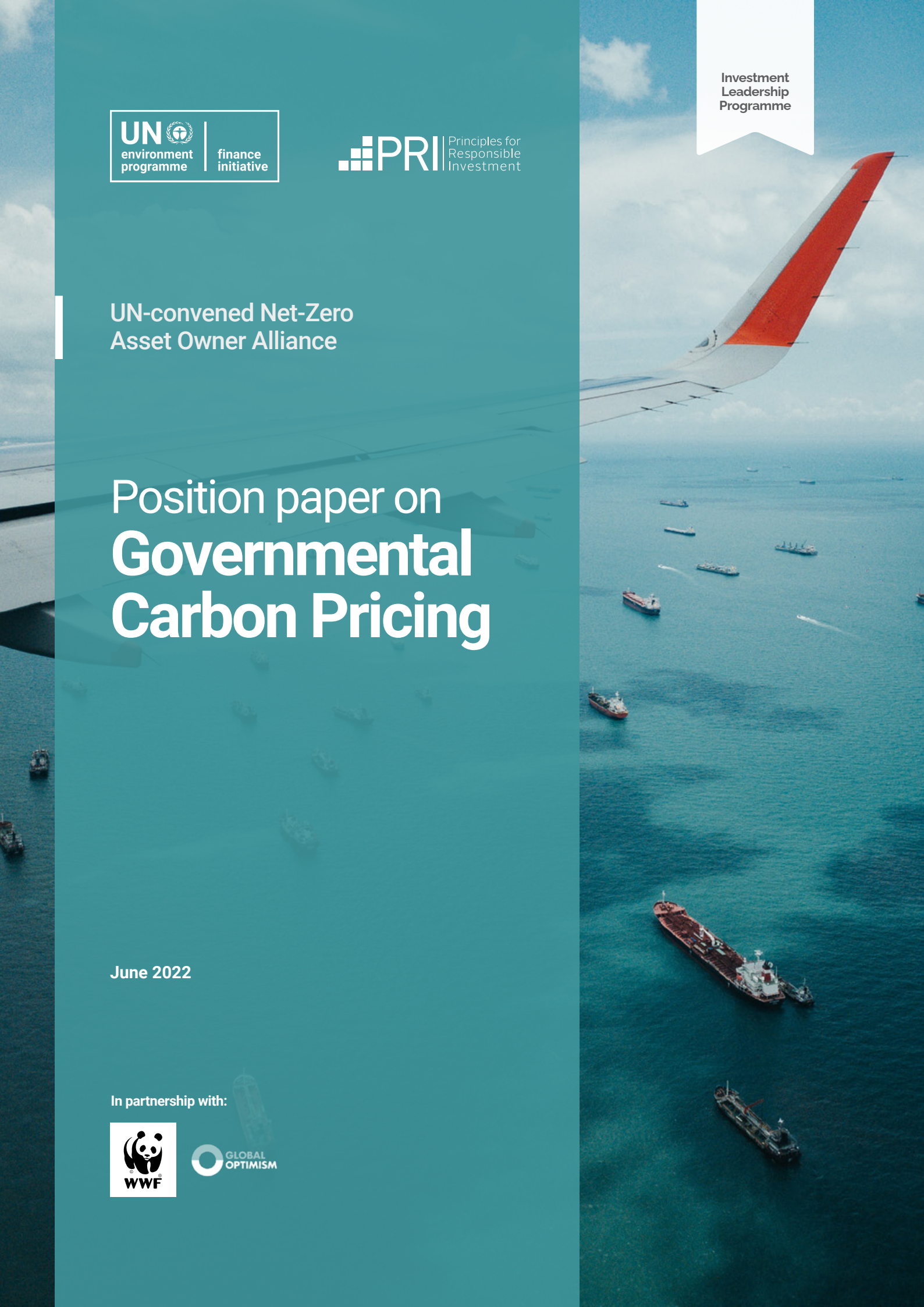

Investment Leadership Programme

UN environment programme | finance initiative

PRI Principles for Responsible Investment

UN-convened Net-Zero Asset Owner Alliance

Position paper on **Governmental Carbon Pricing**

June 2022

In partnership with:

WWF

GLOBAL OPTIMISM

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Preface

As members of the UN-convened Net-Zero Asset Owner Alliance (NZAOA), we are committed to transitioning our investment portfolios to net-zero greenhouse gas (GHG) emissions by 2050. Collectively, we manage USD 10.6 trillion in assets on behalf of our clients and beneficiaries. Through our investment mandates, we can drive the development of industry best practice. We are therefore uniquely placed to play a key role in catalysing decarbonisation of the global economy and investing in climate-resilience. We recognise the imperative that global GHG emissions are halved by 2030, and are committed to working together to achieve these near-term emissions reductions on the path to transitioning our investment portfolios to net-zero GHG emissions by 2050, consistent with limiting global warming to 1.5°C.

This transition hinges on a policy mix consistent with climate goals. To achieve net-zero investment portfolios by 2050, governments must implement policies that drive the transition to a low-carbon economy. This requires increasing climate policy ambition in a socially responsible manner, accounting for social and intergenerational implications,[1] and in an internationally acceptable way. We firmly believe the economic recovery from the COVID-19 pandemic must serve a dual purpose of steering the global economy swiftly towards a low-carbon future while encouraging economic equity. In short, we must build back better.[2]

We therefore call on policymakers to follow through on their commitments outlined in the Paris Agreement, including through appropriately designed carbon pricing instruments. The creation and implementation of emission reduction technologies in many emissions-intensive sectors depends crucially on adequate carbon pricing[3] and supporting policies. Well-designed carbon pricing instruments provide a broad-based incentive for cost-effective decarbonisation. Additional policies such as appropriate public spending, legislative targets, and sectoral regulation are also necessary to enable carbon pricing and to provide support where carbon pricing alone is not sufficient. To create private-sector confidence and attract flows of capital and investment to low-carbon technologies, policymakers will need to transparently outline how they plan to deploy the complete toolbox of policy instruments.[4]

1 Grantham Institute, Investing in a just transition—global project. Available at: lse.ac.uk/granthaminstitute/investing-in-a-just-transition-global-project/

2 UN-convened Net-Zero Asset Owner Alliance (2020) Position on the Coronavirus Recovery. Available at: unepfi.org/wordpress/wp-content/uploads/2020/12/AoA-position-on-the-coronavirus-recovery.pdf

3 The term carbon in this statement refers to all GHGs.

4 Carbon Pricing Leadership Coalition (2017). Report of the High-Level Commission on Carbon Prices. Available at: carbonpricingleadership.org/report-of-the-highlevel-commission-on-carbon-prices

Executive summary

Governmental carbon pricing is a necessary part of the climate policy toolkit required to achieve net-zero emissions and reach the Paris Agreement goals. Carbon pricing provides a broad incentive for decarbonisation, driving emissions reductions where they are most cost-effective. It makes emitting more expensive, incentivising firms to invest in abatement technology and reducing consumer demand for emissions-intensive goods.

Appropriate design is essential for the efficacy of carbon pricing policy instruments. Amid rising energy prices in many jurisdictions, ramping up carbon pricing schemes is a challenging task. A well-designed instrument can maximise benefits from emissions reductions and minimise risks such as loss of competitiveness and negative distributional impacts. The Alliance believes that the following principles should be applied to pave the way for 1.5°C-aligned carbon pricing:

- **Ensuring appropriate coverage and ambition:** As of 2021, less than 5% of global GHG emissions were covered by a carbon price that is consistent with reaching a 1.5 C target.[5] **More policymakers should consider implementing carbon prices that are legally binding and set in line with science-based evidence. Jurisdictions with existing systems should consider expanding coverage and ramping up ambition to provide a sufficiently high long-term price signal.**
- **Delivering a just transition**: Carbon pricing will impact a wide range of sectors, markets, and businesses. In some cases, the shifts in economic activities driven by carbon pricing may be concentrated in disadvantaged communities. Policymakers should design carbon pricing instruments to reduce or compensate for these impacts. For instance, revenues raised from carbon pricing can be used to support communities and households disproportionately impacted by these instruments through retraining, lump-sum transfers, or broader policy changes like reducing income taxes.
- **Providing a predictable price signal**: Certainty over the broad trajectory of carbon prices allows for a planned and orderly transition to a low-carbon economy. Both a carbon tax and an Emission Trading System (ETS) cap can be designed to provide this type of certainty. Carbon taxes can have a steadily increasing rate that is announced well in advance. Similarly, an ETS can be designed to include market stability measures including price floors, ceilings, or corridors, to avoid excessive price volatility and provide a predictable increase in price signal over time. Non-partisan commitments and corresponding legislation can support long-term reliability so the private sector can be assured that the schemes will be followed through.

5 The World Bank (2021) State and Trends of Carbon Pricing 2021. Available at: openknowledge.worldbank.org/handle/10986/35620.

- **Minimising competitive distortions:** Carbon leakage[6] results in both a failure to achieve desired environmental outcomes and a loss in domestic competitiveness. Carbon pricing policies should be designed to avoid leakage by implementing appropriate and targeted protective measures for trade-exposed emissions-intensive firms. These measures, however, must still maintain the incentive to abate. Existing systems have used output-based free allocations for targeted sectors, or carbon border adjustment mechanisms (CBAMs)[7] to minimise competitive distortions.
- **Promoting international cooperation**: International cooperation on carbon pricing is needed to raise ambition and meet the Paris Agreement goals. Governments can cooperate in several ways, including through linking ETSs, knowledge transfers or setting up international 'climate clubs' where members work together to encourage robust carbon pricing.

Carbon pricing works best when supported by enabling policies, and as part of a wider policy package of complementary policies. While carbon pricing has significant benefits, it is not sufficient on its own. Additional policies are needed for carbon pricing to reduce GHG emissions in a cost-effective manner. For example, innovation and research policies are crucial to develop low-carbon substitutes that carbon pricing can incentivise switching to. Supporting policies are also required to overcome non-price barriers such as lack of information or access to capital. Policymakers should also remove market distortions, such as fossil fuel subsidies, which counteract carbon pricing. Finally, the climate policy package requires complementary policies to ensure a just transition.

The Alliance believes governments should implement carbon pricing in line with the principles above, providing a basis for an economy-wide alignment to the Paris Agreement goals. Acknowledging that different jurisdictions face different starting positions and challenges, the Alliance believes that to halve emissions by 2030, adequate and reliable carbon pricing should be implemented in first half of this decade. This paper provides more details on the principles set out above, and is structured as follows:

- **Section 1** provides a high-level overview of carbon pricing including carbon pricing instruments and the status of carbon pricing globally
- **Section 2** summarises five key principles that can guide carbon pricing design
- **Section 3** highlights the role of carbon pricing in achieving net-zero emissions.

6 Companies covered by a carbon pricing instrument can lose competitiveness when facing high carbon costs and competing against entities which are either not covered by a carbon pricing instrument or face a much lower carbon price. To avoid this, these companies may move production to a jurisdiction without carbon pricing (or with a lower carbon price) to reduce their carbon costs. This is known as carbon leakage and measures should be adopted to avoid or minimise it.

7 CBAMs level the competitive playing field by imposing a carbon cost on imports from jurisdictions without a carbon price or with a lower carbon price. CBAMs can also incentivise other jurisdictions to implement carbon pricing to avoid paying a border charge on their exports.

Table 1: Five carbon pricing instrument design choices can contribute to several key objectives

Guiding principle	Design decisions			
Appropriate ambition	**Carbon tax rate or ETS cap** A higher carbon tax rate or a tighter ETS cap leads to higher carbon prices and hence incentivises more abatement		**Scope of coverage** A broader scope of coverage increases the number of entities (and therefore share of emission) that receive the carbon price signal	
Just transition	**Use of revenues** Revenues from carbon pricing instruments can be used to minimise negative distributional impacts		**Complementary policies** Policies additional to carbon pricing, such as re-skilling programs, can help deliver a just transition	
Price predictability	**Carbon tax rate or ETS cap** Steadily scheduled price increases allow for planning	**Scope of coverage** Increased availability of mitigation options stabilises ETS prices	**Market stability measures** Price floors and ceilings protect against extreme price volatility	**ETS linking** More participants and abatement options can increase liquidity and stability
Competitiveness	**Use of revenues** Revenues can be recycled to provide direct support to industries or invested in R&D	**Allowance allocation** ETS allowances can be allocated to targeted industries to maintain competitiveness and avoid carbon leakage	**Carbon border adjustment mechanisms** Import charges on emissions intensive goods from jurisdictions not covered by a carbon price can level the playing field	
International co-operation	**Carbon border adjustment mechanisms** Import charges on emissions intensive goods can incentivise their own carbon pricing	**ETS linking** Linking can increase collaboration between countries and help increase joint ambition	**Climate clubs** Coalitions of countries can encourage and provide incentives for high levels of participation and abatement	

1. Introduction to carbon pricing

This section introduces carbon pricing. Section 1.1 explains how carbon pricing works and sets out the two key carbon pricing policy instruments: carbon taxes and emissions trading systems (ETS). Section 1.2 then provides a brief overview of the status of carbon pricing globally.

1.1 Overview of carbon pricing and types of instruments

Carbon pricing instruments put an explicit price on greenhouse gas (GHG) emissions, forcing firms to internalise these costs. By pricing GHG emissions into the decision-making process of economic actors, carbon pricing instruments establish a direct link between the emissions of a product or process and the costs borne by a firm or a consumer.

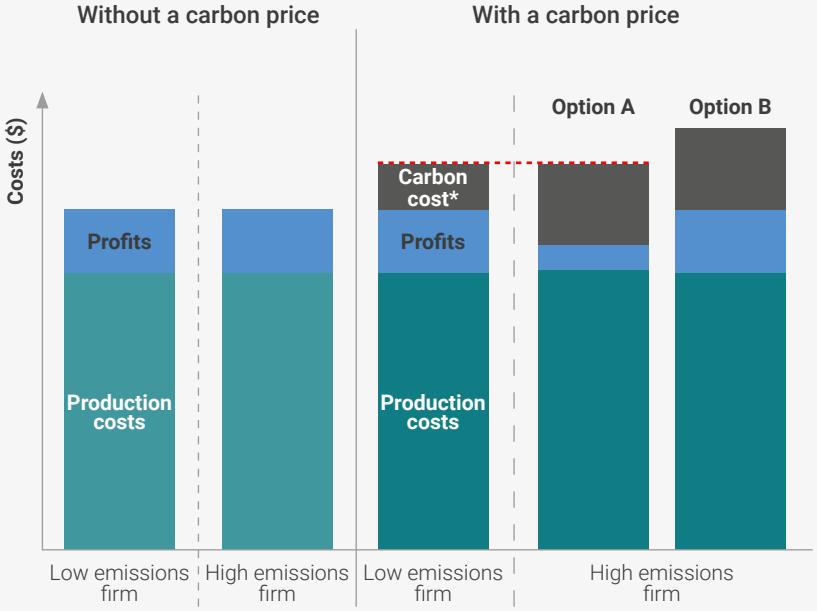
Carbon pricing lowers emissions by incentivising a shift in demand away from high emission production and consumption. Carbon pricing induces firms to shift away from emission-intensive inputs and processes by making them more expensive, resulting in emissions abatement in production. Firms may choose to pass some of the carbon costs through to consumers, resulting in higher prices for emission-intensive goods and services. This helps shift consumption towards less emission-intensive substitutes. Box 1 explains the carbon pass-through mechanism in more detail.[8]

8 See Section 3 of Partnership for Market Readiness (2021) Carbon Pricing Assessment and Decision-Making: A Guide to Adopting a Carbon Price. World Bank, Washington, DC. Available at: hdl.handle.net/10986/35387 .

Box 1: How carbon pricing incentivises emissions reductions

Carbon cost pass-through generates an incentive throughout the production supply chain and the consumer decision-making process. Consider an industry with two firms producing the same product with one firm emitting a higher level of GHGs than the other. Both firms are assumed to face the same production costs, sell their product at the same price and, hence, earn equal profits. Now assume that a carbon price is implemented. This is illustrated in Figure 1 below.

Figure 1: Carbon cost pass-through mechanism



Option A

To maintain competitiveness against the low emissions firm, the high emissions can absorb the carbon cost, thereby reducing its profit margin.

Option B

Alternatively, the high emissions firm can pass the carbon cost onto its prices. Since consumers will face higher prices for the high emission firm's products, they are incentivised to switch to the low emission firm products

*Carbon cost = Carbon price x firm emissions

Outcome for firms

The firm with higher emissions faces a higher carbon cost. The high-emissions firm can either absorb the carbon cost (which would lower profit margins) or pass the cost through to consumers by raising prices (therefore losing market share to the firm with lower carbon cost). In the long run, it will be unsustainable for the firm to continue its operations without lowering its carbon costs. Firms covered by carbon pricing are therefore incentivised to switch to less emission intensive inputs or technologies. Less emission-intensive firms will see an increase in market share over time, while higher-emissions firms will lose market share.

Outcome for consumers

Firms may pass these carbon costs through to consumers, resulting in higher average prices for their product. Since emission-intensive firms face higher carbon costs, their products will become relatively more expensive than low-carbon products. This incentivises consumers to lower their consumption or switch towards low-carbon substitutes. For example, a carbon tax on fossil fuels will encourage consumers to drive less, or to switch from internal combustion engine (ICE) vehicles to electric vehicles.

Carbon pricing is a cost-effective way to incentivise mitigation. By targeting several sectors at once, carbon pricing provides a broad-based incentive for decarbonisation. This allows firms within the sectors to decide where and when emissions reductions would be cheapest and easiest, resulting in cost effective decarbonisation when compared to direct regulation. The reduction in emissions resulting from carbon pricing will depend on the availability of substitutes to emission-intensive production inputs and processes and consumption goods and services. This is discussed further in Section 3.

Emission trading systems (ETS) and carbon taxes are the two main types of explicit [9] **carbon pricing addressing emissions within a jurisdiction.**[10]

- **Emissions trading or cap-and-trade systems** set a fixed limit (or 'cap') on the total volume of GHG emissions generated by regulated industries in a jurisdiction. Emissions allowances are then allocated or auctioned to companies operating in those sectors. Typically, one allowance grants the right to emit one tonne of CO_2 equivalent (CO_2e)[11]. Firms can choose to reduce their own emissions or buy allowances from other firms on a secondary market created to trade allowances. However, total emissions by all covered sectors cannot exceed the cap. This dynamic establishes a market price for emissions which varies over time to balance supply of and demand for allowances.
- **Carbon taxes or levies** require economic actors to pay a fixed price for every tonne of GHG they emit. This provides a financial incentive for companies covered by the carbon tax to reduce their emissions to lower their tax burden. Generally, carbon taxes are easier to administer than ETSs. They do not involve the creation of a new market nor require enforcement rules to prevent market manipulation and can often be applied through existing fiscal taxation frameworks.[12] The costs of emitting are stable and predictable for businesses. However, unlike an ETS, taxes provide less certainty over the quantity of emissions reductions that will be achieved.

Hybrid carbon pricing instruments combine elements from both ETSs and carbon taxes. Many ETSs incorporate market stability measures such as price floors or ceilings to improve price predictability. However, these controls may reduce certainty of abatement outcomes if they result in the addition of allowances to the cap (to reduce price) or if allowances are subtracted from the cap (to increase prices). This type of instrument blurs the lines between ETSs and carbon taxes. Market stability measures are discussed further in section 3. Conversely, some jurisdictions with carbon taxes allow regulated entities to use carbon credits (also called 'offsets') to meet a share of their tax obligations. This introduces a 'market' element to the carbon tax, as the price

9 Some policies, such as low emissions zones, create implicit costs associated with emitting GHGs. The focus of this paper however is explicit carbon pricing policies, which put a direct financial cost on each tonne of GHG emitted.

10 Carbon border adjustment mechanisms (CBAMs), which put a carbon price on emissions intensive imports, price emissions generated outside of the policymaker's jurisdiction. They can operate alongside carbon taxes or ETSs and are discussed further in section 3.6.

11 Carbon dioxide equivalent or CO_2e means the number of metric tons of CO_2 emissions with the same global warming potential as one metric ton of another greenhouse gas.

12 Stiglitz, J. E., Stern, N., et al. (2017) Report of the High-Level Commission on Carbon Prices. Available at: static1.squarespace.com/static/54ff9c5ce4b0a53decccfb4c/t/59b7f2409f8dce5316811916/1505227332748/Carbon-Pricing_FullReport.pdf.

of carbon credits varies with supply factors. For example, in Colombia, firms covered by the carbon tax can meet up to 100% of their tax liability through carbon credits. Other examples of hybrid carbon pricing schemes include the UK with its carbon pricing floor, California, and Switzerland. The latter has a price ratchet function, where when emission reduction targets are missed, the floor carbon price increases. If targets are reached, the floor price stay constant.[13]

1.2 Status of carbon pricing globally and scaling required to reach net zero

The number of jurisdictions with carbon pricing instruments is growing significantly but not sufficiently. The World Bank notes that to date 68 countries, regions and states have implemented or scheduled implementation of carbon taxes and ETSs (see Figure 2). The share of global GHG emissions covered by a carbon price jumped from 15% in 2020 to 22% in 2021,[14] largely driven by the launch of China's national ETS in February 2021.[15] However, this pace is insufficient to align with Paris Agreement goals of limiting warming to well below 2°C and pursuing efforts to limit warming to 1.5°C.

International evidence suggests that carbon pricing does reduce emissions when appropriately designed and supported by the right enabling conditions. It can be complex to estimate emissions reductions resulting from carbon pricing instruments given the need to establish counterfactual emissions and account for potential carbon leakage. Nevertheless, the European Commission found that the EU ETS incentivised a 35% drop in emissions between 2005 and 2019.[16] Annual reductions since 2019 are likely to be even higher given the recent surge in EU carbon prices which are yet to be captured in recent studies. Evidence from the UK also suggests that carbon pricing has reduced emissions with one study finding that the UK carbon price reduced power sector emissions between 41% and 49% over the 2013–2017 period.[17]

Achieving the net-zero goals will require a transformation of carbon markets in coming decades, including more interplay between compliance and voluntary markets. While the expansion of carbon taxes and ETSs is crucial, voluntary markets for carbon credits can play a complementary role in incentivising emissions reductions and removals. Well-designed voluntary markets may support mitigation in jurisdictions and sectors that do not have the readiness to implement a compliance system.[18]

13 For further information on the Swiss carbon pricing scheme see ifo.de/DocDL/ifo-dice-2020-1-Hintermann-Zarkovic-Carbon-Pricing-in-Switzerland-A-Fusion-of-Taxes,Command-and-Control,and-Permit-Markets-spring.pdf

14 The World Bank (2021) State and Trends of Carbon Pricing 2021. Available at: openknowledge.worldbank.org/handle/10986/35620.

15 The Chinese ETS is the largest carbon market in the world, but it caps emission intensity (i.e., emissions per unit of GDP) rather than absolute emissions. Such a cap allows for GHG emissions to increase so long as emission intensity remains at or below the cap.

16 The European Commission (2021) EU Emissions Trading System (EU ETS). Available at: ec.europa.eu/clima/eu-action/eu-emissions-trading-system-eu-ets_enec.europa.eu/clima/eu-action/eu-emissions-trading-system-eu-ets_en#ecl-inpage-687.

17 Leroutier, M. (2019) Carbon Pricing and Power Sector Decarbonisation: the impact of the UK Carbon Price Floor. FAERE Policy Paper, 2019-03. Available at: faere.fr/pub/PolicyPapers/Leroutier_FAERE_PP2019_03.pdf.

18 Institute of International Finance (2021) Getting to Net Zero: The Vital Role of Global Carbon markets. Available at: iif.com/Portals/0/Files/content/Regulatory/10_26_2021_netzero.pdf.

2. Suggested best practice in carbon pricing design

The Alliance believes that realising net-zero goals will require jurisdictions to adopt robust carbon pricing measures as part of a mix of policy instruments including non-pricing instruments. Carbon pricing sends a broad price signal to the economy without prescriptively dictating when and where emissions reductions should occur. This enables market actors to implement the most cost-effective reductions. However, enabling policies are required to build momentum and lay the foundations for an effective carbon price. For example, a carbon price may incentivise consumers to switch away from polluting vehicles, but concurrent policies to develop charging infrastructure are required for a smooth and orderly transition to electric vehicles. This is discussed further in Section 3.

Additionally, the Alliance acknowledges that countries have very different starting positions which influence the choice and design of policies. In many cases, different policy instruments acting as implicit pricing on emissions are already in place.[19] Hence, the way forward to better emission regulation will vary by jurisdiction and must consider regional, national, and local circumstances. While many stakeholders prefer policy instruments such as a carbon tax or an ETS, all explicit and implicit carbon pricing instruments have benefits and challenges depending on the sectors covered, specific country context, and existing regulations.[20]

This section provides an overview of design principles to guide the development of a carbon pricing instrument that can deliver on net-zero targets. The instrument should:

- Ensure appropriate coverage and ambition (section 2.1)
- Deliver a just transition for society (section 2.2)
- Provide a predictable price signal (section 2.3)
- Minimise competitive distortions for firms (section 2.4)
- Promote international cooperation (section 2.5)

Some policy design choices may help achieve more than one of these objectives. For example, expanding the scope of the economic sectors covered by the carbon price not only ensures appropriate ambition, but it also helps increase the predictability of the price signal (broadening the range of mitigation options helps stabilise prices). This mapping of design decisions to the objectives they can help achieve is detailed in Table 1.

19 E.g., efficiency standards, technology phase-outs, support schemes like contracts for difference.

20 Cullenward, D. (2021) Making Climate Policy Work.resilience.org/stories/2021-02-24/making-climate-policy-work/

Table 1: Carbon pricing instrument design choices can contribute to several key objectives

Guiding principle	Design decisions			
Appropriate ambition	**Carbon tax rate or ETS cap** A higher carbon tax rate or a tighter ETS cap leads to higher carbon prices and hence incentivises more abatement		**Scope of coverage** A broader scope of coverage increases the number of entities (and therefore share of emission) that receive the carbon price signal	
Just transition	**Use of revenues** Revenues from carbon pricing instruments can be used to minimise negative distributional impacts		**Complementary policies** Policies additional to carbon pricing, such as re-skilling programs, can help deliver a just transition	
Price predictability	**Carbon tax rate or ETS cap** Steadily scheduled price increases allow for planning	**Scope of coverage** Increased availability of mitigation options stabilises ETS prices	**Market stability measures** Price floors and ceilings protect against extreme price volatility	**ETS linking** More participants and abatement options can increase liquidity and stability
Competitiveness	**Use of revenues** Revenues can be recycled to provide direct support to industries or invested in R&D	**Allowance allocation** ETS allowances can be allocated to targeted industries to maintain competitiveness and avoid carbon leakage	**Carbon border adjustment mechanisms** Import charges on emissions intensive goods from jurisdictions not covered by a carbon price can level the playing field	
International co-operation	**Carbon border adjustment mechanisms** Import charges on emissions intensive goods can incentivise their own carbon pricing	**ETS linking** Linking can increase collaboration between countries and help increase joint ambition	**Climate clubs** Coalitions of countries can encourage and provide incentives for high levels of participation and abatement	

2.1 Ensuring appropriate coverage and ambition

Two key elements that influence whether a carbon pricing instrument is compatible with climate targets are the ambition and coverage of the instrument. In an ETS, the ambition is dictated by the cap, and in a tax, by the price per tonne of GHG emissions. The coverage of an instrument refers to the countries, sectors, entities, and GHGs in scope of the carbon price.

Broadening and deepening carbon pricing coverage across jurisdictions and sectors is the next step in achieving Paris Agreement goals. Carbon pricing instruments should be implemented across more countries, such that a larger share of global emissions is covered. Furthermore, the scope of existing carbon pricing instruments should be expanded to cover more sectors, entities, and GHG emissions where feasible. Currently most jurisdictions cover industry, power, and buildings sectors, with only a few countries covering forestry and waste sectors. For example, the EU ETS covers power, industry and aviation encompassing approximately 57% of total GHG emissions in the jurisdiction.[21] The Chinese ETS also includes transport and buildings in addition to the aforementioned sectors. Figure 2 shows which sectors are covered by ETSs across different jurisdictions. While the scope of carbon taxes also differs by jurisdiction, easier implementation means that broader coverage is possible. Sweden's carbon tax, which has the highest rate in the world, covers about 40% of domestic emissions.[22] South Africa's tax, while set at a much lower rate, covers about 80% of domestic emissions.[23]

21 The World Bank (2020) State and Trends of Carbon Pricing 2020. Available at: openknowledge.worldbank.org/bitstream/handle/10986/33809/9781464815867.pdf

22 Tax Foundation (2020). Looking Back on 30 years of Carbon Taxes in Sweden. Available at taxfoundation.org/sweden-carbon-tax-revenue-greenhouse-gas-emissions/

23 Climate Transparency (2020). Climate Transparency Report: South Africa. Available at climate-transparency.org/wp-content/uploads/2020/11/South-Africa-CT-2020-Web.pdf

Figure 2: Sectoral coverage of Emission Trading Systems

	Power	Industry	Buildings	Transport	Domestic Aviation	Waste	Forestry
United Kingdom	●	●			●		
California	●	●	●	●			
China	●						
Chinese Pilots		●	●	●	●		
EU ETS	●				●		
Germany		●	●	●			
Kazakhstan	●						
Massachusetts	●						
Mexico	●	●					
New Zealand	●	●	●	●	●	●	●
Nova Scotia	●	●	●	●			
Quebec	●	●	●	●			
Republic of Korea	●	●	●		●	●	
RGGI	●						
Saitama		●	●				
Switzerland	●	●		●			
Tokyo	●	●			●		

Source: Partnership for Market Readiness; International Carbon Action Partnership (2021) Emissions Trading in Practice, Second Edition; Carbon Taxation in Sweden (2021); RGGI (2021).

Current carbon prices are below the levels required to limit global warming below 2°C, let alone 1.5°C. In 2017, a World Bank-supported High Commission on Carbon Prices led by Lord Nick Stern and Joseph Stiglitz concluded that a pathway well below 2°C would require significantly higher carbon pricing levels across major economies. The paper estimates that a price of USD 40–80 by 2020 and USD 50–100 by 2030 would be required.[24] Simon Dietz et al. (2018) estimated that median carbon prices of USD 85 by 2020 and USD 145 by 2030 would be required to limit warming to 1.5°C.[25] The OECD also reports a central estimate of USD 147 by 2030 to facilitate net-zero emissions by 2050.[26] The IPCC Sixth Assessment Report also found at a level of $80 per tonne is needed for alignment with

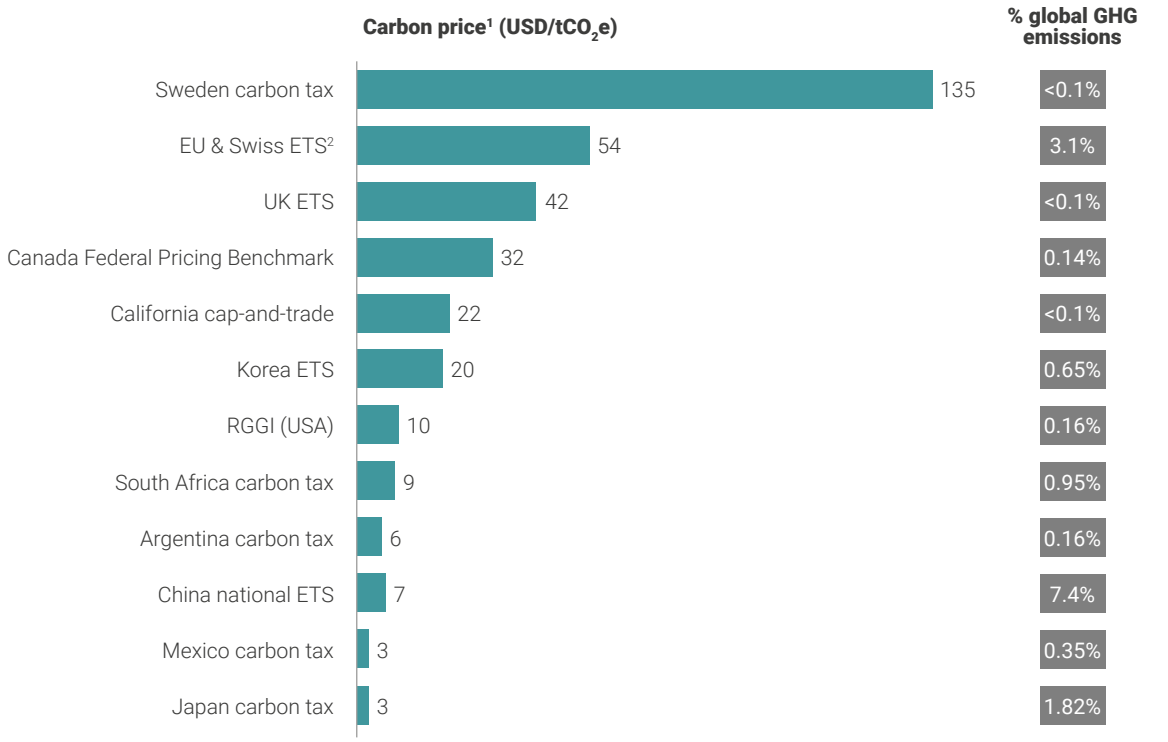
24 Prices in USD per tonne of CO_2. Stiglitz, J. E., Stern, N., et al. (2017) Report of the High-Level Commission on Carbon Prices. Available at: static1.squarespace.com/static/54ff9c5ce4b0a53decccfb4c/t/59b7f2409f-8dce5316811916/1505227332748/CarbonPricing_FullReport.pdf.

25 Prices in USD per tonne of CO_2. Dietz, S., Bowen, A., Doda, B., Gambhir, A., & Warren, R. (2018). The economics of 1.5 C climate change. Annual Review of Environment and Resources, 43, 455–480. Available at: annualreviews.org/doi/abs/10.1146/annurev-environ-102017-025817.

26 Prices in USD per tonne of CO_2. OECD (2021) Effective Carbon Rates 2021. Available at: oecd.org/tax/tax-policy/effective-carbon-rates-2021-brochure.pdf.

a 1.5°C mitigation pathway.[27] Although there are large uncertainties regarding the levels of carbon pricing required to deliver a particular temperature outcome,[28] in 2020, most carbon prices remained far below the USD 40–80 range. Only 4% of global GHG emissions were covered by a carbon price within or above this range.[29] Figure 3 illustrates current levels of carbon pricing in key jurisdictions.[30]

Figure 3: Current explicit carbon pricing level and coverage across leading economies



Notes: 1) Data presents average ETS auction prices, except for the China ETS price (as priced when launched in June 2021). Taxes are applicable as of April 2021. 2) The Swiss ETS has been fully linked with the EU ETS as of January 2020, therefore the carbon price under both systems are equivalent.

Source: International Carbon Action Partnership (ICAP) Allowance Price Explorer, World Bank Carbon Pricing Dashboard, Shanghai Securities News. Government Offices of Sweden.

Even in markets where instruments are operational, the effective carbon price across the economy varies considerably. This is also due to special exemptions from carbon pricing, free allocations of ETS allowances, and counteracting fossil fuel subsidies. For instance, in the 64 countries analysed by the OECD, the effective carbon price on electricity generation was below USD 37/tCO_2 for 90% of emissions. On the other end of the spectrum, 91% of road transport emissions were priced over USD 37/tCO_2, and 58% of emissions were above USD 147/tCO_2.[31]

27 IPCC Sixth Assessment Report Working Group III (2022) ipcc.ch/report/ar6/wg3/downloads/report/IPCC_AR6_WGIII_SPM.pdf

28 The level of carbon pricing required to deliver a particular temperature outcome depends on a number of factors, including the abatement technologies on which the temperature pathway is dependent and their expected costs.

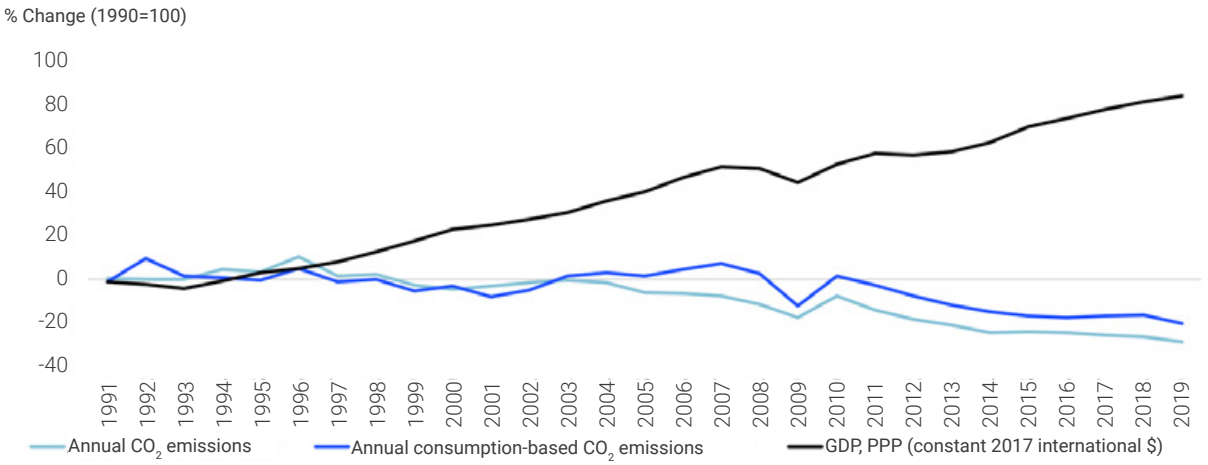
29 The World Bank (2021) State and Trends of Carbon Pricing 2021. Available at: openknowledge.worldbank.org/handle/10986/35620

30 Several jurisdictions have already scheduled increases in their carbon tax rates. For example, Canada has announced a plan to gradually increase its federal carbon tax from CAD 65/tCO_2e in 2023 to CAD 170/CO_2e by 2030.

31 OECD (2021) Effective Carbon Rates 2021. Available at: oecd.org/tax/tax-policy/effective-carbon-rates-2021-brochure.pdf.

Carbon price levels can be raised by tightening the ETS cap or increasing the carbon tax rate. A tighter ETS cap or a higher tax rate leads to higher carbon prices, thereby increasing investment in low-carbon technologies and incentivising more abatement. It can be helpful to raise ambition gradually and in a predictable manner to allow regulated entities time to learn and adjust to the carbon pricing instrument, as discussed further in section 2.3 on providing a predictable price signal. Singapore recently raised its carbon tax from USD 3.7 to USD 18.6/tCO_2 in 2024 with the aim of a progressive increase to USD 57/tCO_2e by 2030.[32] Sweden, the country with the highest carbon tax rate in the world, introduced a carbon tax at USD 28/tCO_2 in 1991. The tax rate was gradually increased to USD 130/CO_2.[33] Despite a strong increase in the tax rate, Sweden's GDP has grown by 84% whilst CO_2 emissions declined by 29% between 1990 and 2019.[34] This is illustrated in Figure 4.

Figure 4: Change in CO_2 emissions and GDP in Sweden



Source: Global Carbon Project, Swedish Environmental Protection Agency, Statistics Sweden

2.2 Delivering a just transition

To deliver a just transition,[35] carbon pricing instruments should be designed to minimise negative distributional impacts on communities and households. Carbon pricing is intended to accelerate the low-carbon transition across a wide range of sectors, markets, and businesses. Although this transition generates new investment opportunities, activities, and employment options, it may be regressive.[36] For example, an increase

32 Prices in USD per tonne of CO_2. National Climate Change Secretariat Singapore. Available at nccs.gov.sg/singapores-climate-action/carbon-tax/

33 Prices in USD per tonne of CO_2. Government Offices of Sweden, Sweden's carbon tax. Available at: government.se/government-policy/swedens-carbon-tax/swedens-carbon-tax/.

34 While this trend does not consider the counterfactual GDP growth in the absence of a carbon tax, it does show that strong environmental policies can go hand in hand with economic progress.

35 For more on just transition, please see International Labour Organisation's guideline on just transition ilo.org/global/topics/green-jobs/publications/WCMS_432859/lang--en/index.htm

36 McKinsey & Company (2022) The net-zero transition: What it would cost, what it could bring. Available at: mckinsey.com/business-functions/sustainability/our-insights/the-net-zero-transition-what-it-would-cost-what-it-could-bring

in energy bills because of carbon pricing will disproportionately impact lower income earners. Carbon pricing may have a greater economic impact on regions that are more reliant on emissions-intensive industries than other regions.

Revenues from carbon pricing instruments should be recycled to deliver a more equitable transition for society. Currently, more than 40% of carbon pricing revenues flow into the general budget of their respective jurisdictions.[37] Governments should consider using at least of part of the carbon pricing revenues to support disproportionally disadvantaged citizens. Box 2 details how carbon pricing revenues in California, the EU, and British Columbia have been used to mitigate negative distributional impacts. Policymakers may also need to complement effective carbon pricing design with additional policies to help ensure that the transition to a low-carbon economy is just (see Section 3).

Box 2: Case studies on revenue recycling

Many jurisdictions have used revenues from carbon pricing instruments to mitigate regressive distributional impacts:

- **California.** In the California cap-and-trade system, 35% of revenues are legally required to go towards projects that benefit disadvantaged and low-income communities and households.[38]
- **The EU.** As part of the latest phase of the EU ETS (2021 to 2030), part of the revenues from auctioning allowances are allocated to the Modernisation Fund. This fund aims to modernise energy systems in low-income member states, including through investments to redeploy and reskill workers in fossil fuel-dependent regions.[39] Additionally, the proposal for a second EU ETS to cover buildings and transport includes revenue recycling into a Social Climate Fund. The fund finances measures and investments that principally benefit low-income households, small companies, or transport users.[40]
- **British Columbia.** The tax was initially designed to be revenue neutral, redistributing all revenues back to British Columbian households and businesses.[41] This was done in the form of reductions in personal income and corporate tax rates, tax credits for lower-income households and small businesses, and benefit payments to rural and remote communities. Although the revenue neutrality requirement is no longer in effect, this feature of the tax helped minimise negative distributional effects. The clear communication of revenue neutrality also strengthened public support.[42]

37 I4CE (2020) Global Carbon Accounts 2020. Available at: i4ce.org/wp-core/wp-content/uploads/2020/05/TarificationCarbone2020-VA.pdf

38 World Bank (2019) Using Carbon Revenues: Annex to report: Case studies. Partnership for Market Readiness Technical Note No. 16. World Bank, Washington, DC. Available at: openknowledge.worldbank.org/bitstream/handle/10986/32247/UsingCarbonRevenuesAnnexCaseStudies.pdf?sequence=3&isAllowed=y Further analysis is also available here: climate-xchange.org/wp-content/uploads/2018/08/Carbon-Pricing-in-a-Just-Transition-Final-Website.pdf

39 European Commission, Modernisation Fund. Available at: ec.europa.eu/clima/eu-action/funding-climate-action/modernisation-fund_en.

40 European Commission, Social Climate Fund. Available at: ec.europa.eu/clima/eu-action/european-green-deal/delivering-european-green-deal/social-climate-fund_en.

41 The requirement for revenue neutrality was eliminated in 2017 and no longer in force from 2018.

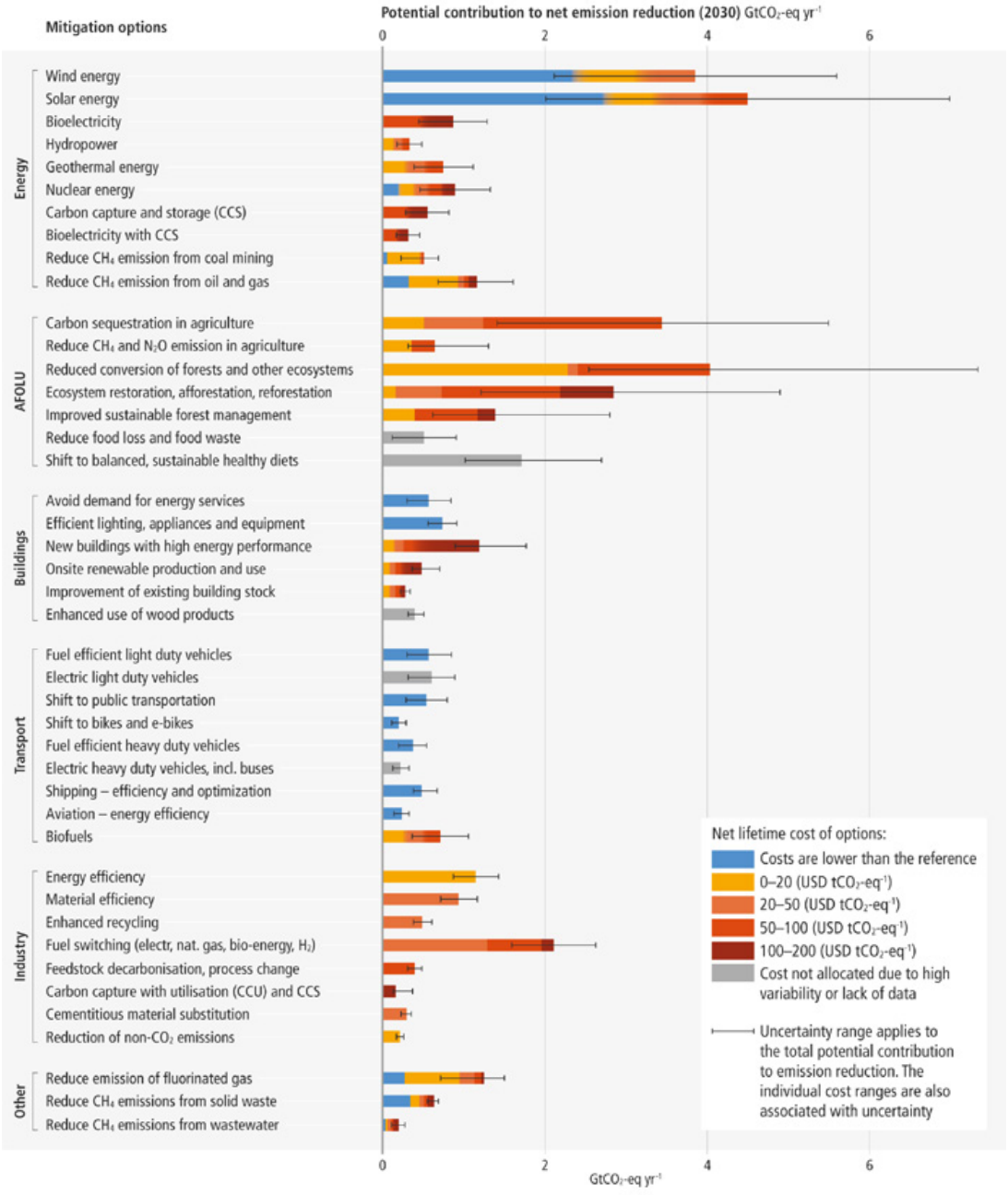
42 World Bank (2019) Using Carbon Revenues: Annex to report: Case studies. Partnership for Market Readiness Technical Note No. 16. World Bank, Washington, DC. Available at: openknowledge.worldbank.org/bitstream/handle/10986/32247/UsingCarbonRevenuesAnnexCaseStudies.pdf?sequence=3&isAllowed=y.

2.3 Providing a predictable price signal

A predictable carbon price signal allows for planning and investment in low-carbon technologies. A clear price signal provides companies and investors with greater certainty regarding future price levels for efficient capital allocation. It also creates stable and reliable incentives for investors, companies, and consumers to adopt or develop low or zero-emission technologies or practices.

The actual prices needed in the year 2030 for many abatement options is relatively low, ranging from USD 0–50 per tonne of CO_2e, as was demonstrated in the contribution of Working Group 3 to the IPCC's Sixth Assessment Report.

Figure 5: Overview of mitigation options and their estimated range of costs and potentials in 2030



Source: IPCC (2022): Assessment Report 6 – Working Group 3 – Summary for Policy-Makers SPM-7

Carbon taxes should be designed to have a steadily increasing rate, providing stakeholders with time to adjust. Policymakers can decide on a pathway for the tax rate to follow over time. A gradually increasing tax rate creates a predictable price signal, increasing the acceptance of a tax and, hence, its overall effectiveness. For example, British Columbia and Singapore both publicly announced the carbon tax schedule in advance, providing businesses with a clear and reliable future trajectory.[43]

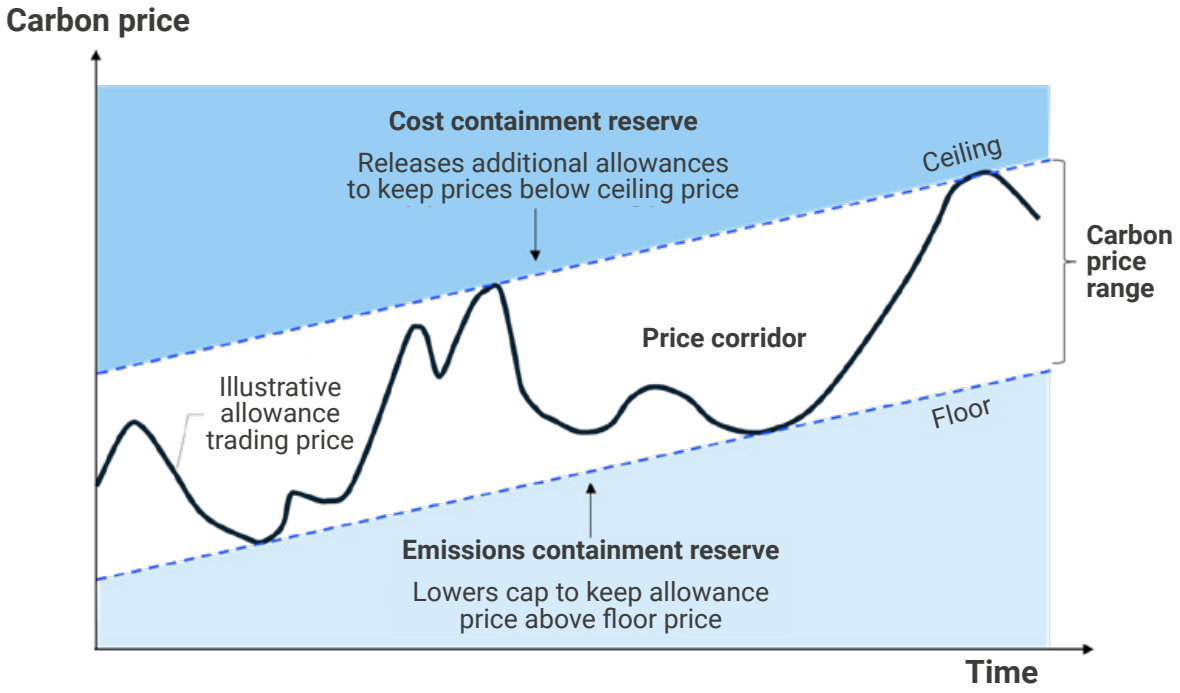
ETSs, which have varying prices by design, can include market stability measures like price corridors to avoid extreme prices. The adoption of market stability measures to minimise excessive price fluctuations in ETSs is now common practice (as discussed further in Box 3). There are several design options available to minimise excessive price volatility in ETSs, including auction reserve prices, cost containment reserves, hard price floors and/or ceilings.

Price-based market stability measures help provide greater certainty regarding price levels. A minimum market price (price floor) in an ETS can provide protection against a price crash due to an oversupply of allowances and offers greater certainty to investors and companies on carbon price. Carbon floor prices can be implemented through emission containment reserves, auction reserve prices (e.g., New Zealand, Québec) and/ or direct taxation (e.g., UK).[44] A maximum market price (price ceiling) can protect firms and consumers against rapid increases in carbon costs, limiting negative impacts that undermine political support for carbon-pricing. A carbon price ceiling can be implemented through a cost containment reserve from which allowances can be released into circulation when a maximum price threshold is reached (e.g., Canada, Republic of Korea). The implementation of both a carbon price floor and ceiling results in what is known as a carbon price corridor. If policy ambition is ratcheted over time (e.g., through the tightening of the ETS cap), the price corridor follows an upward trend, as illustrated in Figure 6 below.

43 In 2008, British Columbia set its carbon tax at a relatively low rate of CAD 10/tCO_2e (c. USD 8) and announced that it would increase by CAD 5/tCO_2e until 2012. The carbon tax is scheduled to reach CAD 50/ tCO_2e (c. USD 40) in April 2022. Similarly, Singapore has announced that its carbon tax, currently at SGD 5/tCO_2e (c. USD 3.7), will increase to SGD 25/tCO_2e (c. USD 18.6) in 2024 and SGD 80/tCO_2e by 2030.

44 Jurisdictions can impose additional charges to ensure that the overall carbon price faced by covered entities remains above a minimum threshold. For example, in 2013, the UK implemented a carbon tax on fossil fuel powered generation which acts as a carbon price floor for the electricity sector.

Figure 6: Illustration of a carbon price corridor



Source: Glitman (2019) Cap and invest: a review of policy, design and models and their applicability in Vermont, Centre for Sustainable Energy, San Diego.

Quantity-based measures help minimise excessive price volatility by adjusting the supply of emission allowances in an ETS. Quantity-based measures aim to manage the number of allowances in circulation by adjusting the supply of allowances. They increase price certainty by improving the balance between supply and demand, creating lower and upper bounds for future price expectations. Although most jurisdictions have adopted price-based triggers, the EU ETS follows a quantity-based trigger. A quantity-based measure can be easier to implement as it does not require consensus over the appropriate price levels. Box 3 provides further detail.

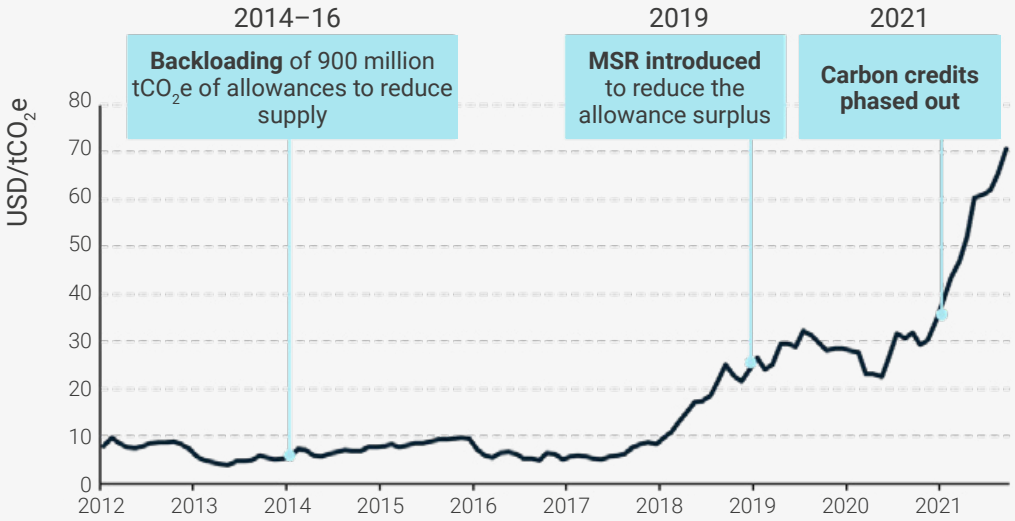
Box 3: Case study on the EU ETS Market Stability Reserve

The surplus of allowances in the EU ETS resulted in low carbon prices and, hence, a weak incentive to reduce emissions. From 2009, a surplus of emission allowances built up in the EU ETS, amounting to over 2.1 billion allowances in 2013. This surplus can largely be explained by the economic crisis (resulting in lower baseline emissions than expected) and high levels of inexpensive carbon credits used to meet compliance obligations.

Quantity-based measures including backloading and the market stability reserve (MSR) were implemented to improve the carbon price signal. In the short-term, the European Commission postponed the auctioning of 900 million allowances between 2014 and 2016, known as backloading of auction volumes. The aim was to rebalance supply and demand in the short term and reduce price volatility. As a long-term solution, the European Commission introduced the MSR which began operating in 2019. The MSR automatically adjusts the number of allowances to be auctioned depending on the surplus of allowances in the market.

The MSR has been effective in helping the EU ETS prices rebound. The backloading of allowances and the MSR have helped reduce the surplus of allowances in the EU ETS. Since it began operating, the MSR has contributed to the resilience of the system, including following the COVID-19 economic shock,[45] helping provide a more predictable price signal to incentivise cost-efficient emission reductions. This is illustrated in Figure 7.

Figure 7: Impact of market stability measures on prices in the EU ETS



45 European Commission (2021) Review of the EU ETS market stability reserve: final report.

2.4 Minimising competitive distortions

Carbon pricing instruments, if not designed well, may lead to loss of competitiveness for companies and carbon leakage. Firms facing high carbon costs can lose market share when competing against entities which are either not covered by a carbon pricing instrument or face a much lower carbon price. To avoid this, these firms may move production to a jurisdiction without a carbon price (or with a lower carbon price) to reduce their carbon costs. This is known as carbon leakage. Carbon leakage undermines the effectiveness of carbon pricing because total global emissions are not reduced, merely shifted from one country to another. Companies are more likely to move production if their compliance costs are high and if they cannot pass these through to consumers because they face competition from international firms which do not have to incorporate carbon costs. Hence, the risk of carbon leakage is greatest for firms that are emission-intensive and trade-exposed (EITE).[46]

Carbon pricing instruments can be designed to protect companies against loss of competitiveness and minimise carbon leakage. Policymakers can minimise these risks through the following design choices:

- **Revenue recycling:** Policymakers can use revenues raised from the carbon tax or auctioning of allowances in an ETS to minimise the impact of carbon pricing on the competitiveness of companies. For example, carbon tax revenues have been used to reduce employer pension and social insurance contributions in Denmark and Finland and to reduce corporate income taxes in France.[47]
- **Allocation of allowances under ETSs:** The methodology used to allocate emission allowances can help minimise competitive distortions and carbon leakage.[48] Providing free allowances to EITE sectors reduces their overall carbon costs and, hence, the impact on their competitiveness. Because excess allowances can be sold at a profit, this method still maintains the incentive to decarbonise.[49] However, auctioning of allowances is preferred for sectors less at risk of carbon leakage because it raises revenues, contributes to price discovery, and may also provide a stronger decarbonisation incentive.
- **Carbon Border Adjustment Mechanisms (CBAMs):** CBAMs are import charges on carbon intensive goods from jurisdictions without a carbon price. The charge is levied based on a measure of the goods' carbon content (see Figure 8). CBAMs help level the playing field between domestic and non-domestic producers, thereby reducing the risk of carbon leakage, as well as incentivising the other jurisdiction to imple-

46 In trade exposed sectors, firms that are subject to a carbon price domestically will face stiff price competition from foreign firms who are not subject to a carbon price (or to a lower carbon price). To remain price competitive, domestic firms may not be able to fully pass on their carbon costs to consumers.

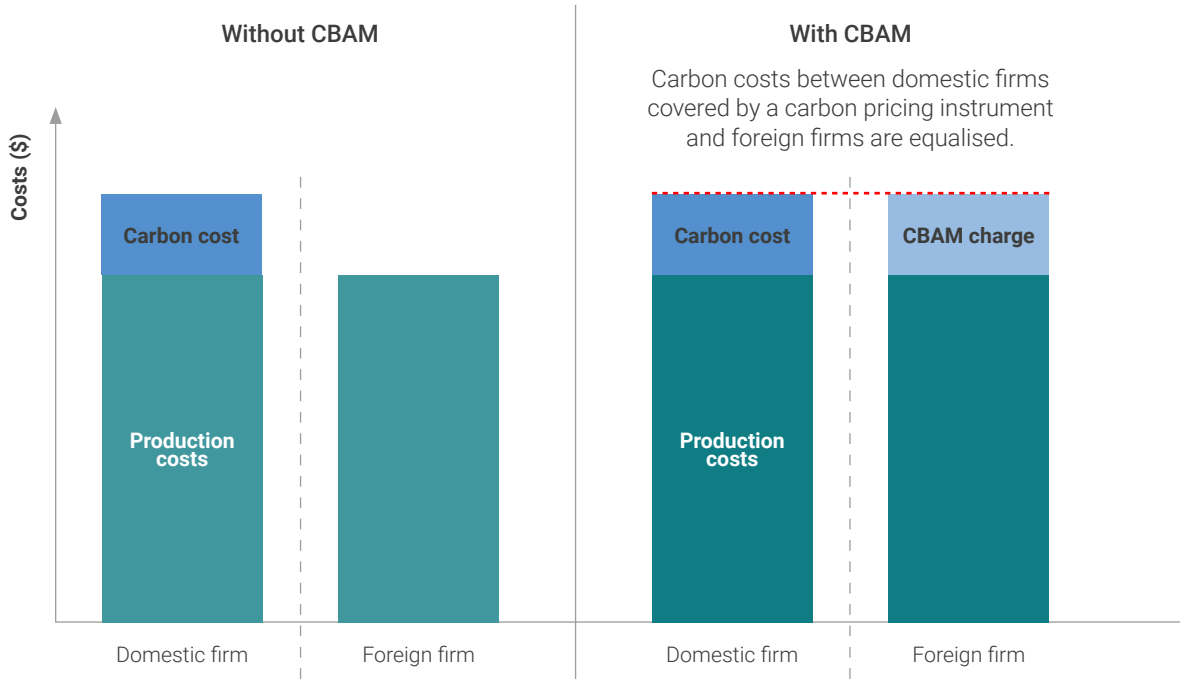
47 Partnership for Market Readiness (2017) Carbon Tax Guide: A Handbook for Policy Makers. World Bank, Washington, DC. Available at: hdl.handle.net/10986/26300.

48 The choice of allowance allocations in ETS design is discussed in detail in Step 5 of Partnership for Market Readiness and International Carbon Action Partnership (2021) Emissions Trading in Practice, Second Edition: A Handbook on Design and Implementation. Available at:. hdl.handle.net/10986/35413

49 The incentive to decarbonise is protected as companies that reduce their emissions can earn revenues by selling the emission allowances they were allocated for free.

ment a carbon price of its own. The benefits and key design principles of CBAMs are discussed further in Box 4. To accelerate emissions reductions while promoting market efficiency and harmonisation, the Group of Seven (G7) and Group of 20 (G20) major economies should align on a potential introduction of CBAMs, especially since the European Union is aiming to introduce them soon.

Figure 8: Illustrative example of CBAM

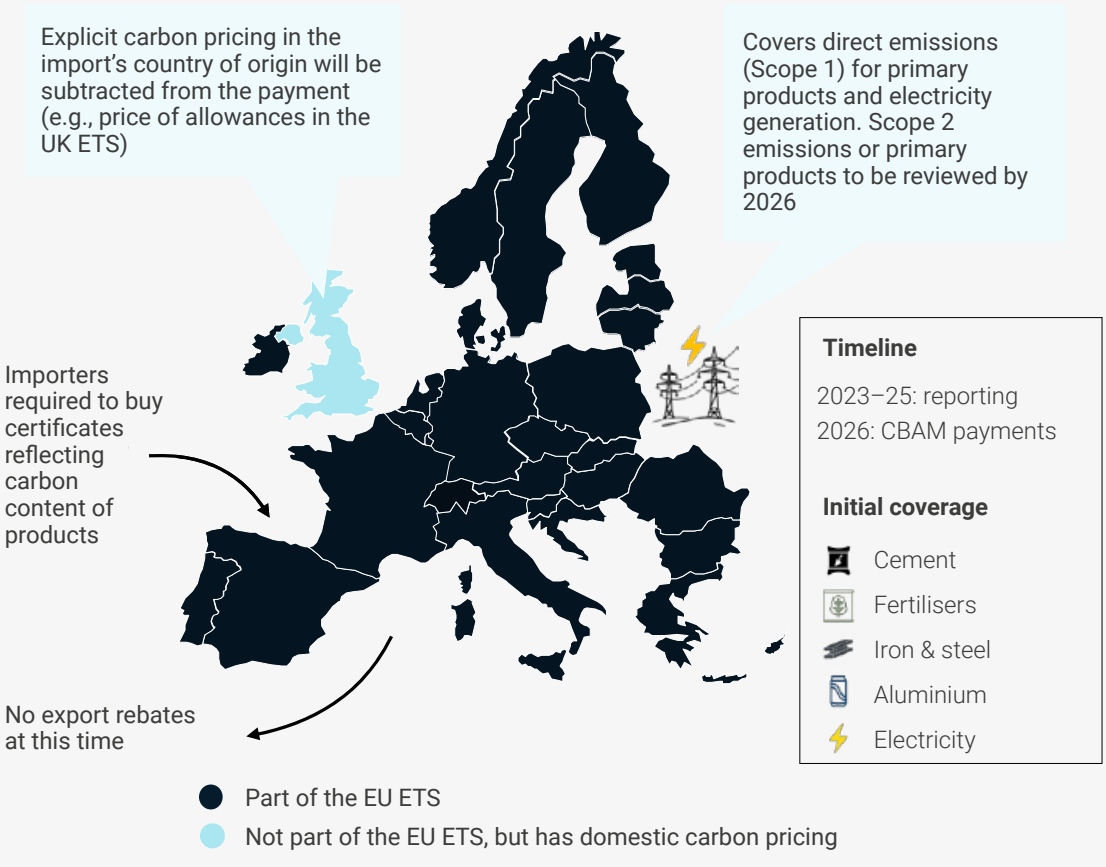


Box 4: Overview of CBAMs and key considerations

Jurisdictions are increasingly considering CBAMs given their triple benefit: mitigating competitiveness impacts, boosting the carbon price signal to domestic consumers, and raising international climate ambition. Although California is the only jurisdiction with a CBAM in place, other jurisdictions such as Canada, Japan, and the EU are considering CBAMs.

- **Minimising competitive distortions and carbon leakage:** By imposing a cost on imports from jurisdictions without or with a lower carbon price, CBAMs can help level the playing field between domestic and non-domestic producers. California, for example, implemented a CBAM on electricity imports. This is a key complementary policy to California's ETS as the state's power sector is highly interconnected with other jurisdictions and imports a large share of its electricity.
- **Increasing domestic decarbonisation:** A CBAM can lead to greater decarbonisation domestically if it replaces free allowance allocations, which weaken the carbon price signal relative to the auctioning of allowances. For example, the EU is proposing to phase out free allowances in favour of a CBAM (see Figure 9).[50]
- **Raising international climate ambition:** CBAMs can incentivise other jurisdictions to implement carbon pricing to avoid paying a border charge on exports and earn carbon revenues instead.

Figure 9: Illustration of the proposed EU CBAM



50 The proposed CBAM would require EU importers to buy carbon certificates corresponding to the price of allowances under the EU ETS. If a carbon price has already been paid for the production of the imported goods in a third country, the EU importer can deduct this cost.

Nevertheless, CBAMs are complex and need to be designed cautiously, following key principles. The Alliance supports the implementation of well-designed CBAMs.

- **CBAMs should be designed to cover material sectors at high risk of carbon leakage** (EITE sectors). Covering sectors which produce relatively homogenous products is also desirable initially, to minimise the administrative burden.[51] With this principle in mind, the EU is proposing to apply the CBAM to iron and steel, cement, fertiliser, aluminium, and electricity.[52]
- **CBAMs should be implemented gradually to allow stakeholders to adjust,** particularly considering the relative nascency of such policies. A phased approach allows time for regulating entities to build capacity, for data to be collected, for businesses to adjust to the new requirements, and for trading partners to address concerns or implement carbon prices of their own. The EU has planned for the CBAM to be phased in gradually, with a transitional phase between 2023 and 2025, and importers expected to start paying the carbon border adjustment in 2026.[53]
- **CBAMs should comply with World Trade Organisation (WTO) rules and other international obligations.** CBAMs can impact global trade patterns and therefore need to comply with WTO rules. For example, CBAMs should not favour domestically produced goods (e.g., by maintaining free allocations whilst imposing a charge on imports) and should not discriminate against any individual trading partner (although some exemptions for least developed countries and small island developing states are discussed). In developing the CBAM proposal, the EU ensured that its design complied with the WTO rules and other international obligations, and consulted widely with a broad range of stakeholders, including third countries which will be impacted by the policy.[54]

2.5 Promoting international cooperation

International cooperation through carbon pricing can reduce the cost of mitigation actions and raise climate ambition.[55] Governments can promote international cooperation on carbon pricing in several ways, including through the mechanisms outlined under Article 6 of the Paris Agreement, ETS linking, and climate clubs.

There are several fora to influence global climate ambition, the key one being the United Nations Framework Convention on Climate Change (UNFCCC) negotiations, which resulted in the Paris Agreement. Article 6 of the Agreement outlines mechanisms to support voluntary international cooperation on carbon markets, as illustrated in Figure 11 below. Although Parties reached agreement on the implementing rules for the three elements of Article 6 at the UNFCCC's 26th Conference of the Parties (COP26), several aspects remain to be defined, creating uncertainty for investments in mitigation projects.[56]

51 This eases the administrative burden on the number and complexity of products for which to establish definitions, MRV rules, and carbon intensity reference values.

52 European Commission (14 July 2021) Carbon Border Adjustment Mechanism: Questions and Answers. Available at: ec.europa.eu/commission/presscorner/api/files/document/print/en/qanda_21_3661/QANDA_21_3661_EN.pdf.

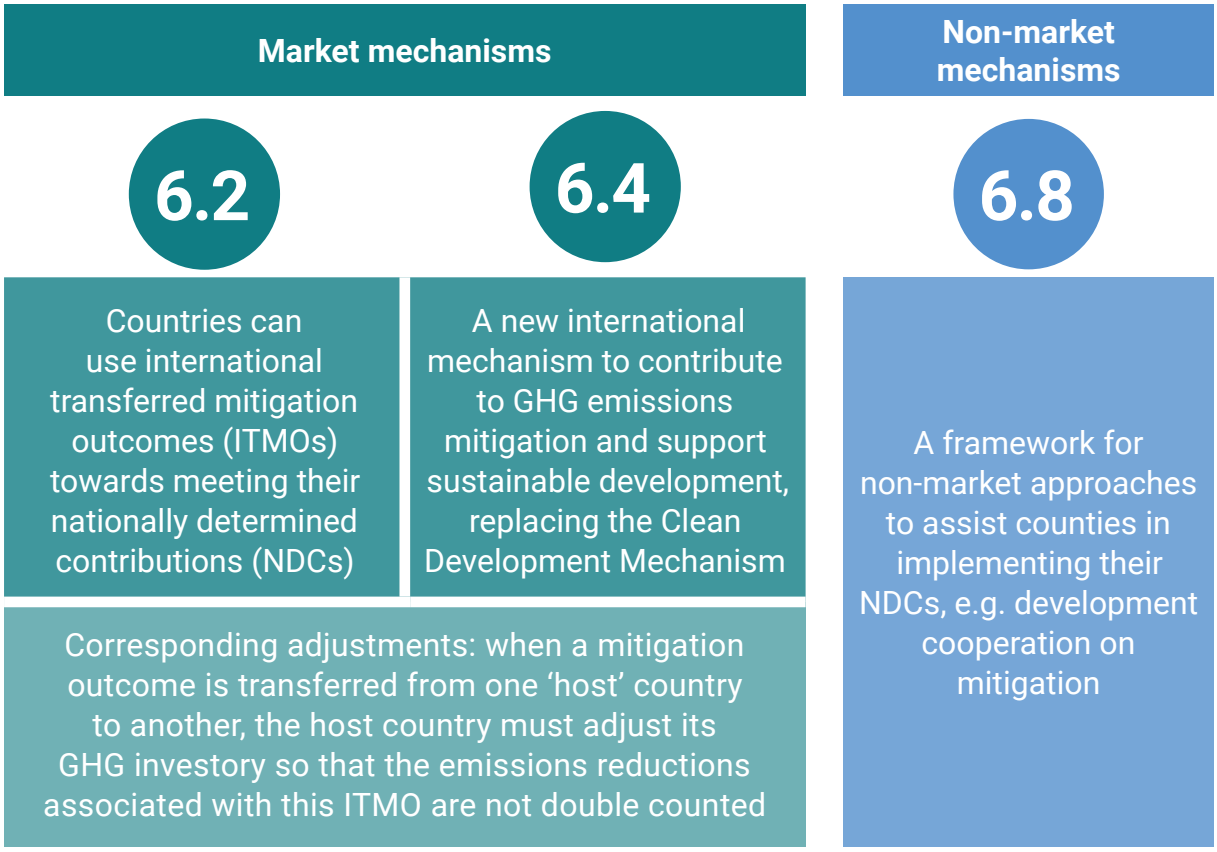
53 European Commission (14 July 2021) Carbon Border Adjustment Mechanism: Questions and Answers. Available at: ec.europa.eu/commission/presscorner/api/files/document/print/en/qanda_21_3661/QANDA_21_3661_EN.pdf.

54 European Commission (14 July 2021) Carbon Border Adjustment Mechanism: Questions and Answers. Available at: ec.europa.eu/commission/presscorner/api/files/document/print/en/qanda_21_3661/QANDA_21_3661_EN.pdf.

55 World Bank (2019) State and Trends of Carbon Pricing 2019. Available at: hdl.handle.net/10986/31755

56 For example, it is unclear whether and, if so, which CDM and independent standard methodologies and projects will be accepted under Article 6. Clarity is also still needed regarding how reductions from hosted activities will be accounted for in NDCs.

Figure 10: Mechanisms for international cooperation under Article 6 of the Paris Agreement



Climate clubs aim to foster climate ambition, but they can take a variety of forms in practice. In January 2022, Germany announced that it would use its presidency of the G7 to push for the establishment of a global climate club which promotes international cooperation. A climate club can be defined as a coalition of countries organised to encourage high levels of climate ambition by providing positive incentives to join the club and/or penalties for non-members. Positive incentives may include knowledge and technology sharing, financing and trade gains while penalties could include CBAMs.[57]

For example, the EU could be perceived as a form of climate club with shared decarbonisation goals, participation benefits including financial support and CBAMs to level the playing field and encourage non-members to increase ambition. Box 5 below puts forward a set of principles for international climate clubs.

57 Falkner, R., Nasiritousi, N., & Reischl, G. (2021) *Climate clubs: politically feasible and desirable?*, Climate Policy, 1–8.

Box 5: Proposed set of principles for international climate clubs

Establishing a set of key principles can help ensure that climate clubs are effective. Although climate clubs could vary significantly including in terms of their objectives, membership, and rules, a specific set of principles can help guide their design and operation.

- **The climate club should be underpinned by clear objectives and theory of change.** This will, in turn, inform the design of incentives to participate in the club and help hold members accountable. This should include the consideration of the impact of their policy on other countries, most notably the less-developed countries. By this, not only intra-societal and intergenerational equity should be addressed but also international equity.
- **Incentives should be established to maintain and enhance club membership.** These can include knowledge sharing, financing, and trade gains. Implementing measures that put non-members at a disadvantage can also motivate countries to join climate clubs.
- **Governance measures should include a well-defined and transparent framework for oversight, decision-making and enforcement.** This can help promote accountability for members and make the club more flexible to respond to changing circumstances.

Jurisdictions may also cooperate through ETS-linking, which can reduce the costs of emissions reduction and enable greater climate ambition globally. Linking of ETSs means that entities covered by one ETS can use allowances from another, linked ETS to meet their compliance obligations. ETS linking improves cost-effectiveness, liquidity, and price stability. It can also help countries jointly raise ambition. The Swiss ETS only covered a small number of entities and was developed with the intention of eventually linking to the much larger EU ETS. This linking took place in January 2020. Nevertheless, ETS linking remains limited to neighbouring countries and similar jurisdictions as it is complex and can present economic and political risks. It therefore requires careful design and thoughtful collaboration.

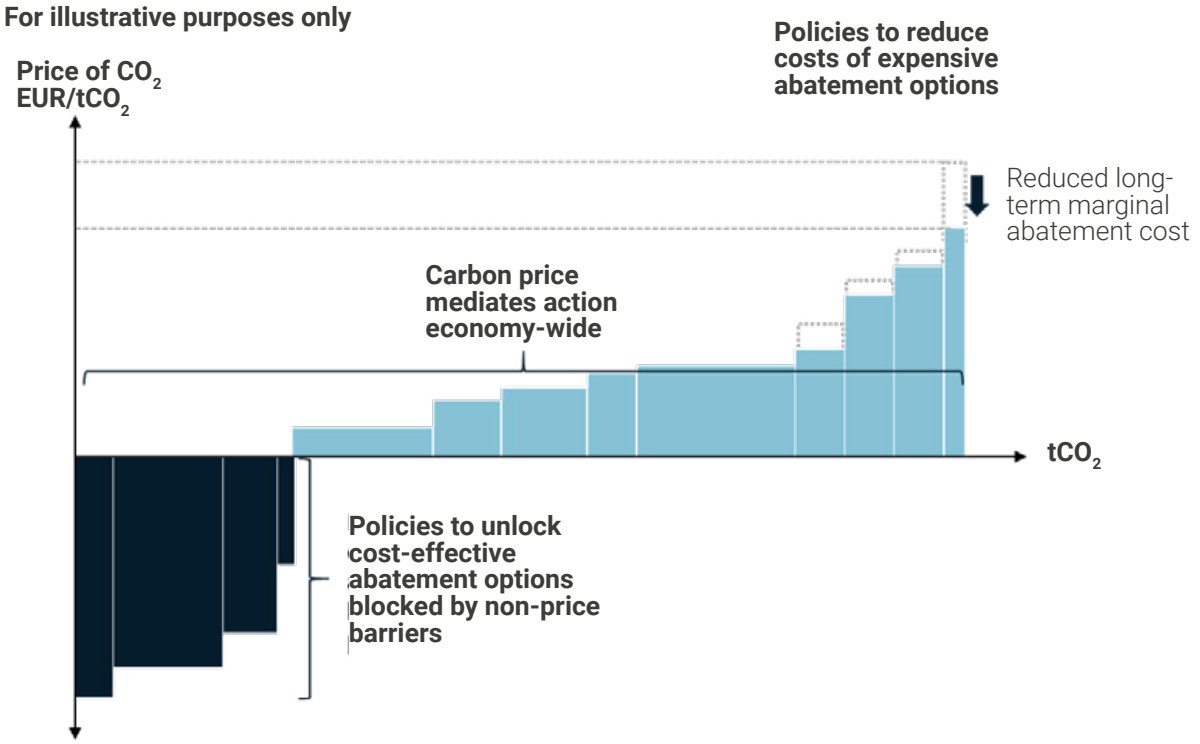
3. Carbon pricing within a net-zero policy mix

While carbon pricing has significant benefits, it is not sufficient to transform the economy to align with a Paris-compliant trajectory. The scale and pace of the change required, particularly for a 1.5°C pathway, must be supported by a mix of policy instruments beyond carbon pricing.

3.1 Enabling policies

Enabling policies are required to lay a foundation for effective carbon pricing. Carbon pricing leads to emissions reductions by incentivising companies and consumers to switch to less emission-intensive production and consumption patterns. However, in some cases, policies are needed to ensure that companies and consumers are both able and willing to switch to low-carbon substitutes. Figure 11 below illustrates the mix of policies required to incentivise the adoption of different abatement options.

Figure 11: A mix of policies is required to incentivise the uptake of different abatement options



Source: Vivid Economics based on Hood, C. (2013). *Managing interactions between carbon pricing and existing energy policies. Guidance for Policymakers.*

Policies are needed to support the development of low-carbon substitutes. In the absence of affordable substitutes, companies and consumers cannot adjust their production and consumption to reduce emissions in response to carbon pricing. However, a carbon price alone is unlikely to drive the pre-commercial development of innovative technologies which typically require large upfront capital. Complementary policy measures are therefore needed to incentivise research and development (R&D) investments. The EU for example has several dedicated funding sources to scale low-carbon technologies.[58] Governments may also use incentives such as contracts for difference to make these investments more financially attractive.

Additional policies may be needed to subsidise investment in abatement technologies that remain prohibitively expensive in the short to medium term. For example, governments may choose to use carbon contracts for differences (CCfDs). Under a CCfD, investors are guaranteed that if the carbon price falls below the cost of the abatement technology they are investing in (i.e., it would have been cheaper for the firm to pay the carbon price than investing in the technology), the government will make up the difference.[59]

Policies are also needed to overcome non-price barriers that prevent switching to low-carbon substitutes. Even when affordable low-carbon substitutes are available, non-price barriers can inhibit their take-up. For example, the lack of information regarding emission levels from different technology options, the lack of access to capital to invest in abatement options (e.g., energy efficient technologies and infrastructure), as well as behavioural barriers can prevent carbon pricing from being effective. Similarly, for carbon pricing to be effective, the infrastructure and skilled workforce required to support low-carbon substitutes (e.g., charge points for electric vehicles) need to be in place. Box 6 provides an overview of these enabling policies using the example of the EU buildings sector.

58 Horizon Europe funds low-carbon technologies from proof of concept to pilot, the Innovation Fund helps these technologies move from pilot to scale up, and the InvestEU fund supports them from scale up to roll out. European Commission, Policy Development. Available at: ec.europa.eu/clima/eu-action/funding-climate-action/innovation-fund/policy-development_en.

59 ICF Consulting Services Limited & DIW Berlin (2020) Industrial Innovation: Pathways to deep decarbonisation of Industry. Available at: ec.europa.eu/clima/system/files/2020-07/industrial_innovation_part_3_en.pdf.

Box 6: Policy mix to decarbonise the EU buildings sector

The European Commission (EC) has proposed a broad suite of policies, including an ETS, to decarbonise buildings and road transport. The proposed stand-alone ETS aims to achieve a 43% reduction in emissions in these by 2030 (compared to 2005).[60]

Policies which will enable the proposed ETS include:[61]

- **Financing for research and development of low-carbon substitutes.** Horizon Europe, the EU's funding programme for research and innovation to tackle climate change, includes a specific cluster focusing on energy efficiency in buildings.[62]
- **Implementation of energy performance standards to overcome behavioural barriers and lack of information.** The EU strategy will implement energy performance standards for buildings as well as disseminate information on the energy performance of buildings to consumers through energy performance certificates.
- **Improving access to capital.** The EU has set out frameworks to co-finance and de-risk investments in energy efficiency in order to attract private capital.[63, 64]
- **Providing technical assistance.** To ensure the workforce can implement abatement projects such as buildings renovations, the EU will provide technical assistance to relevant authorities and training for workers.

In some cases, market distortions also need to be resolved for carbon pricing to be effective. In markets where prices are controlled, such as in regulated electricity markets, the carbon price signal may be muted or non-existent because the carbon cost cannot be reflected in energy prices. Similarly, fossil fuel subsidies (whether through the direct transfer of funds, price supports, or tax benefits) provide perverse incentives, increasing GHG emissions. Several G20 countries are simultaneously subsidising fossil fuels and renewables whilst taxing carbon, policies which have countervailing effects. In 2009, G20 countries pledged to phase out fossil fuel subsidies, a move that investors have long supported. Yet, 13 years on, this pledge is still to be implemented.

60 European Commission (14 July 2021) Questions and Answers—Emissions Trading—Putting a Price on carbon. Available at: ec.europa.eu/commission/presscorner/detail/en/qanda_21_3542.

61 European Commission, Renovation Wave: doubling the renovation rate to cut emissions, boost recovery and reduce energy poverty. Available at: ec.europa.eu/commission/presscorner/detail/en/IP_20_1835.

62 European Commission, Current funding: Leveraging energy efficiency investments via tailored instruments and project development assistance. Available at: energy.ec.europa.eu/topics/energy-efficiency/financing/eu-programmes/current-funding_en.

63 European Commission, De-risking investments. Available at: energy.ec.europa.eu/topics/energy-efficiency/financing/de-risking-investments_en.

64 European Investment Bank, Private Finance for Energy Efficiency (PF4EE). Available at: eib.org/en/products/mandates-partnerships/pf4ee/.

3.2 Complementary policies to reach net zero

Well-designed carbon pricing instruments should be augmented with policies that facilitate a just transition. The transition to a low-carbon economy generates new investment opportunities, activities and employment options, but may also have distributional effects on different groups and regions globally.[65] These negative distributional effects must be addressed both through careful design of carbon pricing instrument itself (see section 2), as well as through complementary policies. For example, carbon pricing can be supplemented by the provision of training programs to reskill workers in emission-intensive sectors and investments to support the revitalisation of fossil fuel dependent regions.[66] Without these additional policies, net-zero efforts could result in large social costs.

Policies are needed to incentivise emission reductions where carbon pricing is not a feasible or optimal policy. It is not always practical to implement carbon pricing instruments. For example, GHG emissions across the agricultural sector are spread across many small emitters. As a result, the monitoring, reporting, and verifying of emission reductions in the sector is complex to administer, making the implementation of carbon pricing difficult and costly. There may also be social and political barriers to the implementation of carbon pricing instruments in certain jurisdictions or sectors. For example, there may be a lack of public acceptance or conflicting policy goals. Other policies are needed to reduce emissions where carbon pricing instruments face these types of complexities.

65 McKinsey & Company (2022) The net-zero transition: What it would cost, what it could bring. Available at: mckinsey.com/business-functions/sustainability/our-insights/the-net-zero-transition-what-it-would-cost-what-it-could-bring

66 Inevitable Policy Response (2019) Why a just transition is crucial for effective climate action. Available at: unpri.org/download?ac=7092#:~:text=The%20Just%20Transition%20is%20Key,long%2Dterm%20interests%20of%20society.

Investment Leadership Programme

UN-convened Net-Zero Asset Owner Alliance

unepfi.org/net-zero-alliance/

In partnership with: