Solar	0.0	8.2
	Bioenergy	0.0	40.9
	Geothermal	0.0	0.0
	TOTAL	**676.9**	**4,045.0**
Malaysia	Hydropower	2,101.1	4,835.9
	Wind	0.0	0.0
	Solar	0.2	282.0
	Bioenergy	695.1	1,025.2
	Geothermal	0.0	0.0
	TOTAL	**2,796.4**	**6,143.1**

Country	RE Source	Avg Installed Capacity	
		2000–2009	*2010–2019*
Myanmar	Hydropower	609.8	2,959.8
	Wind	0.0	0.0
	Solar	0.0	24.8
	Bioenergy	36.0	49.9
	Geothermal	0.0	0.0
	TOTAL	**645.8**	**3,034.5**
Philippines	Hydropower	2,475.5	2,887.0
	Wind	16.5	261.9
	Solar	1.2	380.2
	Bioenergy	12.7	210.6
	Geothermal	1,846.7	1,890.7
	TOTAL	**4,352.7**	**5,630.4**
Singapore	Hydropower	0.0	0.0
	Wind	0.0	0.0
	Solar	0.2	74.3
	Bioenergy	150.5	178.2
	Geothermal	0.0	0.0
	TOTAL	**150.6**	**252.6**
Thailand	Hydropower	2,977.5	3,053.0
	Wind	0.7	455.0
	Solar	13.2	1,517.4
	Bioenergy	964.1	2,965.4
	Geothermal	0.3	0.3
	TOTAL	**3,955.9**	**7,991.1**
Vietnam	Hydropower	4,636.5	15,123.3
	Wind	1.0	131.1
	Solar	1.7	514.0
	Bioenergy	125.0	194.7
	Geothermal	0.0	0.0
	TOTAL	**4,764.3**	**15,963.1**

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