Policy measures to respond to carbon fee impacts on industry in Taiwan

Report prepared for the Ministry of Environment Taiwan

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Contents

Summary

Carbon pricing is increasingly seen as a crucial tool in the global effort to combat climate change. As of April 2023, 37 carbon taxes and 36 emission trading systems (ETS) were in place, with several additional initiatives in the pipeline. In this evolving policy landscape, Taiwan is actively advancing the development of its own national carbon fee, which was launched in 2024, with an initial focus on the electricity and manufacturing industries. Within this framework, Taiwan is exploring the adoption of measures aimed at safeguarding its industries from potential adverse consequences.

Measures relevant for Taiwan

Relevant measures adopted by major carbon pricing jurisdictions, such as the European Union, the United Kingdom, and Singapore, provide valuable insights for addressing potential industry opposition in Taiwan. Firstly, jurisdictions can limit the total compliance cost by restricting the quantity of emissions subject to a carbon price; for example, by excluding small emitters or distributing free allocations (as seen in the EU ETS context). Secondly, the total compliance cost can be reduced by charging a discounted carbon price; for instance, by implementing a lower carbon fee rate for specific entities or fuels (as illustrated by the Climate Change Agreements in the UK Climate Change Levy context and the transition framework for emissions-intensive trade exposed [EITE] sectors in the context of the Singapore carbon tax). Thirdly, the adoption of low-carbon technologies can be promoted using collected revenue, often through earmarking revenues to incentivise R&D and deployment. Finally, the carbon playing field can be levelled by adjusting embedded carbon costs at the border; for example, by imposing a carbon price on the carbon content of imports (as illustrated by the Carbon Border Adjustment Mechanism in the EU ETS context).

Potential opposition to a carbon fee in Taiwan

Resistance to carbon pricing instruments (CPIs) is likely to arise from both the industrial sectors and population groups that will be impacted the most. This report focuses on resistance from the industrial sector, which typically emits a significant share of a country's greenhouse gas (GHG) emissions. Taiwan's industry sector accounts for around 40% of its gross domestic product (GDP). Manufacturing activities are dominated by the electronic parts and components subsector, representing 45% of the total gross manufacturing value added in 2021, followed by the computers, electronic and optical products subsector at 10%. Adjusted for electricity use, the manufacturing industry and construction jointly contribute 51% to gross GHG emissions. The computers, electronic and optical products, and the electronic parts and components subsectors are the sectors with the highest share of exports as a percentage of demand.

The share of employment in carbon-intensive manufacturing sectors such as basic metals, fabricated metal products, non-metallic minerals and chemical materials is relatively small within manufacturing employment in Taiwan. Some employment concentrations in these sectors are observed in Kaohsiung, New Taipei, Taichung and Taoyuan, where stronger resistance to a carbon fee may be expected. In the context of Taiwan's international trade, there is little to no evidence indicating that the existing carbon prices in trade partner jurisdictions significantly influence Taiwan's trade in these carbon-intensive products. This suggests that, at least initially, the carbon fee in Taiwan is also unlikely to be a key determinant.

Drawing insights from international experience provides guidance on effectively addressing opposition. Common industry concerns about adopting carbon pricing encompass fears of economic impact, job losses, reduced profitability, regulatory complexity, increased operational costs and potential disruptions to day-to-day operations. Global strategies emphasise proactive approaches involving public consultations and communication campaigns highlighting job creation and environmental protection, as well as relief measures. Effective communication requires clear messaging, stakeholder engagement, transition support and transparent revenue allocation mechanisms.

Recommendations on measures suitable for Taiwan

The study assesses three of the most suitable measures in the Taiwan context – preferential rates, carbon offsets and mitigation investment subsidies:

- **Preferential rates** offer advantages by shielding domestic industries, mitigating carbon leakage risks and enhancing political acceptability. However, deviations from a uniform carbon price can result in sub-optimal mitigation efforts and introduce complexities. Conditions attached to preferential rates should focus on emissions reduction, clean technology adoption and environmental standards. Additionally, the introduction of sunset clauses and a careful balance between the headline rate and discounts are crucial for optimising climate action and avoiding political interference.
- **Carbon credits** extend the effects of carbon pricing to previously uncovered sectors and activities and can offer vital financial support. However, maintaining high integrity requires strict regulations. It is recommended to focus on high-integrity credits with real, additional, verifiable emission reductions based on robust monitoring, reporting and verification (MRV) systems and avoid double counting. Recognising projects with transparent, sustainable co-benefits, setting caps on usage to avoid overreliance on offsets, and encouraging direct emission reduction is also key for high effectiveness.
- **Revenue recycling through mitigation investment subsidies** may distort the competitive landscape and reduce policy efficacy, necessitating careful monitoring of environmental outcomes. Best practices involve carefully targeting and support to firms in need of assistance to maintain competitiveness. The recycling of carbon pricing revenues in this way may also require a new governance structure and the relaxation of fiscal constraints on the use of tax revenues. Furthermore, transparent communication about how the revenues is used is crucial to building and maintaining public trust and support.

The choice between these measures is ultimately political. Nevertheless, our assessment suggests that the options can be loosely ranked as follows: revenue recycling via mitigation investment subsidies, preferential rates, and then carbon offsets. Beyond those previously discussed, there are several other measures that can be employed to manage opposition and enhance the acceptability of carbon pricing in Taiwan, such as recycling of carbon pricing revenues through the reduction of distortionary taxes and carbon border adjustments.

Overarching recommendations

1. **There is a strong case for simplicity**: keep the carbon fee straightforward to enhance compliance, reduce costs, and build credibility both domestically and internationally.
2. **Maintain policy stringency**: if using flexibility mechanisms like offsets, impose strict restrictions to avoid weakening decarbonisation incentives and prevent lobbying for inefficient preferential rates.
3. **Strike a balance**: ensure the measures instituted to manage opposition are not overly generous; for example, by imposing strict conditions on preferential rates.
4. **Consider international ramifications**: prioritise competitiveness risks but be mindful of the changing global policy landscape where high carbon prices are increasingly adopted.

1. Introduction

The climate emergency is compelling governments worldwide to take measures to reduce their greenhouse gas (GHG) emissions cost effectively and reach the Paris Agreement objectives. In this context, carbon pricing has emerged as a key instrument. Taiwan, in line with this commitment, enacted the Greenhouse Gas Reduction and Management Act in 2015, establishing a target of a 50% reduction in GHG emissions by 2050 relative to 2005 levels. This legislation also mandated the development of a domestic emissions trading system (ETS). However, the progress in ETS policy has been hindered by unresolved issues related to its design and potential impact.

In response, the Environmental Protection Administration (EPA) proposed the introduction of the Climate Change Response Act, also referred to as the Climate Act.[1] This legislation was passed by Taiwan's Legislative Yuan in January 2023 and became effective on 15 February 2023. It increases the ambition of Taiwan's emissions reduction target by specifying a long-term national GHG emission reduction goal of net zero emissions by 2050. The Climate Act also institutes a carbon fee system that is scheduled to start in 2024. The current strategic focus is on prioritising the implementation of the carbon fee system, with the consideration of the ETS deferred to a future date.

Core features of Taiwan's planned carbon fee system

Under the Climate Act, Taiwan's carbon fee system targets emission sources based on their direct and indirect emission levels, initially focusing on electricity and manufacturing installations with annual emissions exceeding 25,000 tonnes of CO_2e.

Scheduled to start on 1 January 2024, the carbon fee system calculates fees based on emissions in 2024, with payments due in 2025, mirroring the income tax system. This staggered introduction is designed to provide businesses with the opportunity to undertake proactive reduction measures to mitigate the financial burden associated with carbon fees.

The precise fee rates, which are critical to the system's effectiveness, will be determined in the first quarter of 2024. These rates will be decided through the careful consideration of a range of factors. Concurrently, the Ministry is actively conducting a comprehensive economic impact assessment of carbon fee collection and utilisation.

Supporting measures to mitigate the impact of the carbon fee in Taiwan include preferential rates for entities meeting designated targets; use of limited numbers of domestic and international carbon credits as offsets, with a preference for the former; and mitigation investment subsidies to promote emission reduction technologies and equipment adoption.

Possible opposition from industry and other stakeholders in Taiwan

In the process of introducing a carbon fee, it is highly likely that various stakeholders, particularly in industry, will express reservations and opposition about the implementation of the carbon fee. They may voice concerns regarding the potential ramifications of the carbon price, such as its impact on economic competitiveness, heightened operational costs and the risk of job losses. Furthermore, industries with substantial emissions, particularly the heavy manufacturing sector, might harbour reservations about their capacity to effectively transition towards low-carbon practices. In addition, stakeholders from carbon-intensive regions could raise objections stemming from their perception of disproportionate impacts on their communities. Successfully addressing and mitigating these concerns through the design and implementation of suitable measures is of paramount importance to maximise the chances of the successful implementation and durability of Taiwan's carbon fee system.

[1] In August 2023, the EPA was officially upgraded to the Ministry of Environment with the establishment of the Climate Change Administration (CCA). The CCA is designated and responsible for Taiwan's climate-related policy implementation.

Main objectives of the study

This study investigates the potential implications of introducing a carbon fee in Taiwan on its industries and formulates strategies to enhance the system's acceptance, effectiveness and sustainability. It entails an extensive review of pertinent international experiences with carbon pricing instruments (CPIs), an analysis of measures that address potential adverse impacts on industry, and the development of tailored recommendations for Taiwan.

The study first analyses CPIs and measures to respond to industry resistance in similar economies. This involves a review of the most relevant international experiences with CPIs in Section 2 and a thorough analysis of selected measures used in other jurisdictions in Section 3.

In Section 4, the study assesses potential for opposition and competitiveness risks within Taiwan's context. By examining Taiwan's carbon-intensive industries, international trade flows, vulnerable groups/regions and specific sectors, the study aims to anticipate and understand potential challenges and areas of concern.

Finally, Section 5 develops recommendations on policy options for Taiwan. These recommendations draw from academic insights, international experiences and best practices in carbon pricing. They aim to address the concerns raised by industries and stakeholders while preserving the effectiveness of the carbon fee in reducing emissions and promoting a low-carbon transition.

Box 1.1. Structure of the report

- **Section 1 introduces and contextualises the upcoming carbon fee in Taiwan.** It states the objectives of the current study.
- **Section 2 provides an overview of CPIs** by examining the CPIs of the most relevant jurisdictions.
- **Section 3 focuses on the theory and practice of measures** used to address concerns around industry competitiveness and to ensure buy-in. It provides details on the experience from the EU, the UK and Singapore.
- **Section 4 maps likely opposition to a carbon fee in Taiwan,** analysing opposition by studying carbon-intensive industries, trade flows, vulnerable groups and specific sectors in Taiwan.
- **Section 5 concludes and sets out our recommendations on measures suitable for Taiwan**.

2. Overview of carbon pricing instruments and definition of measures

Global overview and trends

According to the World Bank, as of April 2023, 73 explicit compliance CPIs (that is, either carbon taxes or emission trading systems) were in force, covering 39 national jurisdictions, one supranational jurisdiction, and 33 subnational jurisdictions. This coverage corresponds to 23% of global greenhouse gas emissions. Of all the implemented CPIs at the time of writing, 37 are carbon taxes and 36 are ETSs (World Bank, 2023). An overview of the CPIs is presented below.

CPIs were first introduced in high-income jurisdictions in the 1990s and 2000s. The first CPI established in a non-high-income jurisdiction was the Ukraine carbon tax in 2011. This was followed by others, also in the 2010s, such as the China regional ETS pilots, the Kazakhstan ETS and several carbon taxes in Latin America. The East Asia and Pacific region has implemented 16 CPIs so far, mostly in the form of ETSs. Of the 39 CPIs currently under consideration or scheduled for implementation, 10 are in this same region.[2]

Despite the increasing penetration of compliance CPIs, the price levels are not high enough, and the coverage is not sufficient, to internalise the damages caused by climate change. In 2021, the global average direct carbon price (that is, the price signal resulting from the implementation of compliance CPIs) was about US$3 per tCO2e, according to the World Bank (Agnolucci et al., 2023). Even focusing on a broader measure of the full policy-related price signal on the combustion of CO_2-emitting fuels, that is the total carbon price (TCP), which includes direct, indirect, positive and negative carbon prices in a consistent methodology, the World Bank calculates that the TCP was around US$30 per tCO_2e. In contrast, recent research by the International Monetary Fund (IMF) in 2022 suggests the global average carbon price that is likely to achieve the 2°C target is around US$80, while that for the 1.8°C scenario is US$100.[3]

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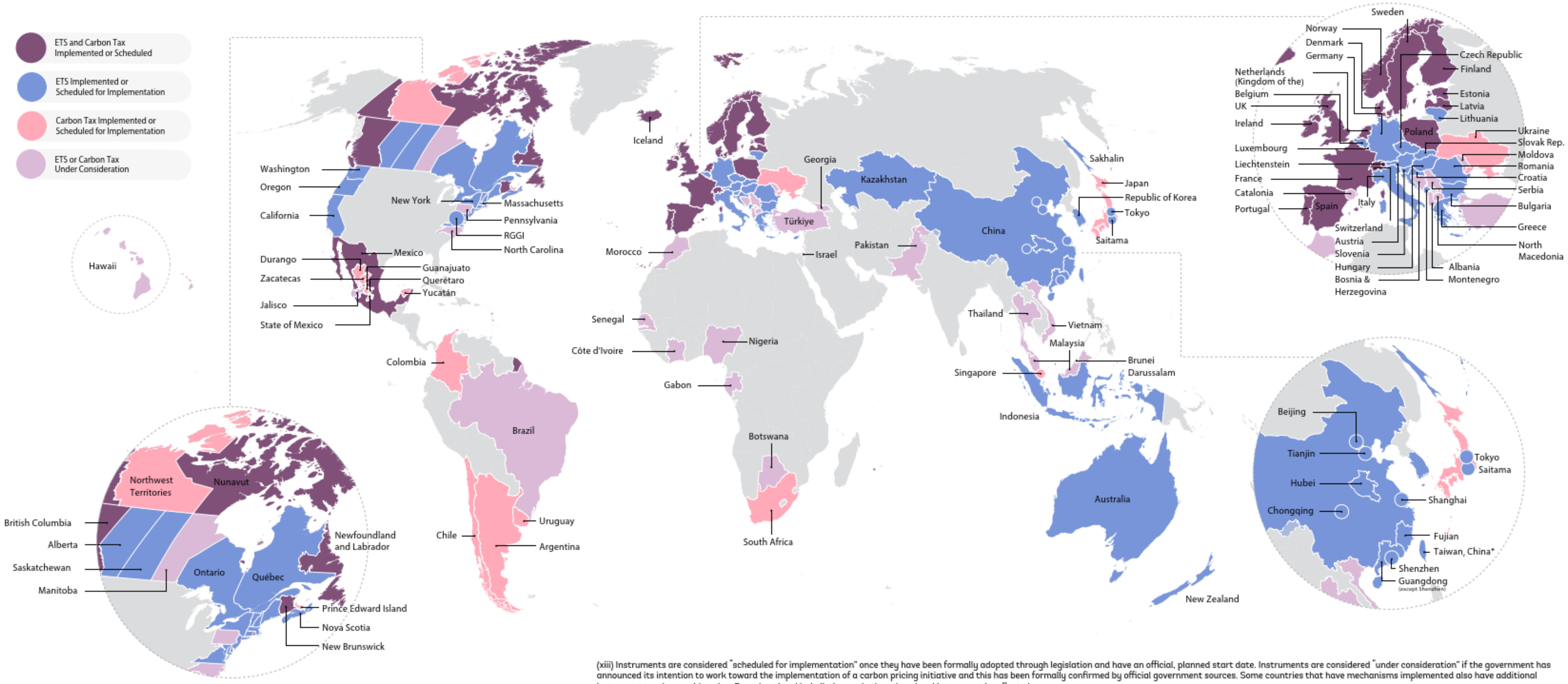
2 See: https://carbonpricingdashboard.worldbank.org/

3 See: Black et al., 2022. The Broader Notion of Social Cost of Carbon, i.e., the value that would internalise the full set of damages due to GHG emissions is in the range of US$40 to US$525 per tCO_2e depending on the discount rate, according to a recent academic review. See Tol R S J, 2023.

Figure 2.1. Map of carbon taxes and ETSs implemented as of 2023



(xiii) Instruments are considered "scheduled for implementation" once they have been formally adopted through legislation and have an official, planned start date. Instruments are considered "under consideration" if the government has announced its intention to work toward the implementation of a carbon pricing initiative and this has been formally confirmed by official government sources. Some countries that have mechanisms implemented also have additional instruments under consideration. For subnational jurisdictions only the subnational instrument is reflected.

Source: World Bank, 2023

Comparable and relevant jurisdictions with CPIs

While CPIs share the common objective of internalising the social cost of GHG emissions, their design is tailored to local circumstances and reflects the unique social, environmental and economic attributes of the jurisdiction in which they are implemented, and often include customised measures to manage the financial burden on regulated entities and address opposition. Therefore, when considering the development of a domestic CPI, it is crucial to consider the practical examples from other jurisdictions. To that end, this section provides an overview of the CPIs elsewhere and their context, while Section 3 delves deeper into measures that have been used in practice to address opposition from industry.

This study assesses the relevance of various jurisdictions' CPI implementation experiences for designing Taiwan's carbon fee in terms of i) the similarity of the economic structure of other jurisdictions to that of |Taiwan; ii) the similarity of the planned design of the Taiwan carbon fee to the instrument that these jurisdictions are implementing or planning to implement; and iii) the prominence of these jurisdictions as trade partners for Taiwan. From this assessment, this study has identified seven relevant jurisdictions: China, EU, Indonesia, Japan, Singapore, South Korea and the UK. A brief review of the CPIs implemented in these jurisdictions is presented below, and Table 2.1 provides a summary at the end of the section.

European Union

The individual member states of the European Union, and the EU itself as a supranational jurisdiction, have the longest track record of using CPIs, going back to the 1990s. At the EU supranational level, the EU ETS, which was introduced in 2005, is the only CPI currently in operation. It regulates emissions from power, industry, (intra-EU) aviation and, from 2024, maritime emissions. Coverage includes these sectors in all member states, as well as in the countries of the European Free Trade Association, Norway, Iceland and Lichtenstein. The EU ETS is linked to the Swiss ETS, which has a similar sectoral coverage.

The EU ETS is considered a "cornerstone of the EU's policy to combat climate change".[4] It is the oldest and one of the largest ETSs in the world. Recent reforms, proposed in 2021 and adopted in 2023, have strengthened the ambition of the system. These include setting a more ambitious GHG reduction target for the covered sectors by increasing the 'linear reduction factor' (that is, the amount by which the cap of the ETS decreases every year) and rebasing the cap (by reducing the cap level permanently by an agreed amount) in 2024 and 2026. The EU ETS has not permitted the use of offsets to provide compliance flexibility since the start of the fourth trading phase (2021–2030). However, it has two dedicated funds, namely the Innovation Fund and the Modernisation Fund, to support member state decarbonisation efforts in the covered sectors and to enhance the political acceptability of the instrument (see Section 5 for additional details). Most of the allowances under the cap are auctioned, but an output-based free allocation mechanism has been in use to manage the risk of carbon leakage. It will be phased out gradually as the Carbon Border Adjustment Mechanism (CBAM) is phased in over the next decade. Both the free allocation mechanism and CBAM are discussed in further detail in the next section.

Allowance prices in the EU ETS have steadily increased since 2018 from below €10 (US$10.5)[5] per tCO_2e to a maximum of around €100 (US$105.3) in early 2023, with allowances currently trading at around €85 (US$89.5). At the time of writing, 14 EU member states have also implemented additional national CPIs (12 carbon taxes, two ETSs), mostly covering fossil fuels or sectors not otherwise covered by the EU ETS. Some of these CPIs may be superseded by the new ETS covering building, road and transport sectors that the EU plans to launch in 2027 (or 2028 at the latest, depending on energy prices prevailing at the time).

4 See: https://climate.ec.europa.eu/eu-action/eu-emissions-trading-system-eu-ets_en

5 Throughout the report, values in US$ represent 2022 average exchange rates as published by the IMF's International Financial Statistics: https://data.imf.org/?sk=4c514d48-b6ba-49ed-8ab9-52b0c1a0179b&sid=1390030341854

Japan

Japan currently has a carbon tax in place at the national level as well as two subnational ETSs. The national carbon tax was introduced in 2012 and applies to CO_2 emissions from the combustion of fossil fuels across all sectors, with exemptions for certain uses of fossil fuels in the agriculture, industrial, power and transport sectors. The tax is applied upstream and set at a rate of ¥289 (US$2.2) per tCO_2e. The subnational ETSs, the Tokyo Cap-and-Trade Program and the Saitama Prefecture Target Setting ETS, are linked systems that were implemented in 2010 and 2011, respectively. Both subnational ETSs cover CO_2 from the industrial and commercial buildings sectors. The caps in both Tokyo and Saitama are aggregated bottom-up from facility-level baselines (Bureau of the Environment, Tokyo Metropolitan Government, 2010). Covered entities are freely allocated credits up to their baseline, which are calculated using historical emissions and a compliance factor. Those whose emissions fall below their baselines may keep or sell their surplus credits; those who exceed their baselines must buy additional credits to meet their surrender obligations. Facility-level targets are determined based on the type of facility and other factors such as expected energy efficiency gains. Credits in both systems are mutually exchangeable through the link.

In February 2023, the Japanese Government approved a policy roadmap setting the country on a path towards a compliance carbon market (Ministry of Economy, Trade and Industry, 2023). This roadmap includes the Green Transformation (GX) League, a voluntary baseline and credit system, in place since April 2022, which is set to transition to a mandatory ETS from 2026. Auctioning will be introduced from 2033. Separately, the Government will impose a carbon levy on fossil fuel importers from 2028, though details on scope and coverage are not yet finalised. Japan also aims to expand its Joint Crediting Mechanism,[6] a bilateral offset crediting mechanism designed to incentivise leading decarbonisation technologies and infrastructure, currently constituting 27 partner countries.

South Korea

The Korea Emissions Trading Scheme (K-ETS) came into force in 2015 as the first mandatory ETS in East Asia, covering approximately 74% of South Korea's total GHG emissions. The K-ETS regulates almost 700 of the largest emitters in the country across the buildings, domestic aviation, industrial, power, transport and waste sectors. Notably, the K-ETS also includes indirect emissions from electricity use.[7] At least 10% of Korean Allowance Units must be auctioned, while free allocation is granted to sectors that are classified as energy intensive and trade exposed, based on production cost and trade intensity benchmarks. Domestic financial intermediaries and other third parties may also participate in the carbon market.

In terms of flexibility, banking is allowed with restrictions across and within phases, and borrowing is permitted within a single trading phase. Offsets generated from domestic projects outside the scope of the K-ETS or credits converted from certified emission reductions (CERs) are called Korean Offset Credits (KOCs) and were allowed in Phase 1 (2015–2017). KOCs and international credits subject to qualitative criteria have been permitted since Phase 2, beginning in 2018. However, both must be converted to Korea Credit Units to be used for compliance (ADB, 2018).

[6] See: www.jcm.go.jp/

[7] The effectiveness of ETSs to provide a price signal in electricity markets is also conditional on how the electricity markets are designed and regulated. See Acworth et al., 2021 and Kuneman et al., 2021.

Singapore

The Singapore carbon tax was introduced in 2019 at SGD 5 (US$3.6) per tCO_2e. The 2022 addendum to the jurisdiction's Long-Term Low-Emissions Development Strategy and updated Nationally Determined Contribution have established a target to achieve 60 $MtCO_2e$ by 2030 (with a peak in emissions before that) and a net zero goal by 2050.[8] The country's goals will be achieved through four key thrusts and underpinned by the carbon tax,[9] which was reformed in 2022 so that its level increases from SGD 20 to SGD 25 (US$14.5 to US$18.1) in 2024, and then again by the same amount in 2026 to SGD 45 (US$32.6). The target of the carbon tax reform is for the instrument to reach between SDG 50 and SDG 80 (US$36.3 and US$58) by 2030. Revenues collected under the carbon tax are used to support decarbonisation efforts and the transition to a green economy, as well as to alleviate impacts on businesses and households.[10]

Together with the reforms to gradually increase the carbon tax rates, Singapore introduced a 'transition framework' for EITE sectors to give 'allowances' to a portion of their regulated emissions, to help them in their low-carbon transition and reduce the risk of carbon leakage. Moreover, Singapore introduced the option for regulated entities to offset a limited (5%) amount of their taxable emissions using high-quality carbon credits.[11] The transition framework and use of offsets is discussed in Section 3.

China

China's experience with compliance CPIs started when the National Development and Reform Commission selected seven provinces and cities to establish pilot ETSs during the Twelfth Five-Year Plan, between 2011 and 2015 (Zhang et al., 2014). These pilot systems started operating between 2013 and 2014 in cities and provinces of different economic profiles and under different sectoral coverages and designs. Using the experience from the regional pilots, the country started developing its national ETS in 2017 and launched it in 2021. According to the (OECD), the national ETS is one of several GHG emissions mitigation policies, including feed-in tariffs, subsidies on energy-saving products, trading of green certificates and a vehicle purchase tax.[12]

Currently, the national ETS is the largest compliance carbon market by coverage, covering the CO_2 emissions from the power sector, including combined Organization for Economic Co-operation and Development heat and power and captive power plants. Allowances are allocated through benchmarking, and four benchmarks exist: conventional coal plants below 300 MW, above 300 MW, unconventional coal, and natural gas. Compliance obligations are limited: gas-fired plants only need to surrender allowances up to their level of free allocation, whereas other regulated entities only have compliance obligations up to their level of free allocation, plus 20% of their verified emissions (International Carbon Action Partnership [ICAP], 2023a).

Allowance prices in the China national ETS have fluctuated between ca. CNY 40 and CNY 76 (US$5.9 and US$11.3) per tCO_2, with the higher prices only being observed in the second half of 2023.[13] Under the national ETS, up to 5% of the compliance obligation of a regulated entity may be covered using offsets from the Chinese Certified Emission Reduction Scheme, which was suspended in 2017 but is in the process of being relaunched.[14] It is expected that the relaunched scheme will focus on credits from renewables, forestry and methane reduction, and have more comprehensive verification and certification processes.[15]

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8 See: www.nccs.gov.sg/singapores-climate-action/singapores-climate-targets/overview/

9 See: www.nccs.gov.sg/singapores-climate-action/mitigation-efforts/overview/

10 See: www.nea.gov.sg/our-services/climate-change-energy-efficiency/climate-change/carbon-tax

11 See: www.nccs.gov.sg/singapores-climate-action/mitigation-efforts/carbontax/

12 See: https://oecd-main.shinyapps.io/pinedatabase/

13 See: https://icapcarbonaction.com/en/ets-prices

14 Liqiang, H. China Closer to Relaunch of Certified Carbon Emission Reduction Program. (2023) www.chinadaily.com.cn/a/202310/25/WS6538bf9ca31090682a5eaaa9.html

15 See: https://asiahouse.org/research_posts/chinas-voluntary-carbon-market-set-to-relaunch-as-registration-begins/

United Kingdom

Currently, two compliance CPIs operate in the UK: the carbon price support mechanism (CPS), which targets emission reductions from the power sector; and the UK ETS, which focuses on emission reductions from the power, industry and domestic aviation sectors. Together, they introduce a carbon price floor for the power sector. In addition, the UK has a tax on electricity and fossil fuels that does not explicitly depend on their carbon intensity or content. This tax is known as the Climate Change Levy (CCL). This section provides a high-level overview of the CPS and the UK ETS, while the CCL is covered in greater detail in the next section.

The **carbon price floor** was first introduced in the UK Coalition Government Budget 2011 when the UK was still part of the EU ETS and the price for EU ETS allowances was consistently low at around €5 (US$5.3) per tCO_2e. It imposes a carbon cost on fuels used to generate electricity and was introduced to guarantee a minimum carbon price to drive low-carbon investment (Hirst, 2018). The CPF sets a target carbon price per year. The CPF started at £9 (US$11.1) per tCO_2e in 2013 and increased to £18 (US$22.2) where it has been frozen since the Spring Budget 2015.[16] It has two components: the price for ETS allowances and the CPS rates.[17] If the allowance price is below the CPF, then the difference becomes the CPS rate and covered entities must pay both the allowance and the CPS prices so that the total carbon price is equivalent to the CPF. If the allowance price is above the CPF rate, then the CPS rate equals the CPF rate, and regulated entities pay both the allowance price and the CPS rate, so that the total carbon price paid is the sum of the allowance price and CPF target rate. Given the liberalised wholesale power market in the UK, producers are then able to pass these costs on and transmit the carbon price signal down the value chain towards end users.

The **UK ETS** started operating in 2021, when the UK ended its participation in the EU ETS, which corresponded with the end of the EU ETS's third trading period. It covers the power, industry and domestic aviation sectors, representing around a quarter of the UK's territorial emissions. In 2026 and 2028, respectively, the system will expand to include domestic maritime transport and waste. Reforms announced in mid-2023 strengthen the cap from 2024 to make it consistent with the UK's 2050 net zero goal. The scheme plans to incorporate removals and phase out free allocation for aviation in 2026.[18] Currently, the UK ETS does not allow for the use of offset credits for compliance. While the allowances traded at £90 (US$110.9)[19] at their peak, they currently stand at around £45 (US$55.5).[20]

16 Ibid.

17 The reference allowance price was that of an EUA until UK ended its participation in the EU ETS in 2021. Thereafter, the reference price has been the UKA.

18 See: https://icapcarbonaction.com/en/news/uk-announces-reforms-align-ets-net-zero-target

19 See: https://icapcarbonaction.com/en/ets-prices

20 See: https://ember-climate.org/data/data-tools/carbon-price-viewer/

Indonesia

After a pilot system was implemented in 2021 covering 75% of power sector emissions and averaging a carbon price of US$2 per tCO_2, Indonesia announced the launch of its mandatory, intensity-based ETS for the power generation sector in February 2023. The Indonesia ETS covers facilities with a production capacity exceeding 100 MW, with the possibility of smaller coal and fossil fuel plants also being included in the future. The system initially applies to 99 coal-fired power plants, constituting 81.4% of the country's total power generation capacity. These facilities belong primarily to the state-owned electricity company Perusahaan Listrik Negara (PLN). The Government defines intensity targets to determine the allocation of allowances for each facility based on their electricity generation per MWh. Unlimited offsetting is allowed. The ETS will be implemented in three phases; the first from 2023–2024 covers only coal-fired power plants. Coverage may be extended to oil and gas-fired power plants, other coal-fired power plants not connected to PLN's grid and other sectors from the second phase (2025–2027) onwards.

The new ETS will eventually work as a hybrid 'cap-tax-and-trade' system alongside a carbon tax that was announced in 2021. Facilities that do not meet their obligations under the ETS will be subject to the tax, the rate of which will eventually be linked to the price of the domestic carbon market. Initially to be introduced in April 2022, the carbon tax has now been postponed likely until at least 2025.

As the diverse examples of compliance CPI from comparable and relevant jurisdictions reviewed above demonstrate, each instrument reflects the unique national circumstances and objectives of their governments. A critical component of any CPI design is how it anticipates and responds to the political economy challenges from vested interests, as well as citizen and business groups that may be adversely affected. Left unaddressed, these challenges may undermine the instrument. The next section focuses on this issue by first characterising the different measures available to governments in theory, and then by describing the measures adopted by the governments of the EU, Singapore and the UK in practice.

Table 2.1. Key characteristics of CPIs in selected jurisdictions

Jurisdiction	CPI	Year (start)	Sectoral coverage	GHG/fuel coverage	Price level (2022 average)[21]	Price/cap trajectory	Are offsets allowed?
EU22	EU ETS	2005	Power, industry, domestic aviation, domestic shipping (from 2024)	CO_2, N_2O, PFCs	€79 (US$83.2)	Cap with linear reduction factor: 2.2% (until 2023); 4.3% (2024–2027); 4.4% (2028–2030).	No
Japan	Japan carbon tax	2012	Fossil fuels (some uses exempt)	Fossil fuels (some uses exempt)	¥289 (US$2.2)	NA	No
	Tokyo C&T	2010	Industrial and commercial buildings	CO_2	¥650 (US$4.9)	Not determined beyond current period. Each compliance period has had a more ambitious reduction target.	Yes
	Saitama ETS	2011	Industrial and commercial buildings	CO_2	¥144 (US$1.1)	Not determined beyond current period. Each compliance period has had a more ambitious reduction target.	Yes
South Korea	South Korea ETS	2015	Aviation, buildings, domestic transport, industry, power, waste	CO_2, N_2O, PFCs, HFCs, SF_6	KRW 23,243 (US$18)	Not determined beyond current period. To date, each new phase has involved a more ambitious cap.	Up to 5% of compliance obligation
Singapore	Singapore carbon tax	2019	Manufacturing, power, sewage and waste management, and water supply	CO_2, N_2O, PFCs, HFCs, SF_6	SGD 5 (US$3.6)	Price increasing to between SDG 50 and SDG 80 by 2030.	Up to 5% of compliance obligation
China[23]	China national ETS	2021	Power	CO_2	CNY 55 (US$8.2)	N.A. The system is expected to increase in scope over time.	Up to 5% of compliance obligation

[21] Data on the price of ETS allowances not otherwise specified in the text above comes from the ICAP allowance price explorer: https://icapcarbonaction.com/en/ets-prices and ICAP, 2023a

[22] Several member states have also implemented their own CPIs at the national level.

[23] Several provinces and cities in China have their domestic ETSs covering different sectors.

Jurisdiction	CPI	Year (start)	Sectoral coverage	GHG/fuel coverage	Price level (2022 average)[21]	Price/cap trajectory	Are offsets allowed?
UK	UK CCL[24]	2013	Electricity and some fossil fuels	Electricity and some fossil fuels	Varies for each taxable commodity	Rates have tended to increase over time.	No
	UK CPF	2013	Power	CO_2	£18 (US$22.2)	No further rate increases have been announced.	No
	UK ETS	2021	Power, industry, domestic aviation, domestic shipping (from 2024)	CO_2, N_2O, PFCs	£75 (US$92.4)	The cap is consistent with the country's net zero strategy.	No
Indonesia	Indonesia ETS	2023	Power	CO_2	NA (pilot prices at around US$2)		Yes

Source: authors

[24] Strictly speaking, the UK Climate Change Levy is not a CPI, but rather an environmental tax on electricity and on other taxable commodities including natural gas, liquified petroleum gas, coal and lignite, as well as related fuels. See below for more details.

3. Existing and planned measures relevant for Taiwan

CPIs internalise the damages from GHG emissions and by doing so raise the cost of carbon-intensive goods and services relative to alternatives. Many of these goods (for example, cement and steel) and services (such as heating and transportation) are indispensable to the functioning of a modern economy and critical for the wellbeing of citizens. Moreover, the low-carbon alternatives may not be readily available, and, where they are, the transition to them may require significant upfront public and private investment and take time. If the design of the CPI does not anticipate it, resistance from adversely impacted industries and citizens could undermine the effectiveness of the instrument, and in extreme cases may lead to its demise.

Consequently, jurisdictions that have implemented a CPI, or are considering it, take the potential resistance from industry seriously and have developed measures to respond to it. Box 3.1 offers a high-level taxonomy of support measures for industry that are available to jurisdictions.

Box 3.1. Taxonomy of support measures for industry

Suppose a jurisdiction imposes a carbon price on a well-defined set of GHG emissions using a carbon tax or an ETS and allocates revenues collected, if any, to the general budget. Depending on the jurisdiction's overall objectives for the CPI, the instrument may exclude some entities, sectors, activities, gases or fuels by design. For example, an ETS whose objective is to reduce power sector CO_2 emissions of coal plants necessarily omits combustion and process emissions from industry, emissions from natural gas power plants and methane emissions from pipelines.

For illustration, this box takes the overall objectives of the jurisdiction for its CPI as the starting point and considers measures that implement deviations from that starting point to mitigate the potential adverse impacts of the carbon price on industry. These measures typically modify the covered entities, sectors, activities, fuels and use of revenue collected, and are grouped according to the following taxonomy:

1) Measures to limit total compliance cost **by restricting the quantity** of emissions to which the carbon price applies. These include:
   a. Exemptions that further restrict the scope of covered emitters (such as by excluding small emitters) or activities (for example, by excluding process emissions).
   b. Free allocations in an ETS (for instance, free allocations based on historical emissions or output benchmarks).
   c. Tax-free emissions under a carbon tax (for example, first 25 kt of emissions per regulated entity are not taxed).
   d. Capping emissions subject to carbon price at a certain level (e.g. carbon price only applies up to twice the magnitude of last year's emissions).
   e. Permitting the use of authorised offsets.
2) Measures to reduce the total compliance cost **by charging a discounted carbon price**. These typically differ between carbon taxes and ETS as follows:
   a. A lower carbon tax rate to emissions of entities meeting certain conditions.
   b. A lower carbon tax rate to specific fuels.
   c. A price ceiling on the price of allowances in an ETS.
3) Measures to promote the adoption of low-carbon technologies **by using the revenue collected** (if any) to the benefit of regulated entities. These include:
   a. Earmarking revenues to incentivise the R&D and rapid diffusion of such technologies.
   b. Offering tax credits to entities that adopt such technologies.

4) Measures to level the (carbon) playing field **by adjusting the cost of embedded carbon at the border**. These include:

    a. Imposing a carbon price on the carbon content of imports.

    b. Rebating the carbon price paid to exporters.

    c. International cooperation with main trade partners to align carbon prices by linking ETSs and/or harmonising carbon taxes.

An appendix table offers a few examples of measures from various CPIs in force.

The rest of this section provides details on three measures that are of relevance for Taiwan.

Case 1: Climate Change Agreements in the UK Climate Change Levy context

Climate Change Levy

Introduced in 2001, the UK Climate Change Levy is an environmental tax on electricity and other taxable commodities including natural gas, liquified petroleum gas (LPG), and coal and lignite, as well as related fuels.[25] Its objective is to increase the energy efficiency of businesses and contribute to GHG emission reductions. CCL was originally introduced as a revenue-neutral tax by reducing employers' national insurance contributions.[26]

The levy rate varies for each taxable commodity. During the UK fiscal year covering April 2023 to March 2024, the CCL rates are £0.00775 (US$0.00955) per kWh for electricity; £0.00672 (US$0.00828) per kWh for natural gas; £0.02175 (US$0.02681) per kg of LPG; and £0.06064 (US$0.07474) per kg of other taxable commodities. An important implication of applying the levy per energy content or weight of different taxable commodities is that different carbon prices apply to different taxable commodities.[27] Strictly speaking, the CCL is not a direct carbon price but rather a set of indirect carbon prices (World Bank, 2023) and is not included in the World Bank's Carbon Pricing Dashboard.

CCL does not apply to electricity and heat producers; however, these producers must pay the carbon price support rate and also purchase and surrender allowances against their verified emissions under the UK ETS. Other significant exemptions from the CCL include charities, domestic consumers, exports and small users.[28] Finally, businesses have the option of entering into an agreement with the Government to qualify for reduced rates as described below.

Climate Change Agreements

Energy-intensive businesses can pay reduced rates on the CCL (a reduction of between 77% and 92%) if they enter into a voluntary Climate Change Agreement (CCA) with the Environment Agency.[29] Before entering into a CCA, UK industry sectors negotiated with the then UK Department of Energy and Climate Change to determine energy efficiency targets for their sectors. [30] These targets were then formalised in 'umbrella agreements' between sector associations and the Environment Agency. After umbrella agreements are established, individual operators can enter into an 'underlying agreement' that specifies the efficiency targets that the operator must comply with. Efficiency targets of the underlying agreement are derived from the targets of the umbrella agreements. The formalisation of a sectoral umbrella agreement is a prerequisite for the formalisation of an underlying agreement, as underlying agreements are managed by the corresponding sector association.

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25 These include any other hydrocarbon gas in a liquified state and coke, semi-coke and petroleum coke. For additional details, see: www.gov.uk/guidance/register-for-climate-change-levy#tax-com

26 For additional information on the political economy context of the CCL, see Seely, 2009.

27 Using the UK Government's conversion factors for 2023, these CCL rates for 2023 imply a carbon price per tCO_2e of approximately £37 (US$45.6) for electricity, £33 (US$40.7) for gas, and £22 (US$27.1) for industrial coal. The conversion factors are available at: www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2023

28 A full list of exemptions and excluded supplies can be found at: www.gov.uk/guidance/exemptions-from-climate-change-levy

29 See: www.gov.uk/green-taxes-and-reliefs/print

30 In various rounds of departmental reorganisation in the UK, the Department of Energy and Climate Change was succeeded by the Department of Business, Energy and Industrial Strategy, and more recently by the Department of Energy Security and Net Zero (DESNZ).

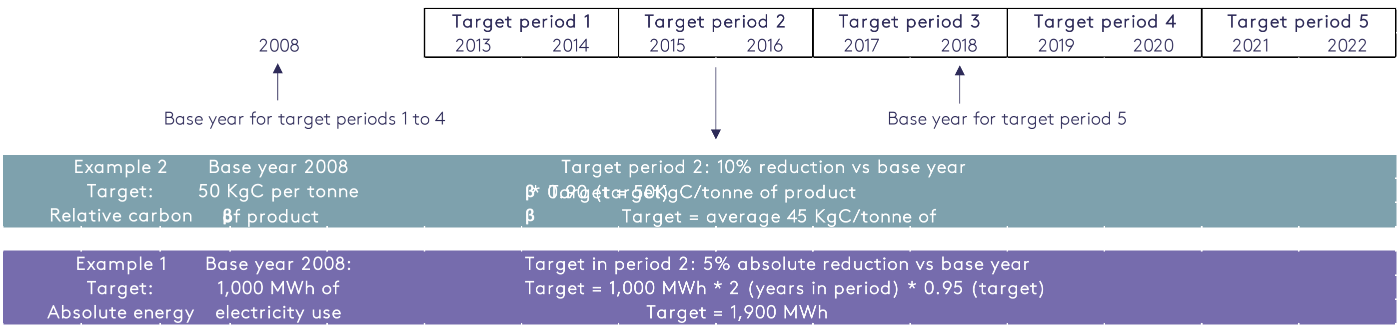
Sector commitments for the first four target periods were agreed in 2012 and the fifth in 2020 (Environment Agency, 2022). In 2023, the government decided to extend the scheme until the end of 2024,[31] and it is currently considering different options to reform the scheme (DESNZ, 2023). As of September 2023, there were 53 umbrella agreements under the scheme covering a wide range of sectors including aluminium, cement, semi-conductors and steel, among others.[32]

CCA targets

CCA targets can be expressed in terms of energy or carbon emissions. They can also be stated in relative terms (per unit of activity) or absolute terms. As such, four types of targets can be set. Underlying agreements must contain targets of the same type as those defined by the sector commitments in the umbrella agreements (either carbon or energy) but may differ on whether they are expressed in absolute or relative terms. [33]

Efficiency targets are relative to a 'base year' in which operators measure their baseline performance. Targets are set for biennial 'target periods' running from 1 January of a year until 31 December of the year after. Of the five existing target periods, the base year for target periods 1 to 4 (covering the years from 2013 to 2020) is typically 2008, whereas the base year for target period 5 (covering years from 2021 to 2022) is typically 2018 (see Figure 3.1). [34] For example, if the base year for target period 2 is 2008 and the target for target period 2 is a 5% reduction of absolute energy emissions, this means that absolute average energy consumption in 2015–2016 for that unit should be 5% below what they were in 2008 (see example 1 below). Meeting the target for a target period means that the operator may continue to pay the discounted CCL rates.[35]

Figure 3.1. Example of the functioning of the CCAs under the UK Climate Change Levy[36]



Source: authors

[31] See: www.gov.uk/government/publications/spring-budget-2023/spring-budget-2023-html#policy-decisions

[32] See: www.gov.uk/guidance/climate-change-agreements--2

[33] See Environment Agency (2022: 29–30) for details.

[34] Ibid.: 29–30.

[35] See: www.gov.uk/guidance/climate-change-agreements--2

[36] Example does not include the "Ratio relative (Novem) target", used " when a target unit produces two or more products that have very different energy intensities of production or whose throughput is measured in very different units (for example, m 2 and litres). The target is stated as a ratio of the target energy consumption to the reference energy. This is the energy that would have been consumed in the base year for the same level of throughput and product mix as the target period. The Novem method corrects any distortions created by a changing mix of throughput by generating one common output". See Environment Agency (2022: 30) for details.

Compliance flexibility and penalties

Before target period 5, the overachievement of the target in a given target period was recorded (in tonnes of CO_2e equivalent, tCO_2e) and was counted towards the achievement of the target in future compliance periods if an operator did not directly meet its target. Overachievement of previous targets cannot be used in the fifth target period.[37]

An operator not meeting its target may alternatively use a 'buy-out' mechanism to show progress towards achieving its target and continue to benefit from the reduced CCL rates. In the buy-out mechanism, the underperformance is translated into tonnes of CO_2e equivalent (tCO_2e) and paid at a fee per tCO_2e specific to the target period. In the fifth target period, the buy-out fee is set at £18 (US$22.2) per t$CO_2$e. Failing to pay the buy-out fee means that the operator is decertified and cannot benefit from paying the discounted CCL rates. Fees may be imposed if operators fail to report data needed to assess achievement of the targets by the corresponding deadline; if they don't provide additional information that has been requested; if they provide inaccurate information; or if they do not report relevant changes that would affect the CCA.[38]

Case 2: Free allocations and CBAM in the EU ETS context

Free allocation in Phase IV of the EU ETS

Approximately 57% of the allowances within the EU ETS are allocated via auctioning, while the remaining portion is distributed freely using benchmarking and targeting stationary industrial sources.[39] In the EU ETS, the allocation process is dependent on data linked to the sub-installation level, and the computation for free allocation spans five-year periods, incorporating data from the preceding five years before the allocation occurs. To qualify for free allocation, operators of installations are required to submit an application that includes: a) a verified report of baseline data at the installation and sub-installation level; b) a plan outlining the monitoring methodology that served as the foundation for the baseline data report; and c) a verification report concerning the baseline data report.[40]

For installations that aren't electricity generators, free allocation is calculated as the product of:

- Historical Activity Levels (HAL): defined as the arithmetic mean of annual production in the baseline period.
- Benchmarks applicable to the product.
- Applicable carbon leakage exposure factor.
- A cross-sectoral correction factor (CSCF): when the aggregate amount of allowances to be allocated for free exceeds the budget of allowances available for free allocation (Directorate-General Climate Action of the European Commission, 2019).[41]

Changes in production output have an impact on installations' allocation when: i) the change (increases or decreases) are more than 15% of the production level of the installations, as determined when comparing a rolling two-year activity average with HAL; and ii) the changes amount to at least 100 allowances in total.[42] If this is the case, then the two-year average activity level is used to calculate free allocation instead of HAL. This calculation is done before the application of other applicable correction factors (that is preliminary allocation). Allowances to make this adjustment are taken from the New Entrants Reserve (NER) and returned to the NER or, in some cases, to the Market Stability Reserve.[43]

37 See: Managing your climate change agreement (CCA) – www.gov.uk

38 See: www.gov.uk/guidance/managing-your-climate-change-agreement-cca

39 The vast majority of EU electricity producers have not received free allocations since 2013 with the few exceptions in low-income EU member states that are in the process of modernising their respective energy sectors. For further details on free allocations to industrial sectors, see: https://climate.ec.europa.eu/eu-action/eu-emissions-trading-system-eu-ets/free-allocation/allocation-industrial-installations_en

40 See: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32019R0331

41 For new entrants, and for electricity generators in years where no CSCF applies, a linear correction factor, LCF, applies to reduce free allocation over time.

42 See: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A02019R1842-20220619

43 See Article 10a in the EU ETS directive: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A02003L0087-20230605

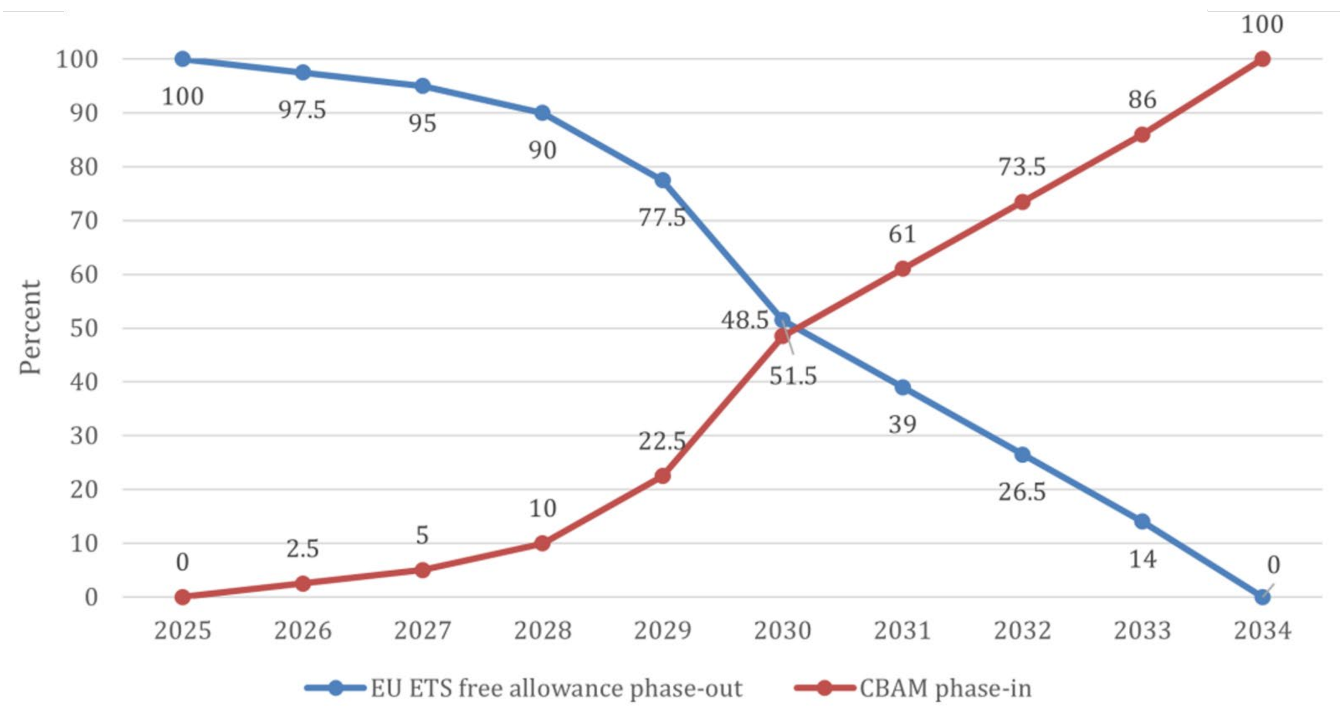
Benchmarks are calculated for individual products, intending to incentivise reductions in greenhouse gas emissions and encourage energy efficiency. These are established based on the average performance of the most efficient 10% of installations for each sector; and from Phase 4 onwards, they are progressively reduced to reflect technological advancements.[44] Moreover, the CSCF guarantees that the overall quantity designated for free allocation does not surpass the available allowances under the cap. Also, free allocation is set to be gradually phased out, mirroring the gradual phase in of the Carbon Border Adjustment Mechanism (see below).

The EU ETS CBAM

In 2021, the European Commission proposed the 'Fit for 55' package as a set of proposals to reform EU legislation to reduce the EU's GHG emissions by 55% by 2030. These proposals included the implementation of CBAM, which will put a price on embedded emissions of carbon-intensive imports (starting with aluminium, cement, electricity, fertilisers, hydrogen production, and iron and steel) to prevent carbon leakage, level the playing field for producers in different countries, and provide an incentive for other jurisdictions to adopt a carbon price.

Under the CBAM rules, any imports of the covered products need to declare their direct and indirect embedded emissions. Failing to do so will trigger pre-defined and typically punitive emission factors for the calculation of embedded emissions. The importers must buy and surrender 'CBAM certificates' against these emissions with the price of certificates calculated based on the recent weekly average auction value of EU ETS allowances, in €/tCO_2e. If the importers can prove that a carbon price under a domestic compliance ETS or carbon tax has been paid in the jurisdiction of origin of the imported good, the corresponding nominal amount will be deducted from the obligation to be paid to acquire CBAM certificates.[45] In other words, CBAM is intended to replicate the carbon price signal in the EU ETS for non-EU producers that export to the EU. It will run in parallel to the gradual phase out of free allocations under the EU ETS. Figure 3.2, by the ICAP Secretariat, illustrates how these two processes will be coordinated by mapping the respective phase-out and phase-in trajectories of free allocations and CBAM.[46]

Figure 3.2. EU ETS free allowances phase-out and CBAM phase-in



Source: ICAP, 2023b

[44] See: https://climate.ec.europa.eu/eu-action/eu-emissions-trading-system-eu-ets/free-allocation/allocation-industrial-installations_en

[45] See: https://taxation-customs.ec.europa.eu/green-taxation-0/carbon-border-adjustment-mechanism_en

[46] See: https://icapcarbonaction.com/en/news/eu-adopts-landmark-ets-reforms-and-new-policies-meet-2030-target

From October 2023 until the end of 2025, CBAM is operating in a 'transitional phase' in which EU-based importers of covered goods will have to report the embedded emissions of these imports but without having to buy any CBAM certificates. This transition period is intended to give regulated entities time to prepare for their compliance obligations while testing and refining the methodology before the financial liabilities are imposed.[47] The first reporting period for importers ends on 31 January 2024.[48]

Until the end of 2024, companies may calculate embedded emissions using one of three different options: full reporting according to the EU method; using an equivalent method; or using default reference values. The use of default reference values will only be permitted until July 2024. Starting in 2025, only the EU method will be accepted. After this date, estimates may only be used for complex goods and when the estimates represent less than 20% of the embedded emissions. The EU has published guidance documents for EU-based importers and for installation operators outside the EU.[49]

CBAM will be reviewed before the entry into force of the definitive system. The EU may also consider the incorporation of additional products, currently covered by the EU ETS, into the scheme. This assessment will incorporate a timetable for inclusion by 2030.

Case 3: Frameworks for Transition and International Carbon Credits in the Singapore carbon tax

The Singapore carbon tax was introduced in 2019 at a rate of SGD 5 (US$3.6) per tCO_2e. It covers industrial 'business facilities' with annual direct GHG emissions of at least 25,000 tCO_2e within the manufacturing, power, sewage and waste management, and water supply sectors. An MRV system is in place to identify the tax liability of regulated entities. As discussed in Section 2, the increase of the tax rate to SGD 25 (US$18.1) in 2024 will be accompanied by the introduction of two measures to facilitate compliance with the mechanism: the transition framework for EITE sectors and the International Carbon Credit Framework. There is an additional programme in place to support the purchase of energy efficient appliances by households. The Government does not expect to receive new income from the tax but instead will use the revenue collected to support decarbonisation and the transition to a green economy.[50]

Transition framework for emissions-intensive trade-exposed sectors

The transition framework for EITE sectors of the Singapore carbon tax will start in 2024 and seeks to provide temporary and partial alleviation to these sectors to transition to a low-carbon economy and avoid carbon leakage.[51] Under this framework, eligible sectors will be given allowances for a portion of their emissions. Allowances will exempt businesses from the payment of the tax for the emissions that the allowances cover.

The number of allowances that an entity will receive will be based on their performance against 'internationally recognised' efficiency standards or on facilities' decarbonisation plans. This amount will be reviewed regularly.[52] The details of the transition framework have not been made public yet, but the framework is meant to be similar to the benchmarking mechanisms under the ETSs of California, the EU and South Korea.

[47] See: ICAP. EU Carbon Border Adjustment Mechanism (CBAM) Takes Effect with Transitional Phase. (2023). https://icapcarbonaction.com/en/news/eu-carbon-border-adjustment-mechanism-cbam-takes-effect-transitional-phase

[48] See: https://taxation-customs.ec.europa.eu/carbon-border-adjustment-mechanism_en#guidance

[49] Ibid.

[50] See: www.nea.gov.sg/our-services/climate-change-energy-efficiency/climate-change/carbon-tax

[51] Ibid.

[52] Ibid.

International Carbon Credit Framework

Also starting in 2024, the International Carbon Credit (ICC) Framework will allow companies to offset up to 5% of their taxable emissions with the use of high-quality international carbon offsets. The ICC Framework is set to be aligned with Article 6 of the Paris Agreement. As such, under the ICC Framework, certified emissions reductions or removals need to have occurred between 2021 and 2030 and meet seven eligibility criteria: not double-counted, additional, real, quantified and verified, permanent, resulting in no net harm, and resulting in no leakage. The National Environment Agency is tasked with determining which ICCs adhere to the criteria, including releasing a list of eligible countries, carbon credit programmes and methodologies.[53]

ICCs may be sourced from countries with which Singapore has signed 'Implementation Agreements' that set out the requirements and processes to be compliant with the cooperation mechanisms under Article 6 of the Paris Agreement. Singapore has concluded negotiations on Implementation Agreements with Ghana and Vietnam and has signed Memoranda of Understanding with other host countries to work towards Implementation Agreements. Moreover, Singapore is developing a national ICC registry to account and track surrendered units under the carbon tax and is working with five carbon credit programmes, including American Carbon Registry, Gold Standard and Verified Carbon Standard, so that ICCs issued under these programmes and surrendered for compliance under the carbon tax mechanism are "robustly validated, verified, issued and retired". Singapore is also working with the World Bank and the International Emissions Trading Association on the Climate Action Data Trust Initiative, which was launched in December 2023 and provides access to information on carbon credits issued across different registries.[54]

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53 See: www.nea.gov.sg/media/news/news/index/singapore-sets-out-eligibility-criteria-for-international-carbon-credits-under-the-carbon-tax-regime

54 For more details, see: https://climateactiondata.org/about/

4. Mapping possible opposition to a carbon fee in Taiwan

Opposition to the implementation of CPIs may be expected from both the industrial sectors and population groups that will be impacted the most. While this report acknowledges that the increase in prices of carbon-intensive goods caused by the carbon fee could have significant negative effects on various citizen groups, especially vulnerable and low-income individuals, its main focus is on the industrial sectors. These are sectors that typically emit the most GHGs, in absolute terms or per unit of value added. Among these, particular attention should be given to the largest sectors (by employment, by contribution to gross added value or by trade), as well as to geographical regions that may be disproportionally affected by the introduction of the carbon fee.

Manufacturing sector in Taiwan

Taiwan is an advanced economy, within which the services sector constitutes around 58% of the jurisdiction's GDP, industry accounts for around 40%, and agriculture makes up the remainder.[55] Manufacturing activities in Taiwan are dominated by the electronic parts and components subsector, representing 45% of the total gross manufacturing value added (GVA) in 2021. This is followed by the computers, electronic and optical products subsector (10%), basic metals (6%), and chemical materials (6%). The computers, electronic and optical products and the electronic parts and components subsectors also have the highest share of exports as a percentage of demand, with 64% and 58%, respectively. The electronics parts and components subsector is the largest employer in manufacturing, representing 23% of manufacturing employees in 2021. Fabricated metal products, machinery and equipment and computers, and electronic and optical products follow, with 12%, 8%, and 8%, respectively. Table 4.1 presents key economic indicators of the industries in the manufacturing sector with 2021 data.

Table 4.1. Key economic indicators of manufacturing sub sectors in Taiwan in 2021

Manufacturing subsector	*GVA (bn TWD)*	*Persons employed*	*GVA per person (m TWD)*	*Annual growth rate*	*Export as % of demand*	*Import as % of supply*	*Electricity as % of costs*
Mining and quarrying	12.08	3,416	3.54	1.96	3.29%	93.75%	1.7%
Food products and prepared animal feeds	167.42	133,573	1.25	4.55	5.92%	14.74%	1.7%
Beverages and tobacco products	111.34	15,876	7.01	0.47	5.72%	11.34%	3.1%
Textiles	92.37	93,743	0.99	14.64	38.00%	12.86%	3.8%
Wearing apparel and clothing accessories	35.37	35,304	1.00	7.79	30.32%	21.39%	1.1%
Leather, fur and related products	18.98	19,279	0.98	6.56	15.39%	32.79%	1.8%
Wood and of products of wood and bamboo	15.10	16,337	0.92	18.72	2.99%	27.00%	1.9%

[55] Gross Domestic Product by Kind of Activity (Chained 2016 Dollars) from Taiwan's National Accounts 2022, National Statistics https://nstatdb.dgbas.gov.tw/dgbasall/webMain.aspx?k=engmain

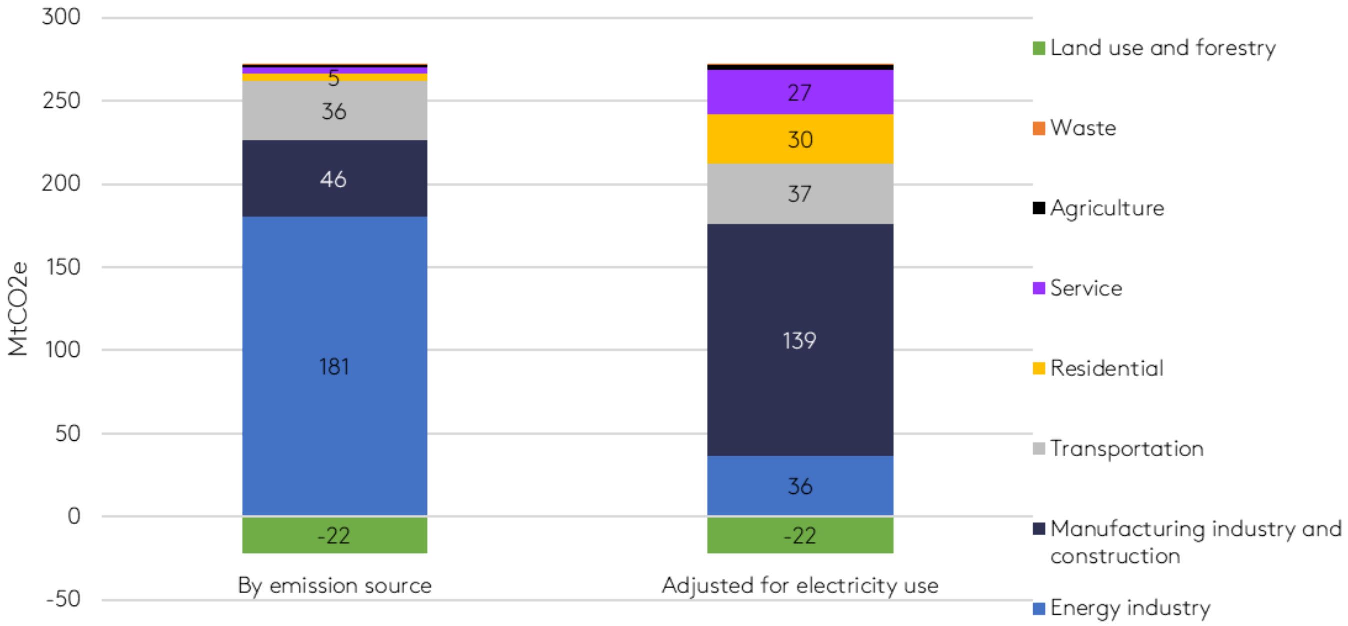
Manufacturing subsector	*GVA (bn TWD)*	*Persons employed*	*GVA per person (m TWD)*	*Annual growth rate*	*Export as % of demand*	*Import as % of supply*	*Electricity as % of costs*
Paper and paper products	75.03	50,940	1.47	11.79	11.21%	17.53%	4.3%
Printing and reproduction of recorded media	43.74	54,793	0.80	1.44	3.79%	3.12%	3.2%
Petroleum and coal products	140.50	11,543	12.17	32.78	21.34%	24.99%	5.5%
Chemical materials	**423.55**	**67,047**	**6.32**	**36.88**	**32.94%**	**23.09%**	**5.4%**
Other chemical products	88.89	53,090	1.67	9.32	17.04%	33.04%	2.8%
Pharmaceuticals and medicinal chemical products	63.12	33,794	1.87	3.89	7.19%	30.11%	1.6%
Rubber products	43.84	39,473	1.11	4.33	32.64%	16.11%	3.9%
Plastics products	163.96	137,494	1.19	8.38	31.15%	19.72%	4.0%
Other non-metallic mineral products	134.29	71,003	1.89	5.70	9.77%	20.45%	**7.5%**
Basic metals	**433.31**	**111,675**	**3.88**	**41.93**	**18.20%**	**24.33%**	**2.5%**
Fabricated metal products	372.60	**350,657**	1.06	19.44	33.55%	13.17%	2.4%
Electronic parts and components	**3304.02**	**642,527**	**5.14**	**19.21**	**58.00%**	**25.06%**	**3.3%**
Computers, electronic and optical products	**753.65**	**232,525**	**3.24**	**9.21**	**64.19%**	**26.12%**	**0.5%**
Electrical equipment	184.81	125,398	1.47	13.66	29.83%	30.14%	0.9%
Machinery and equipment	302.11	235,461	1.28	18.27	28.58%	43.22%	1.1%
Motor vehicles and parts	145.32	83,651	1.74	11.44	20.88%	24.91%	1.3%
Other transport equipment and parts	122.69	77,100	1.59	10.14	38.38%	24.81%	0.7%
Furniture	25.26	30,662	0.82	11.73	37.00%	16.14%	1.1%
Other manufacturing	143.98	89,422	1.61	9.21	30.18%	17.53%	1.6%

Source: Industry and Service Census, Principal Figures from National Accounts, input output tables

GHG emissions profile in Taiwan

At the aggregate level, activities related to the energy industry, manufacturing industry and construction, and transport sectors accounted for 96% of gross GHG emissions (excluding land use and forestry) in 2020 (See Figure 4.1). Energy industry emissions represented the majority (66% of GHG emissions), followed by manufacturing industry and construction (17%) and transportation (13%). Adjusted for electricity use, manufacturing industry and construction represented 51% of gross GHG emissions in the same year, with both the transport and the energy industry sectors following, with 13% of emissions each.

Figure 4.1. GHG emissions in Taiwan by inventory sector in 2020

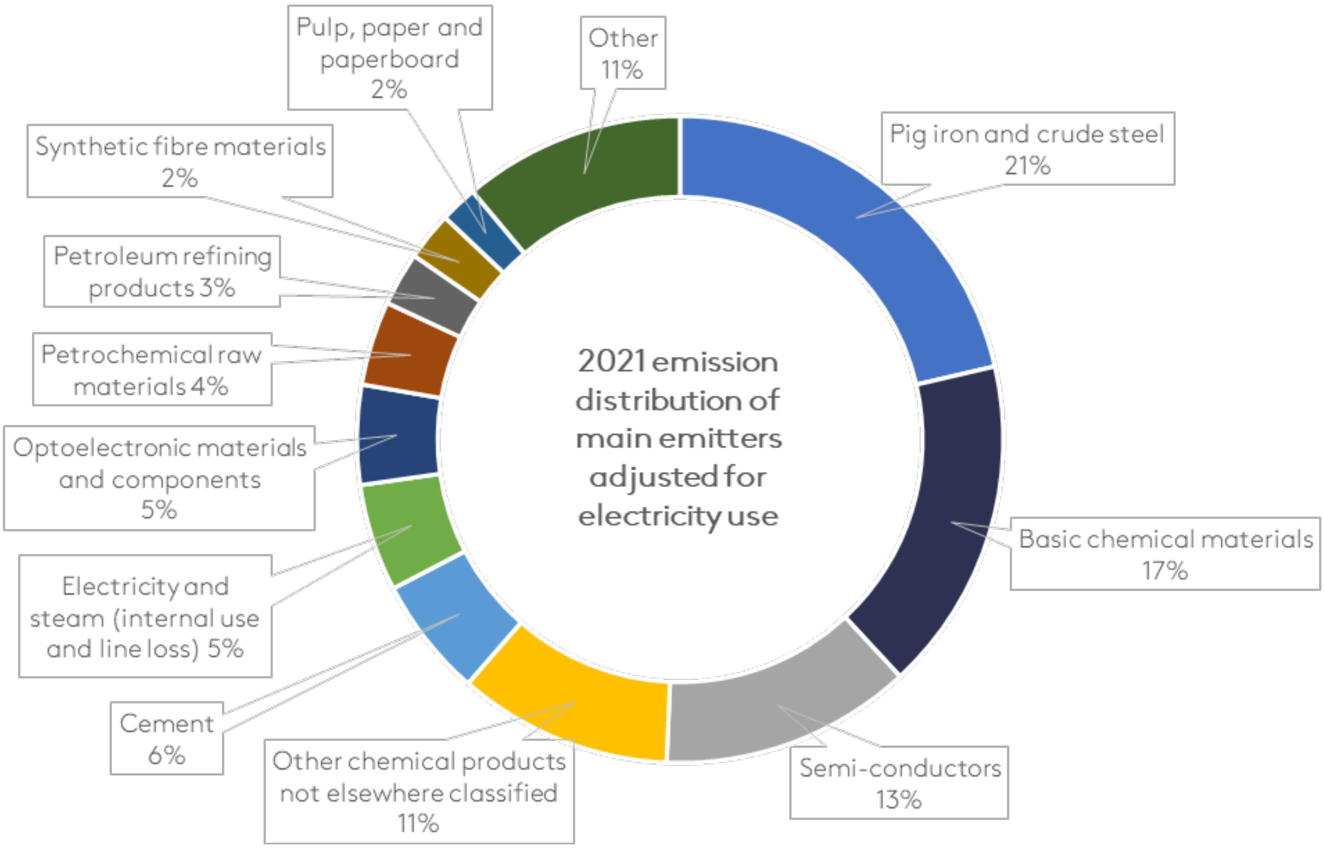


Source: adapted from the 2022 National Greenhouse Gas Inventory Report and 2021 Statistical Analysis of Carbon Dioxide Emissions from Fuel Combustion

GHG emissions profile in the manufacturing sector

The relevance of manufacturing as a source of emissions can be understood in more detail with data from the Mandatory Greenhouse Gas Reporting System. The system was established by the Greenhouse Gas Reduction and Management Act (now Climate Change Response Act) and requires larger emitters in the power and industry sector to measure and report their emissions.[56] In 2021, the main emitters of direct and indirect emissions were pig iron and crude steel (21%), basic chemical materials (17%), semi-conductors (13%), other chemical products (11%) and cement (6%).

Figure 4.2. GHG emissions by mandatory reporting emitters adjusted for electricity use in 2021



Source: adapted from Climate Change Administration, Ministry of Environment, Mandatory Greenhouse Gas Reporting System, 2021 data

Data from the Industry and Service Census is also helpful in highlighting the socioeconomic importance of these emitting sectors. For instance, in 2021 manufacture of basic metals (a proxy for pig iron and crude steel) represented the third largest subsector in manufacturing GVA (6%) and the eighth largest subsector in terms of employment (4% of manufacturing employment). Manufacture of chemical materials (a proxy for basic chemical materials) closely followed basic metals as the fourth largest subsector (6% of GVA) and accounted for 2% of employment. It had one of the highest labour productivity values, as measured by GVA per employed person (TWD 6.3 million). The subsector with the highest labour productivity by the same measure was the manufacture of petroleum and coal products (proxy for petroleum refining). The GVA per employed person is TWD 12.2 million in this subsector, which accounts for almost 2% of GVA. Finally, manufacture of non-metallic mineral products (proxy for cement) contributed almost 2% of GVA and 2.5% of employment in manufacturing.

[56] See: https://ghgregistry.moenv.gov.tw/epa_ghg/Accession/Accession_en.aspx

CPIs, competitiveness and carbon leakage in Taiwan

A carbon fee implemented on direct and indirect emissions from the power and manufacturing subsectors will impact the carbon-intensive entities disproportionately. The fee will lead to cost increases for these entities and, in a closed economy, raise the relative price of their output as producers pass these higher costs on. This will induce a substitution towards low-carbon alternatives.[57] However, the potential for price increases for entities exposed to international competition can be limited and puts their jobs, value added and profits at risk.

Therefore, in an open economy like Taiwan's, a concern arises regarding how to maintain the competitiveness of the emitting sectors. This is because their international competitors may not be covered by similarly ambitious climate policies or face similarly high carbon prices, putting them at a relative disadvantage domestically (through imports to Taiwan) or abroad (through the export of Taiwanese goods). A related concern is to avoid the relocation of production and/or investment to jurisdictions with negative, zero or lower carbon prices, or relatively low climate policy ambition, which would not necessarily reduce global emissions but negatively affect the economic standing of Taiwan. Against this backdrop, measures to protect competitiveness and to avoid carbon leakage should focus on levelling the playing field between domestic and foreign producers without muting the carbon price signal.

In other jurisdictions that have implemented a CPI, such as California, the EU and Singapore, industry at a higher risk of carbon leakage and loss of competitiveness is identified by combining two metrics: i) the carbon intensity of the produced goods; and ii) the exposure to international trade (Acworth, Kardish and Kellner, 2020). Using carbon intensity goes beyond observing the aggregate emissions of a sector, but rather emphasises emissions per unit of output or value added. Understanding exposure to international trade is relevant because the output of carbon-intensive emitters, such as aviation, domestic transport and shipping, is not traded internationally so entities engaged in these activities do not face international competition.

A higher resolution picture of Taiwan's international trade in carbon-intensive goods is therefore helpful to customise the recommendations of this report in Section 5. To that end, this study focuses on aluminium, cement, fertilisers, and iron and steel – four products affected by the EU's CBAM.[58] These four products are considered to be carbon-intensive and trade-exposed products in other jurisdictions as well, and are the subject of measures to protect competitiveness and avoid carbon leakage (for example, under the UK ETS, the California cap-and-trade system, and the New Zealand ETS). For each of these products, Table 4.2 summarises the top five international trade partners for Taiwan using data from 2022. It complements this with information on whether they have a CPI covering this product.

Three broad observations can be made based on the patterns in the table. First, several of Taiwan's international trade partners in carbon-intensive goods already have a carbon price in place (for example, China and the EU), albeit the stringency and effectiveness vary significantly. Others are planning to launch theirs soon (including Malaysia and Vietnam). Second, many of these countries simultaneously receive Taiwanese exports and are the source for Taiwanese imports. For example, both China and the US export iron and steel to Taiwan while also importing significant quantities of the same products from Taiwan.

Third, there is little to no evidence in the table to suggest that carbon price is the most important factor determining Taiwan's international trade in these carbon-intensive products. Several export markets of Taiwan have a carbon price covering the direct and/or indirect emissions of the sectors producing these products. Together, the EU and Japan, for example, receive 27% and 18% of Taiwan's iron and steel, and aluminium exports, respectively. This indicates that Taiwanese exporters may be benefitting from not having to incur carbon costs. At the same time, many export markets, including Hong Kong, Malaysia, and, for the most part, the US, do not have a carbon price suggesting that Taiwanese exporters succeed even when their competitors do not have to incur carbon costs.

[57] In electricity markets where dispatch is regulated and end-user prices are capped, the carbon price signal is not fully transmitted downstream and can affect the financial health of the electricity sector. See: Acworth et al., 2021.

[58] EU CBAM also covers electricity and hydrogen but we exclude these products from our analysis as Taiwan's international trade in these goods is unlikely to be significant in the near future.

Moreover, some Taiwanese imports of carbon-intensive products come from jurisdictions with CPIs that cover the direct or indirect emissions in the exporting jurisdictions. For example, Canada and China are significant exporters of fertilisers and iron and steel to Taiwan despite having CPIs in place.

Table 4.2. Taiwan's international Trade in carbon-intensive products[59]

	Iron and steel	*Aluminium*	*Fertilisers*	*Cement*
Share of product exports in total exports	3%	0.46%	0.05%	0.01%
Taiwan's exports go to... (percentage of total product exports)	1) EU (18%) * 2) US (11%) ** 3) Japan (9%) + 4) Vietnam (8%) 5) China (8%) +	1) US (25%) ** 2) China (19%) + 3) Japan (11%) + 4) EU (7%) * 5) Korea (7%) *	1) Japan (19%) + 2) Malaysia (13%) 3) Mexico (9%) * 4) Vietnam (8%) 5) Peru (8%)	1) US (50%) ** 2) Hong Kong (33%) 3) Guam (9%) 4) Malaysia (6%) 5) Northern Mariana Islands (1%)
Share of product imports in total imports	3%	0.73%	0.11%	0.05%
Taiwan's imports come from... (percentage of total product imports)	1) Indonesia (23%) + 2) Japan (20%) + 3) China (14%) + 4) Russia (11%) 5) US (6%) **	1) China (15%) + 2) UAE (13%) 3) Australia (12%) * 4) India (11%) 5) Russia (8%)	1) Canada (44%) * 2) China (21%) + 3) Belarus (7%) 4) EU (6%) * 5) Israel (4%)	1) Vietnam (52%) 2) Indonesia (22%) + 3) Thailand (12%) 4) Japan (10%) + 5) Korea (1%)*

Notes:

1) Jurisdictions marked with a * have a CPI covering the respective product and those marked with a + have a CPI which does not cover direct emissions associated with the product.
2) The US does not have a CPI at the national level. ** represents coverage under the California cap-and-trade and under the Washington cap-and-invest programme. Other subnational CPIs in the US do not cover industry (the Regional Greenhouse Gas Initiative of the northeastern states covers the power sector, whereas the Oregon Climate Protection programme covers certain fossil fuels upstream).

Source: authors with data from the Trade Statistics of the Taiwan International Trade Administration. See: https://cuswebo.trade.gov.tw/FSCE3000C?table=FSCE3020F

The final observation comes with several important caveats. It is based on one year of data, considers only Taiwan, and does not consider the effect of broader climate and economic policies on international trade flows between Taiwan and its partners. However, recent reviews of the academic literature on the topic reach broadly similar conclusions and highlight the important role that different measures can play in preventing loss of competitiveness while preserving environmental effectiveness.[60]

59 Iron and steel (CCC Code 72), aluminium (CCC Code 76), fertilisers (CCC Code 31) and cement (CCC Code 2523).

60 See: Dechezleprêtre and Sato, 2017 and Vrolijk and Sato, 2023.

Location of exposed subsectors and workers

The implementation of a carbon fee on key emitting sources may also have geographically concentrated socioeconomic impacts. To understand this better, this section provides an overview of the Taiwanese counties and cities that employ the most people in manufacturing subsectors associated with the production of carbon-intensive products listed in the previous section.

In aggregate, the manufacturing sector engages around three million people in Taiwan, representing just over a quarter of total employment in the jurisdiction. Table 4.3 shows that the top five cities and counties represented 68% of manufacturing employment in 2021, whereas the top 10 cities and counties (not displayed) accounted for 92%. Almost half a million people are employed in the manufacturing sector in each of Taoyuan, Taichung and New Taipei. Manufacturing activities and employment are concentrated in the densely populated north and southwestern parts of the jurisdiction.

Table 4.3. Top Taiwanese cities and counties by employment in the manufacturing sector (2021)

City	Number of people engaged in the manufacturing sector
1) Taoyuan	485,152
2) Taichung	484,176
3) New Taipei	456,882
4) Tainan	331,207
5) Kaohsiung	314,469
Total	**3,058,287**

Source: Industry and Service Census, business overview of industrial and service establishment units by industry

Table 4.4 shows how employment is distributed across cities and counties for the carbon intensive products discussed in the previous section. Data are once again disaggregated by city and county, correspond to 2021, and are drawn from the Industry and Service Census. The geographical pattern is broadly similar to that of overall distribution of manufacturing employment. Production of fabricated metals employs more people than the production of all the other goods in Table 4.4 and is relatively evenly spread between the north, west and southwest of the jurisdiction. That said, more than 60% of employment in the basic metals is concentrated in the southwestern and western parts of the jurisdiction. The same regions also provide about 50% of the employment in the chemical materials and fertilisers subsector.

Table 4.4. Top Taiwanese cities and counties by employment in selected carbon-intensive goods (2021)

	Top five Taiwan cities and counties (percentage of subsector total)					*Number of people engaged in the subsector*	*Share of subsector total in total manufacture*
Basic metals	Kaohsiung (25%)	Tainan (19%)	Taichung (17%)	Taoyuan (13%)	New Taipei (9%)	116,169	4%
Fabricated metal products	Taichung (22%)	New Taipei (17%)	Kaohsiung (15%)	Changhua (12%)	Tainan (11%)	405,225	13%
Non-metallic mineral products	New Taipei (16%)	Taichung (14%)	Taoyuan (11%)	Tainan (8%)	Kaohsiung (8%)	71,448	2%
Chemical materials and fertilisers	Kaohsiung (22%)	Taoyuan (14%)	Yunlin (11%)	Tainan (7%)	Changhua (7%)	79,948	3%

Source: Industry and Service Census, business overview of industrial and service establishment units by industry.

Responding to opposition

As Taiwan nears the implementation of a carbon fee, it is crucial to develop effective strategies based on lessons from similar initiatives in the EU, Singapore and the UK. This section delves into industry opposition in these jurisdictions, offers recommendations for addressing concerns, and draws key lessons from the Partnership for Market Readiness's (PMR) guide on communicating carbon pricing to ensure the successful implementation of a carbon fee in Taiwan.

Industry opponents of a carbon fee frequently worry about the economic impact of a carbon fee, job losses, reduced profitability and potential negative effects on economic growth. They also claim that added regulations will hinder business operations, add complexity and increase costs, further worsening the economic impact. Additionally, they fear that carbon fees will disadvantage domestic industries in global markets, potentially leading to a loss of market share. Moreover, there are concerns that carbon fees may disproportionately affect certain industries or regions, potentially leading to income disparities and affecting smaller businesses more severely, intensifying the uneven burden. There is also scepticism about the actual environmental benefits of the fee, particularly if it does not lead to significant emissions reductions. Finally, there is a fear of losing market share to competitors in countries without carbon pricing, potentially leading to business closures or job losses, further exacerbating the loss of competitiveness.

Lessons from the UK, the EU and Singapore

- United Kingdom: while many British companies endorsed the Climate Change Levy, asserting that it could incentivise investments in low-carbon power generation, certain industrial groups have voiced reservations and opposition to the policy. Key arguments included concerns about the economic impact and regulatory burden. Industry stakeholders also raised concerns about losing domestic market share to foreign producers and diminished ability to compete in international markets under the levy's financial burden. The industry opposition was mainly expressed in public statements, in consultation processes and through industry-specific trade associations. In response, the UK Government conducted extensive public consultations with industry stakeholders and launched a communication campaign targeting industry critique. The campaign emphasised job creation and environmental protection, as well as relief measures such as available discounts on the levy subject to Climate Change Agreements, using clear, accessible language, and providing regular updates on the tax's implementation.[61]
- European Union: the EU ETS faced opposition from various sectors, especially energy-intensive industries. Key concerns were similar to the ones in the UK. To respond to these critiques, the EU actively involved industry associations, as well as other stakeholders, in the development and revision of ETS policies. The EU initiated the engagement process through public consultations, providing a platform for all interested parties, including industry associations, to offer feedback on proposed regulations. In addition to consultations, the EU organised public hearings and stakeholder dialogues to facilitate discussions on ETS-related matters, gather input and address concerns. In the legislative process, the EU emphasised the generous provisions for free allowances at the initial stages of the ETS, and dedicated Innovation and Modernisation Funds as measures to safeguard energy-intensive industries against adverse effects. The EU also placed a strong emphasis on transparency throughout the legislative process. Draft regulations, impact assessments and the results of consultations are published and made readily accessible to the public and industry stakeholders. This transparency fosters an environment in which industry associations can actively monitor and contribute to the process.
- Singapore: Singapore's carbon tax, particularly the tax rate increase scheduled for 2024, also raises similar concerns among industry stakeholders. In Singapore, the Government is responding by emphasising the tax's environmental objectives and crafting messages that highlight the value of carbon pricing for long-term sustainability. Additionally, it emphasises in its public communications that it is offering financial support and schemes to support businesses' decarbonisation, in particular the aforementioned use of International Carbon Credits and transition framework.[62]

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[61] For example language used on official website, see: Climate Change Levy rates – www.gov.uk

[62] For example, see: Carbon Tax (nccs.gov.sg)

Lessons from the PMR's Guide to Communicating Carbon Pricing

To address industry opposition effectively, strategies should be detailed and comprehensive. The following lessons, drawn from the World Bank's publication Guide to Communicating Carbon Pricing, can help to shape an adequate response to the main concerns:

- **Clear messaging**: ensuring that the communication of carbon pricing policies is clear, concise and conveying the purpose, benefits and expected outcomes of the carbon tax in a straightforward manner. Table 4.5 offers a selection of standard counterarguments:

Table 4.5. Typical concerns by industries form the introduction of a CPI

Economic growth, competitiveness, and leakage	
1) Carbon pricing can impede industry/private sector competitiveness and stymie economic growth	While there is little evidence that carbon pricing has resulted in damage to industry to date, eventually, it is inevitable that there will be some winners and losers in the shift to a low-carbon economy. However, negative impacts in some sectors are usually compensated by growth in other 'greener' sectors, helping the country to gain a competitive advantage in the economy of the future. This means that carbon pricing will often be either neutral or positive for the economy as a whole.
2) Industry/companies may outsource in anticipation of carbon pricing legislation, resulting in unemployment	There is no evidence of this happening to date. Carbon prices typically only make up a very small share of companies' overall costs, and decisions to outsource are usually driven by multiple drivers, including the availability of workforce, salary level, investment climate, closeness to customers and availability of resources.
3) Carbon pricing can threaten energy security	Carbon pricing helps drive the development of indigenous renewable energy, helping to ensure long-term energy security that is not subject to finite resources or imports from volatile states.
4) Carbon pricing takes away money from companies that could have invested in low-carbon innovation	Carbon prices provide companies with an incentive to invest in low-carbon innovation, as doing so will enable them to avoid costs. In some carbon prices, the revenue collected is recycled back to low-carbon investments through subsidies or green funds.
5) Carbon pricing provides an unfair advantage to 'green' sectors over traditional industries	The growth of many industries has been supported by government policies. Carbon pricing helps level the playing field so companies that produce goods and services without harming the environment can compete and grow.

Source: PMR, 2018

- **Transparency:** maintain transparency in communicating the objectives and benefits of the carbon levy. Provide clear information to industry stakeholders and the public.
- **Stakeholder engagement:** actively engage with industry representatives. Understand their concerns and integrate their feedback into policy design.
- **Transition support:** communicate the government's commitment to supporting industries in adopting cleaner technologies and reducing emissions. Provide concrete details on financial incentives and technical assistance.
- **Clear revenue allocation:** define how revenues will be allocated to benefit the economy, fund environmental initiatives and support vulnerable communities.
- **Global context:** stress the importance of aligning with international climate agreements and reducing emissions to remain a responsible global actor.

5. Recommendations on measures suitable for Taiwan

In principle, a uniformly applied carbon price across all GHGs, regions and sectors, whether through a tax, ETS or a hybrid instrument, is the most cost-effective method for reducing emissions (Bowen, 2011). A uniform carbon price incentivises all economic actors to seek the lowest cost abatement options, enabling the GHG emission abatement to take place where it is least costly. For a carbon price to be deemed efficient, it should equate the cost of emissions abatement with the incremental harm these emissions inflict upon society. These are the fundamental recommendations of environmental economics and underpin the economic arguments in favour of carbon pricing. A uniform carbon price also countervails the potential for free riding and lobbying (Weitzman, 2014).

Moving away from this textbook ideal of a uniform carbon price compromises the cost effectiveness of the instrument. When different sectors face different carbon prices, the overall cost of achieving a given emission reduction target rises. This is because some sectors might be forced to undertake expensive reductions, while others, facing a lower price, continue to emit more than they would under a uniform price. The result is a mismatch, with some sectors over-contributing and others under-contributing to the overall reduction effort, leading to higher aggregate costs than necessary.

While the economic rationale for a single carbon price is compelling, the realities of political economy often necessitate deviations from the required carbon price level. Different sectors have varying abilities to pass on costs to consumers, various levels of political influence, and different exposure to international competition.

Given these challenges, it is understandable that policymakers might seek to phase in carbon pricing gradually, offer transitional assistance to certain sectors, or implement supporting measures and policies to address specific challenges. While these can dilute the economic efficiency of an optimally identified carbon pricing approach, they are often essential to building the broad political coalition necessary to implement and sustain carbon pricing over the long term (Bataille et al., 2017).

In the section below, we examine three measures – preferential rates, use of carbon offsets and revenue recycling via mitigation investment subsidies. We also briefly introduce additional measures, including the recycling of carbon pricing revenues through the reduction of distortionary taxes and measures at the border.

Preferential rate

A preferential carbon rate is essentially a special, often reduced, rate of a carbon price applied to specific emitters, sectors or industries within a jurisdiction. Unlike a uniform carbon price across all emitters, a preferential rate offers a discount to eligible entities, reducing the financial burden of carbon pricing.[63] This reduction is often temporary and subject to conditions such as the adoption of decarbonisation plans. The primary motivation behind introducing preferential rates is to address two intertwined challenges: carbon leakage and competitiveness.

To implement preferential rates effectively, it is crucial to identify which industries are most at risk of carbon leakage and face competitiveness concerns. Typically, these are industries for which energy costs (and hence carbon costs) form a significant portion of total costs and which face stiff international competition. Examples might include steel, cement and certain chemical industries (see subsection on the impact of CPIs on competitiveness and carbon leakage above).

[63] In principle, free allowances in an ETS and exemptions under a carbon tax may be viewed as a discount of 100% on the carbon price on a subset of verified emissions, which would otherwise face the full carbon price. We note that this line of thinking blurs the distinction between the first two categories of measures in the taxonomy described in Section 3.

Advantages and disadvantages of preferential rates

When considering the implementation of preferential rates for the carbon fee in Taiwan, it is essential to weigh the advantages against the potential drawbacks.

On the positive side, a preferential rate can shield the competitiveness of domestic industries, especially those exposed to international competition. This approach can mitigate the risk of carbon leakage, preventing activities and businesses from relocating to countries with laxer climate policies. Politically, offering such rates can make carbon pricing more acceptable, especially to influential industrial actors. Moreover, it provides industries with a transitional period to adapt to the new carbon pricing landscape, enabling them to invest in cleaner technologies gradually.

However, there are also notable challenges. Economically, a uniform carbon price is the most efficient means to reduce emissions, and deviating from this ideal can lead to sub-optimal allocation of mitigation efforts and resources. The Government will also collect reduced revenue from the carbon fee, limiting funds for financing other measures and more broadly supporting the transition to a low-carbon economy. The fair implementation of preferential rates can be complex, requiring careful determination of which industries qualify for these rates. Having different rates for different sectors potentially exposes policymakers to greater levels of rent-seeking and lobbying, especially from the largest firms and trade associations in the most polluting sectors. Entering into bilateral agreements where preferential rates can be individually agreed may result in fighting against their termination in line with any sunset clauses, leading to potential market distortions. This could adversely affect the credibility of the Government's commitment to a given carbon fee trajectory, undermining overall credibility of its climate policy (OECD, 2021; Gale, Brown and Saltiel, 2013). Lastly, if these rates persist, they might deter long-term investments in cleaner technologies, potentially undermining Taiwan's carbon reduction objectives specified in its Climate Act.

Lessons learned from existing programmes

Strictly speaking, the UK CCL, reviewed in Section 3, is not a carbon price. However, it is a prime example of a levy system with conditional preferential rates. During the fourth target period of the CCAs (covering the years 2019–2020), there was a 17% reduction in overall emissions reported by the sectors with umbrella agreements, which represented an approximate 13% reduction compared with the base year. This reduction against the base year is a slightly higher aggregate achievement than if all operators had met their targets exactly. Forty-seven per cent of units met or exceeded their targets, with the remainder complying with the scheme by using surplus achievement from previous years or by using the buy-out mechanism.[64] In the absence of a suitable counterfactual, it is not possible to conclude that the levy and its preferential rates based on CCAs have been cost effective. However, the scheme's durability suggests that, at a minimum, this measure has worked in maintaining minimum industry buy in.

Similarly, early studies suggested that the CCAs appeared to have had an 'awareness effect' in stimulating energy savings and resulted in overall environmental benefits above those that would have derived from the imposition of a flat-rate tax with no rebate and no CCA (Ekins and Etheridge, 2006). However, more recent evidence from microdata found that the direct price incentive provided by the CCL led to larger reductions in energy intensity and electricity use than the targets agreed under the CCA (Martin, de Preux and Wagner, 2014). Businesses subject to the CCL reduced their emissions between 8% and 22% more than businesses with CCAs (Bassi et al., 2013). While CCAs may enhance political acceptability, they also weakened the incentive to decarbonise. Caution must therefore be applied when drawing comparisons between the discount available in this scheme and those that might be considered under a typical carbon tax. Indeed, the high discount available under the CCA would be far too high if replicated under a more conventional carbon fee.

[64] See: www.gov.uk/government/publications/climate-change-agreements-cca-biennial-report/climate-change-agreements-biennial-progress-report-for-2019-and-2020

Getting preferential rates right

To maintain the mitigation incentive, conditions should be attached to the preferential rates. Conditionality entails establishing specific, measurable criteria or benchmarks that industries must consistently meet or maintain to qualify for the reduced rate. These criteria could include, but are not limited to, demonstrable efforts to reduce greenhouse gas emissions, additional investments in clean technology, or meeting certain environmental performance standards.[65]

Sunset clauses could also be helpful in this context. These clauses outline a clear timeline or set of conditions under which the preferential rate would be phased out, ensuring that these measures are temporary and aimed at fostering a transition to low-carbon practices, rather than creating permanent exemptions for certain industries. This approach balances the need for immediate industrial support with the long-term goal of sustainable and widespread decarbonisation.

The actual preferential rate can be determined in numerous ways. It could be set as a fixed discount on the standard carbon price, a percentage reduction, or even a fixed reduced rate for certain industries. The level of the discount would ideally be based on assessments of the risk of carbon leakage and the need to maintain competitiveness.

Use of carbon credits

The use of carbon credits (also known as offsets and offset credits) serves as a mechanism to lower the compliance costs associated with carbon pricing. Carbon credits expand the range of emission reduction possibilities, often providing cheaper alternatives to directly paying the carbon price. They improve the business case of the abatement activities outside the scope of the carbon price by providing these activities with a revenue stream. Typical activities can include credits for reducing methane emissions from landfills or for the additional carbon absorption resulting from afforestation and reforestation investments. As highlighted in Table 2.1, they feature in several CPIs.

These credits are typically generated from activities that fall into two broad categories: GHG reductions and GHG removals. Reduction credits pertain to projects that result in emissions lower than a predetermined baseline. Examples include transitions to renewable energy sources, N_2O and methane abatement, and carbon capture and storage. Removal credits involve projects that actively extract CO_2 from the atmosphere. This category encompasses nature-based solutions like afforestation and reforestation, as well as negative emission technologies such as direct air carbon capture and storage and bioenergy carbon capture and storage.

Carbon credits can be categorised by the duration for which carbon is stored: non-storage, short-term storage, or long-term storage. Non-storage credits involve strategies that avoid or reduce emissions directly, without the need to store carbon, such as through renewable energy projects or energy efficiency improvements. In contrast, short-term storage methods capture and store carbon for a limited period but carry a greater risk of the carbon being released back into the atmosphere within decades. Examples include certain types of forestry or agricultural practices. Long-term storage techniques, on the other hand, store carbon for extended periods, in deep geological formations or in the form of rocks, and are less likely to release it back. Given the variety of carbon credits in the market, it is crucial to evaluate which techniques are simultaneously feasible and effective. Current analyses lean towards removal credits with long-term storage, suggesting a sustainable shift away from non-storage credits.[66]

65 For instance, an industry might be required to reduce its carbon emissions by a set percentage within a defined timeframe, or to invest a proportion of its revenue in renewable energy technologies. Compliance with these benchmarks ensures that the preferential rates serve their intended purpose of promoting environmentally sustainable practices, rather than simply offering a cost reduction with no strings attached. Regular monitoring and assessment of these criteria are also crucial to ensure ongoing compliance and to adjust benchmarks as necessary to align with evolving environmental goals and technological advancements. In essence, the conditionality associated with preferential carbon rates acts as a strategic tool to align industrial activities with broader environmental objectives, ensuring that the benefits of reduced rates are earned through genuine efforts towards sustainability.

66 See: Allen et al., 2020.

Advantages and disadvantages of carbon credits

Carbon pricing often focuses on specific industries or activities, leaving many carbon reduction or removal options outside its scope. Carbon credits can be instrumental in bridging this gap. They offer crucial financial support to projects that are not covered by carbon pricing measures, providing a vital alternative funding source. This is particularly important for initiatives in developing countries or those involving new technologies, which may struggle to secure funding through conventional means. The sale of carbon credits enables these projects to raise funds essential for their growth and continued operation. Without revenue generated from selling carbon credits, these projects would not be feasible, implying that the emission reductions generated are additional.

Yet, ensuring 'additionality', a key component of high-integrity credits, remains a significant challenge. Without confirmed additionality, there is no definitive assurance that the emission reduction activities will in fact result in a decrease in emissions that would not have occurred in the absence of credits. Therefore, credit generation requires strict regulatory frameworks to ensure the integrity and authenticity of the claimed emissions reductions. Weak oversight can lead to the issuance of credits that do not genuinely benefit the climate; for example, as evidenced by the generation of 20–39 million questionable carbon credits in the California Emission Trading System (Song and Temple, 2021). Such instances erode trust in the use of carbon credits and lead to scepticism about their actual impact. Moreover, they can undermine the environmental integrity of the CPI they are allowed to interact with.

A second potential issue with carbon crediting is leakage, where the impacts of a project extend beyond its carbon accounting boundaries, shifting emissions to another location or sector where they are neither controlled nor accounted for. This means that emissions may be reduced in one area because of the project, but inadvertently increase elsewhere. Rigorous project-level accounting and certification by third-party standards are key tools to manage this type of leakage, ensuring the integrity and actual effectiveness of carbon offset projects (Filewood and McCarney, 2023).

Lessons learned from the use of carbon credits

There are legitimate economic reasons for why policymakers may wish to build flexibility in CPIs. For example, the ability to use credits for compliance could bring down overall abatement costs and help reduce opposition. However, the historical use of credits in ETSs provides useful context to highlight the risks of doing so.

The New Zealand ETS (NZ ETS) initially allowed unlimited units generated under the Clean Development Mechanism (CDM) to be used for compliance purposes. From the outset, these so-called certified emission reductions could be used for compliance in the NZ ETS. When the financial crisis occurred, the country experienced both reduced demand for allowances due to a decline in economic activity and an oversupply of CERs internationally (Narassimhan et al., 2018). This led to a collapse in the price of New Zealand Units (NZUs) from NZD 20 (US$12.7) in May 2011 to NZD 2 (US$1.3) in May 2013.

During this period, the price of NZUs was closely tied to and influenced by the price of CERs. Unlike other ETSs such as California, China, the EU ETS and South Korea (which were also affected but to a more limited extent due to quantitative limits), the NZ ETS did not feature a quantitative restriction on the number of CERs that could be purchased and surrendered for compliance until 2015. It was not until 2013 when an announcement was made to sever the connection between the market for CDM credits and the NZ ETS that the NZU price rose above the CER price. In June 2015, the Government stopped accepting offsets from international markets (Leining and Kerr, 2018).

The evidence on the use of carbon taxes and offsets in developing countries is limited, although South Africa and Colombia can offer helpful case studies. In 2019, South Africa implemented a carbon tax as an important policy lever for the country's mitigation strategy. Like the proposed carbon fee in Taiwan, the tax covers a large share of emissions. Reflecting concerns about opposition from industry and the loss of competitiveness, a generous package of support was simultaneously introduced. The package included a quantitative restriction allowing companies to use offsets but for only up to 5–10% of their taxable emissions. Because of the time required to develop and monitor new domestic projects, a large proportion of offsets used for compliance purposes in the early years of the policy were from historical projects under the CDM.

The policy initially proposed to cap the number of historical offset projects in the first phase of the carbon tax (running from 2019–2022); however, their utilisation period is likely to be extended until 2025.[67] The main drawback of this approach is that the package of offsets, allowances and exemptions significantly dilutes the efficacy of the price signal, such that the overall effective price that polluters face is particularly low, despite an increasing headline rate.

Similarly, Colombia introduced a hybrid CPI that allows emitters to use offsets generated from domestic projects, which can be used to meet liabilities. Initially, emitters in Colombia could surrender offsets for up to 100% of their obligations, but a reform in 2022 introduced a 50% limit.[68] Offsets could initially be generated by certain certification programmes outside of Colombia, but this has since been amended to only allow for domestically generated offsets. Many have questioned the environmental integrity of the offsets used because of the inflated baselines of the projects generating the credits. Combined with poor MRV systems, these issues have damaged the credibility of Colombia's carbon tax and called its environmental integrity into question (Wang-Helmreich and Kreibich, 2019).

Getting carbon credits right

The core value of carbon credits lies in their ability to authentically reduce or remove carbon emissions. For credits to be effective, they must maintain high integrity, meaning that each credit should represent a real, verifiable and additional reduction or removal of GHG emissions. This necessitates robust MRV systems to ensure that the emission reductions are genuine and measurable. Additionality is key, ensuring that the climate benefits provided by the project are beyond what would have occurred without it. To uphold the credibility of carbon credits, stringent accountability mechanisms, including third-party auditing, transparent reporting and compliance enforcement are essential. The following principles could help guarantee that crediting meets its environmental goals and maintains stakeholder trust.

While credits can play a role in a comprehensive climate strategy, they should not become a primary means of achieving emission reduction targets. Carbon credits should not substitute for emission reductions. Relying too heavily on credits can divert attention and resources away from direct emission reduction efforts. It is crucial to set a limit on the number or share of credits that can be used to meet emission reduction targets. By doing so, entities are encouraged to prioritise direct emission reductions while using credits as a flexibility tool.

Not all credits are equal in their impact. Some projects offer more sustainable and long-term benefits than others. By setting effective qualitative criteria, policymakers can ensure that only the credits from the most effective and beneficial projects are recognised. This might include prioritising projects with co-benefits, such as biodiversity conservation or community development, or favouring projects that align with national or regional sustainability goals.

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67 In addition to offsets, the package included tax-free thresholds and allowances. According to the IMF, there is a basic tax-free allowance ranging from between 60% and 75% of emissions across sectors, with additional allowances and offsets potentially adding up to 95% depending on the sector. The policy has in-built flexibility that allows the tax-free threshold to be ratcheted up or down, although this is capped at 5%. See: IMF African Dept., 2023.

68 See (in Spanish): www.dian.gov.co/normatividad/Documents/122_000890_CONTRIBUYENTES.pdf and (in Spanish): www.funcionpublica.gov.co/eva/gestornormativo/norma.php?i=199883

Revenue recycling via mitigation investments subsidies

A further option available to policymakers to enhance the political viability of carbon pricing is to recycle revenue back to affected groups. Revenues generated from a carbon fee can be used to mitigate undesirable distributional impacts on households or allay industry concerns over the potential impact of asymmetric carbon prices across jurisdictions. To level the playing field for industry, policymakers can make use of mitigation investment subsidies, funded through the revenue raised from the carbon fee. This works by channelling finance to affected firms often on the condition that the money is re-invested in emissions reductions activities. Examples of this include financing low-carbon machinery, offering subsidies for energy efficiency improvements, subsidising low-carbon research and development and innovation support to help companies transition to a low-carbon future.

This type of support is a common feature in some of the most established carbon pricing initiatives. In the EU, for example, between 2012 and 2016, at least 50% of the approximate €17 billion (US$17.9 billion) raised was redistributed for climate- and energy-related purposes and for retrofitting existing infrastructure. The EU has also established two new funds: an 'Innovation' fund to extend existing support for demonstration of innovative technologies; and a 'Modernisation' fund available to ten lower-income member states to facilitate investments in modernising the power sector and fostering energy efficiency (Narassimhan, 2018).

Advantages and disadvantages of mitigation investment support

There are several benefits of mitigation investment support. First, it can be used to overcome market failures such as underinvestment in R&D, stemming from the inability of innovators to capture all the economic returns to new ideas (Bowen, 2011). By offering mitigation investment support, the government can reduce the perceived risk of investment in new low-carbon production and crowd in greater multiples of private capital. Beyond this, increasing low-carbon investment can act as a Keynesian fiscal stimulus that could stimulate economic growth. Macroeconomic modelling points to GDP growth when revenue is recycled to firms, although the fiscal multiplier is higher if these revenues are distributed to households rather than firms (Pareliussen, Saussay and Burke, 2022). Second, it speeds up the transition to cleaner production, which reduces both emissions and the carbon tax liability faced by polluters. Third, the use of this measure may mean that the carbon tax can be lower than if it were the only instrument available (Fischer and Newell, 2008). Indeed, the authors conclude that, with subsidies, the carbon tax can be more than one-third lower. This reinforces the notion that optimal policy involves a portfolio of different instruments targeted at emissions.

Despite the macroeconomic benefits and capability to alleviate potential opposition, recycling revenue to industry presents several challenges. First, depending on the design of the scheme, there is a risk of providing preferential treatment to specific firms, technologies or regions, distorting the competitive landscape. This may give rise to the government picking winners, and the government could become captured by vested interests in order to preserve the special treatment they receive. Second, it may reduce the efficacy of the policy's effectiveness, so it will be essential to monitor the behaviour of covered entities over time to ensure that environmental outcomes are being achieved.

Third, revenue recycling of this type can often be hard to implement because it requires a change to the conventional fiscal thinking that sees all revenue treated as income for the government. An important precondition of any measure structured around targeted revenue recycling is that it relaxes the institutional and political economy constraints that would otherwise impede the implementation of the CPI. Where this precondition is not satisfied, the successful adoption of a CPI may require its inclusion in tax policy changes as part of a broader fiscal reform. This reflects that there are competing claims for the use of carbon pricing revenue, including recycling to firms or households, for boosting existing spending on green infrastructure or to fund cuts in other distortionary taxes.

Lessons learned from mitigation investment subsidies

Evidence suggests that an effective strategy for implementing carbon pricing requires a combination of compensatory measures for improving social outcomes and maintaining a firm's competitiveness. In contrast, the absence of compensation makes the adoption of ambitious carbon pricing strategies implausible (Muth, 2023). Consequently, any recycling strategy that compensates industrial actors must also earmark funds for other purposes. While considerable evidence highlights the impact of such strategies on social attitudes and outcomes, less is known about their environmental effects. Existing studies, however, indicate that recycling revenues into industries, particularly through corporate income tax reductions and subsidies for clean energy sectors, can lead to significant emissions reductions (Liu et al., 2023). Thus, tying industry compensation to investments in energy efficiency or emissions reduction technologies appears to be a practical approach.

Innovation and Modernisation Funds of the EU ETS

The EU established the Innovation and Modernisation Funds as a means to direct revenues from the EU ETS. On the one hand, the Modernisation Fund targets lower-income EU member states, aiming to support their transition to net zero. It provides financing for low-carbon generation, low-carbon infrastructure and energy efficiency initiatives. This fund is financed by auctioning 2% of the total EU ETS allowances from 2021 to 2030. A robust governance process has been established to ensure the appropriate use of funds. This includes a two-procedure assessment process. In the first procedure, the European Investment Bank will determine if the investment complies with the requirements to support energy system modernisation in the priority areas of energy efficiency improvement in agriculture, buildings, energy storage, transport or waste. As an example of funding conditionality, the assessment requires that no support is provided to electricity generation facilities utilising solid fossil fuels. If the project is deemed to comply with the priority areas, then it may be financed for up to 100% of the relevant investment costs. It is expected that at least 70% of the total fund will be used for these projects only (European Roundtable on Climate Change and Sustainable Transition, 2018). However, if the proposed use of funds meets some but not all of the assessment criteria, a project can still receive up to 70% of the total cost of the project. A maximum of 30% of the Modernisation Fund can be used to finance these types of projects.

On the other hand, the Innovation Fund is dedicated to new technologies in Europe, focusing on projects that can substantially reduce emissions. Unlike the Modernisation Fund, the Innovation Fund does not rely on a fixed percentage of allowances. Instead, it is financed through the monetisation of 530 million EU ETS allowances, and it is set to continue until 2030. The fund only covers up to 60% of total project costs. Examples of projects that can be financed through the fund include safe carbon capture and utilisation, products that substitute for carbon-intensive products in covered sectors, environmentally safe geological capture and storage, and innovation technologies related to energy storage.

Having a transparent governance process for both funds with clearly defined eligibility criteria and ringfenced budgets helps ensure that finance is channelled to projects that will make a meaningful contribution to emission reductions across EU member states.

Getting mitigation investment subsidies right

When recycling revenue to support mitigation investment, there are two critical elements to 'get right'. First, the recycling of revenue to affected firms must be targeted to those that genuinely need assistance to maintain competitiveness and reduce carbon leakage. However, in practice, this can be hard to assess because existing evidence for carbon leakage tends to be weak and drawn largely from ex ante theoretical and quantitative models. In the future, more accurate targeting of support measures will need to be underpinned by ex post empirical analysis that identifies the impacted sectors and goods. Second, the recycling of carbon pricing revenues in this way may require new governance structures and the relaxation of fiscal constraints. These new structures should ensure that mitigation investment subsidies have strong conditionality attachments similar to those set out under the EU ETS Innovation and Modernisation funds. This can help guarantee that the funds are only used for investments that make a significant contribution to the strategic priorities of the government and benefit only those technologies that will significantly reduce emissions.

Overall, evidence suggests that while mitigation investment subsidies can increase the acceptability of carbon pricing within industry, it needs to be balanced with other forms of revenue recycling that aim to reduce the adverse distributional impacts on vulnerable and lower-income households (Dechezleprêtre et al., 2022). That said, revenue recycling is not a panacea to increase the acceptability and political feasibility of carbon pricing. Its success relies on a broader set of factors including trust in government, as carbon pricing can often be seen as a backdoor way of raising government revenue, rather than as an incentive to reduce emissions, amid broader mistrust that carbon pricing will be ineffective in reducing GHG emissions. Best practice suggests that, in addition to revenue recycling, carbon pricing should be phased in over time so that the effectiveness and impact of the policy can be observed. Furthermore, careful and regular communication about how the generated revenues will be used is crucial to build public trust and support (Carattini et al., 2017).

The three measures outlined above – preferential rates, use of carbon credits and revenue recycling via mitigation investment subsidies – each imply trade-offs that balance economic efficiency, environmental stringency and political feasibility. The choice of measures is ultimately a political choice. That said, it is our judgement that a hierarchy exists, and the options can be ranked in the following order: revenue recycling via mitigation investment subsidies, preferential rates, and then carbon offsets. In accordance with our recommendations below, prioritising mitigation investment subsidies is likely to maintain policy stringency while maintaining simplicity. This does not mean alternative options are not effective, but it may be more difficult to adhere to the recommendations set out below.

Other measures to help manage opposition

Beyond those previously discussed, there are several other measures that can be employed to manage opposition and enhance the acceptability of carbon pricing in Taiwan. A particularly effective approach is the use of carbon pricing revenues to finance the reduction of distortionary taxes.

Using carbon pricing revenue to reduce distortionary taxes

By using carbon pricing revenues to reduce distortionary taxes, the government can offset some of the potential negative economic impacts of the carbon pricing mechanism. Academic research in fact points to the potential of a 'double dividend' when introducing a carbon price and reducing distortionary taxes. In other words, this approach suggests that environmental revenues could finance reductions in pre-existing taxes, yielding an additional or 'double' benefit: one from environmental improvement and a second from lowering distortions from pre-existing revenue-motivated taxes (Nerudova, 2014).

A strategic approach to this can utilise different incentive mechanisms. Firstly, by reducing taxes on capital, governments can incentivise investment and support business growth, which is particularly appealing for the corporate sector. This could bolster capital accumulation, enhancing long-term growth and increasing support from private sector stakeholders that might otherwise be resistant to new environmental taxes. Secondly, recycling revenues through a reduction of taxes on labour can directly benefit the workforce and enhance overall employment.

This approach not only stimulates employment growth but can also increase the public's acceptance of carbon pricing by directly impacting their disposable income positively.

Recent academic evidence provides insights on the relative magnitude of different mechanisms. For example, considering the management of output losses in energy-intensive sectors, preliminary models suggest that utilising carbon tax revenue to reduce capital taxes is more effective than using labour tax adjustments or lump-sum recycling methods (Macaluso et al., 2018).

Thirdly, reducing taxes on consumption, such as lowering value-added tax, can have a widespread impact on the general public. This method can make the introduction of carbon pricing more acceptable to consumers by offsetting increased costs due to carbon taxes with lower consumption taxes. It is also important to note that any revenue not allocated to these specific areas could contribute to the general government budget, providing flexibility for the government to use these funds as deemed necessary in other critical areas.

Ultimately, a mixed approach in recycling carbon tax revenues is likely to be the most effective. Combining reductions in capital, labour and consumption taxes can balance the economic impact across various sectors, garnering broader support, and ensuring a more equitable distribution of the benefits and burdens of carbon pricing.

Measures at the border

The start of the operation of CBAM in its transitional phase during October 2023 means that the EU has now activated a mechanism that eventually aims to equalise at the border the competitive landscape between EU producers, which bear carbon emission costs, and those in countries without comparable carbon pricing in place. As discussed in more detail in Section 3, CBAM adds a carbon-related charge to imports from nations lacking a comparable carbon price, while adjusting the charge for any carbon price that may have been paid in the country of production. The adjustment accounts for free allowances, exemptions and offsets that may be available to the producers in the EU and third countries in light of the respective carbon prices in their jurisdictions.

For Taiwan, with its export-driven economy and significant trade ties with the EU, the roll out of the EU CBAM has substantial implications. Should Taiwan adopt a high domestic carbon fee without preferential rates or use of carbon offsets with low prices, it positions itself to avoid the extra charges imposed by the CBAM. This approach, while ensuring CBAM-implied revenue stays within Taiwan, may require the implementation of a similar border adjustment measure domestically to maintain a competitive balance. Alternatively, if Taiwan opts for a low domestic carbon fee, potentially supplemented by measures such as preferential rates and the utilisation of carbon credits and offsets, it will have to face CBAM charges on its exports to the EU, at least until the carbon fee ramps up and the preferential rates and low-cost offsets are phased out.

Considering these points, Taiwan's choice of measures to manage domestic opposition is pivotal. By carefully calibrating them, Taiwan can mitigate the extra charges introduced by the EU's CBAM and retain the revenues that would otherwise be directed to the EU. In this way, Taiwan can make progress towards its climate neutrality goal while maintaining buy-in from domestic industry.

Overarching recommendations

- When implementing a carbon fee in Taiwan, include various measures to manage opposition from industry, to enhance public acceptability and ensure a durable and effective instrument. This study makes the following overarching recommendations.

1) *There is a strong case for simplicity*

The fewer and simpler the measures, the better. Multiple measures can create confusion for regulated entities, increase administrative costs, and compromise the transparency and fairness of the carbon fee. A straightforward and easily comprehensible carbon fee can facilitate compliance, reduce enforcement costs, and enhance the credibility of the instrument in the eyes of both domestic stakeholders and international partners.

2) Maintain policy stringency

If flexibility mechanisms such as offsets are to be used, there must be strict quantitative and qualitative restrictions, including limits on the number or share of credits that can be used to meet emission reduction targets. Only allowing the use of domestic credits may give the Government more control to assure that the offsets represent real, additional, permanent emissions reductions. Moreover, while preferential rates may enhance acceptability, they also weaken the incentive to decarbonise. This brings with it the risk of powerful industries lobbying for more advantageous preferential rates and for them to remain in force for longer.

3) It is essential to strike a balance

Decisions on the balance between the various measures to manage opposition need to be made to prevent them from being overly generous. For example, higher quantities of free allowances or preferential rates necessitate lower shares of hypothecated revenue and vice versa. Should any revenue be hypothecated, it should be contingent on reinvestment for energy efficiency or in emissions technologies. Not all revenue should be recycled to industry. A strategy that improves both social outcomes and maintains firms' competitiveness is more likely to be acceptable and durable.

4) Consider international ramifications

While prioritising domestic competitiveness for Taiwanese industries in key international markets is essential, it is crucial to consider the changing policy landscape. A substantial difference in the effective carbon prices paid by Taiwanese exporters and their competitors in export markets cannot be maintained for much longer in the context of the emergence of mechanisms like the EU's CBAM. Preferential rates and generous offset provisions might be politically expedient or deemed necessary to shield certain domestic industries, but they will lead to a disparity between the carbon prices in Taiwan and other jurisdictions that use CPIs. If nowhere else, this disparity will start having tangible consequences from 2026 and may have a large impact on Taiwanese industry.

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Appendix: Examples of taxonomy measures in established CPIs

Type of competitiveness protection mechanism	*Name of the carbon pricing instrument*	*Description of selected competitiveness protection mechanisms*	*Type of CPI*	*Type of jurisdiction covered*	*Jurisdiction covered*	*World Bank region*	*Year implemented*
Limits to regulated emissions	China national ETS	According to the 2021-2022 Allocation Plan, compliance obligations are limited. Gas-fired plants only need to surrender allowances up to their level of free allocation as per the benchmarks. Coal-fired plants with free allowances of less than 80% of their verified emissions will have their allocation adjusted upwards to 80%, which means that 20% remains the maximum shortfall as the first compliance period.	ETS	National	China	East Asia & Pacific	2021
	South Africa carbon tax	Tax exemptions range from 60% to 95%, depending on the sector. The level of tax exemption depends on the presence of fugitive emissions, level of trade exposure, emission performance, offset use and participation in the carbon budget programme. Companies can also claim an energy efficiency tax incentive, and are able to offset payments of the electricity generation tax and additional purchases of renewable energy against their carbon tax liability. This transitional support is available until 31 December 2025.	Carbon tax	National	South Africa	Sub-Saharan Africa	2019
Discounted carbon price	Denmark carbon tax	Certain (energy-intensive) industries can claim a flat-rate reimbursement of carbon tax costs, intended to reflect the free allocation afforded to installations covered by the EU ETS. Companies that adopt technologies to reduce unburned methane are eligible for reimbursement.	Carbon tax	National	Denmark	Europe and Central Asia	1992
	Regional Greenhouse Gas Initiative (RGGI)	Since 2014, RGGI has operated with a cost containment reserve (CCR), consisting of a quantity of allowances in addition to the cap, which are held in reserve and only released to the market when certain trigger prices are reached. Beginning in 2021, allowances provided within the CCR are equal to 10% of the regional cap. The trigger price is US$14.88 in 2023 and increases by 7% per year. The CCR has been triggered in 2014, 2015, 2021 and 2023.	ETS	Subnational	RGGI	North America	2009
	Singapore carbon tax	There are no exemptions to the carbon tax. A transitional framework for EITE sectors provides entities in these sectors with allowances for part of their emissions, based on efficiency standards and decarbonisation targets. Companies can also continue to tap on existing support measures for decarbonisation, such as the Resource Efficiency Grant for Energy, Investment Allowances for Emissions Reduction and Energy Efficiency Fund. Moreover, regulated entities may offset a limited (5%) amount of their taxable emissions using high-quality carbon credits.	Carbon tax	National	Singapore	East Asia & Pacific	2019

Type of competitiveness protection mechanism	*Name of the carbon pricing instrument*	*Description of selected competitiveness protection mechanisms*	*Type of CPI*	*Type of jurisdiction covered*	*Jurisdiction covered*	*World Bank region*	*Year implemented*
Revenue recycling/ Direct support	Alberta TIER	If TIER Regulation compliance costs exceed 3% of sales or 10% of profit at a facility, the facility owner may be eligible to receive some regulatory relief under the province's Compliance Cost Containment Program (CCP).Under the CCP, facility owners may, in order of precedence: i) be allowed to use more offsets or performance credits; ii) qualify for grant funding for onsite projects that generate emission reductions; iii) receive further allocation.	ETS	Subnational	Alberta	North America	2007
	BC carbon tax	The CleanBC Program for Industry directs an amount equal to the incremental carbon tax paid by industry above CA$30/t$CO_2$e into incentives for cleaner operations and emission reduction projects.	Carbon tax	Subnational	British Columbia	North America	2016
Border adjustments	EU ETS	The EU ETS has introduced the Carbon Border Adjustment Mechanism to imports of aluminium, cement, electricity, fertilisers, hydrogen, and iron and steel. From 2026, imports of these goods into the EU will be charged a carbon levy (referenced to the market price of EU ETS allowances) based on the embedded emissions generated during the production process. In the EU ETS, emission-intensive and/or trade-intensive sectors at risk of carbon leakage receive free allowances up to 100% of the benchmark level. The percentage of free allocation will gradually decrease in line with the introduction of CBAM.	ETS	Regional	EU, Norway, Iceland, Liechtenstein	Europe and Central Asia	2005
	New Zealand ETS	Complementary to the ETS, New Zealand has a levy on imported goods containing synthetic greenhouse gases (mostly those contained in air conditioning and refrigeration units). For motor vehicles, the levy is applied when the vehicle is first registered for on-road use (that is, when it receives its licence plate). The levy on other goods is applied at the point of import and is administered by the New Zealand Customs Service (see: Kardish, Elbrecht and Acworth, 2021).	ETS	National	New Zealand	East Asia & Pacific	2008

Source: List and descriptions of competitiveness protection measures based on: https://carbonpricingdashboard.worldbank.org/map_data and on https://icapcarbonaction.com/en/ets. Additional sources are referenced, as applicable, under the "Competitiveness protection mechanisms" column for each case.