**Carbon Market Platform**

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# *Designing Carbon Pricing Instruments for Ambitious Climate Policy*

***Discussion paper***

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# Table of Contents

## Summary

Proposed national actions to mitigate climate change, embodied by Nationally Determined Contributions (NDCs), are widely understood to be collectively insufficient to achieve the ambitious goals of the Paris Agreement. Carbon pricing has long been recognised as a cost-effective means to reduce greenhouse gas (GHG) emissions. It is therefore an important part of the toolkit available to policy makers, both to achieve current NDCs at least cost and to encourage greater ambition in future.

The design of carbon pricing systems is important to ensure they provide strong and long-lived investment incentives and are effective at driving emissions reductions. But even well-designed systems are unlikely to drive the deep economic and technological transformation required by the Paris Agreement. Complementary policy measures are necessary, for example to accelerate technology innovation and overcome behavioural barriers.

There has been a recent trend towards increased carbon pricing around the world, whether through tradable permits or taxes. However, coverage remains patchy and prices have generally been too low to provide strong investment incentives. To explain why the potential of carbon pricing has not yet been met, a range of political and technical barriers can be identified, as well as strategies to help overcome them. Barriers to carbon pricing relate both to the specific design of the pricing system and to broader misalignments with other policies that may run counter to the goals of carbon pricing and render it less effective.

Barriers specific to pricing systems include concerns over industrial competitiveness, impacts on poorer households and constraints on government capacity for implementation. Overcoming these barriers requires good system design (including revenue recycling), enhanced international co-operation and support for innovation. One form of international co-operation is linking of carbon pricing mechanisms to increase coverage and to ease competitiveness concerns by exposing international competitors to the same carbon price. However, the diversity of NDCs and national circumstances may lead to widely differing carbon prices and levels of ambition, meaning that linking can be challenging and should be pursued with care. Broader policy misalignments can occur right across the policy spectrum in areas such as tax, financial regulation and land planning. Examples include fossil-fuel subsidies and design of electricity markets.

The Carbon Market Platform can play an important role to facilitate international co-operation on carbon pricing with a view to unlocking greater ambition on carbon pricing. A number of discussion questions are proposed to explore how best to leverage the role of the CMP internationally.

## 1. Introduction

Under the 2015 Paris Agreement on climate change, most countries announced initial national climate change objectives for the post-2020 period – known as nationally determined contributions (NDCs) – reflecting their respective intentions to reduce or limit emissions domestically, in light of their differing national capabilities and circumstances. Parties to the Agreement also collectively agreed to hold the global average temperature increase to well below 2°C and to pursue efforts to limit it to 1.5°C. There is general recognition that the sum of the envisaged emissions reductions by countries under the Paris Agreement is currently insufficient to be on track with the longer-term temperature stabilisation objective.[1] One of the main objectives of the Agreement is to encourage Parties to increase their climate change ambition over time through a transparency, reporting and review process, ultimately aiming to counter concerns over free-riding that otherwise plague global commons issues (even though the agreement does not require direct reciprocity).[2]

Achieving the long-term objectives of the Paris Agreement requires more than incremental emissions abatement. Rather, we need to think in terms of deep transformation of our economies and how to create prosperous low-carbon societies. This transformation will require massive reallocation of capital to low-emissions infrastructure and technology, both to reduce current emissions and to put in place the infrastructure that will avoid locking-in future high-emission pathways (OECD, 2017).

Carbon pricing is the essential bedrock for the needed transformation, as it provides an efficient means to internalise climate change costs into consumption and investment decisions across the economy, leading to low-cost abatement. The cost-effectiveness of carbon pricing means that it can be a facilitator of greater ambition for climate action domestically, and by extension for achieving the Paris Agreement goals. Carbon pricing can also be a direct means of co-operation between countries within the Paris Agreement, via the mechanisms described in Article 6 of the agreement.[3] Applying a price on greenhouse gas (GHG) emissions is not, of course, the only cost-effective tool for addressing climate change, and it is unlikely that pricing alone will initiate the necessary transformation. Complementary measures, for example to support innovation and to encourage energy efficiency, are also important alongside issues of policy alignment and enabling environments for investment.

There has been a positive trend in recent years towards increased carbon pricing globally, including both of the two main types of pricing: carbon markets with tradable permits and more straightforward tax instruments.[4] Political and business leaders have spoken out in favour of further pricing.[5] However, coverage has been patchy and the price levels achieved have generally been low. Within the G20, for example, more than 60% of $CO_2$ emissions are still not priced at all, and less than 10% are priced at EUR 30 or more per tonne of $CO_2$, even when measuring combined price influences on a basis of "Effective Carbon Rates" (see Box 1 below). The potential of carbon pricing is not being realised, and it is urgent to understand and overcome the barriers that have been holding back carbon pricing to date.

This paper is intended to stimulate discussion about how the Carbon Market Platform can act to increase the role of carbon pricing as a catalyst for greater ambition on climate change internationally. The rest of the paper is structured as follows. Section 2 revisits the core economic benefits of different types of carbon pricing, with a view to stimulating discussion on how those benefits can be better communicated politically. Section 3 explains the importance of policy design for effective carbon pricing

1 Cooper et al.(2017).

2 OECD (2017); Cramton et al. (2017); Ostrom (1990).

3 The Article 6 mechanisms are not the focus of this note; see Howard (2017), also prepared for the CMP.

4 World Bank (2016).

5 Such as through the ICAP Joint Statement on 1 September 2017 (https://icapcarbonaction.com/en/news-archive/485-icap-10-anniversary-joint-statement) and the Carbon Pricing Leadership Coalition.

and lays out core principles of good design that can facilitate the roll-out of pricing policies. Section 4 briefly examines the types of barriers that have led to carbon prices being low and patchy, and suggests how these barriers can be overcome. In addition to barriers directly linked to the roll-out of carbon pricing instruments themselves, the discussion also covers broader barriers due to pre-existing regulations and policies being misaligned with or running counter to the objectives of carbon pricing. Finally, Section 5 poses questions for discussion with a view to identifying potential roles for the Carbon Market Platform in facilitating the roll-out of effective carbon pricing.

## 2. The benefits of carbon pricing

Far-sighted governments seeking sources of sustainable economic growth will implement policies that trigger and accelerate the economic transformation to a fully low-carbon economy. This transformation is urgent but is just one of many competing political priorities. Policies to accelerate the long-term transition need to be compatible with important short-term objectives such as sustaining economic growth and improving people's well-being.[6] Climate policies therefore need to be demonstrably cost-effective and beneficial to society as a whole, so that governments can convince citizens and firms that they are delivering long-term change that is also good for the short term. This section shows how carbon pricing can deliver benefits that meet these criteria.

Carbon pricing has long been recognised as offering theoretical and proven advantages in terms of **cost-effectiveness**. A well-designed carbon pricing system, whether based on taxes or carbon markets, sends a single price signal to all entities covered by the scheme, encouraging them to undertake emissions mitigation at the same marginal cost; no source pays more than another, at the margin, to cut emissions and the objective is met at least overall cost. There are of course conditions for this theoretical objective to be achieved, as highlighted in the policy design discussion in the following section. But cost-effectiveness is an important prerequisite for greater climate ambition. If short-term costs to society are minimised, this frees up resources and may facilitate political discussions about scaling up longer term policy ambition on climate.

Carbon pricing can also provide an appropriate balance between **comprehensiveness and country circumstances**. While the most effective results from carbon pricing are achieved if all GHG emissions are priced, this is often not politically or technically possible from the outset. Most carbon pricing systems allow for incremental implementation, both in terms of coverage of different sectors and stakeholders and in terms of stringency and price level. The actual price applied to GHG emitting sources extends beyond the stated explicit carbon price (see Box 1).

Many forms of carbon pricing lead to significant **revenue raising** for governments. This can be politically beneficial for the implementation of pricing if the revenue is recycled in a way that adequately compensates both industrial emitters and, potentially, poorer households facing increasing energy costs due to carbon pricing adding to the unit cost of home energy sources. Such compensation requires some, but not all of the revenue from carbon pricing. Consequently, revenue recycling can also help with the design of a more growth-friendly tax system, as well as gradually reorienting the tax base away from revenue from carbon-based fuels. Carbon taxes have an added advantage in that revenues accrue to national governments, who then make decisions on how to use the revenue, so discussions on how much to charge and how to share the proceeds are more separated than in most trading systems. This can simplify co-ordination and implementation.

[6] OECD (2017).

**Box 1: Effective carbon rates**

Calculating "Effective Carbon Rates" is a means to combine the carbon prices resulting from emissions trading, carbon taxes and the carbon price equivalent of specific taxes on energy use. These three components all increase the price of $CO_2$ emissions compared with other spending items, so they capture the economically relevant contribution of tax and emissions trading policies to the cost of emitting $CO_2$. Currently, ECRs consist mostly of excise taxes, although carbon taxes and emissions trading systems play a significant role in some sectors and countries.

Currently, high effective carbon rates occur mostly in road transport, due to excise taxes on motor fuels. Such taxes are generally implemented as revenue raising instruments rather than to price carbon or change behaviour, but they do provide an incentive to reduce $CO_2$ emissions, as well as helping to curb air pollution, congestion and other external costs related to car use. Therefore, high rates in transport may well be justified. They have not been enough to decarbonise road transport, however, indicating that even where prices work, they do not necessarily by themselves drive a structural shift away from low-occupancy, car-oriented or carbon-intensive mobility patterns.

In G20 countries, 84% of energy-related $CO_2$ emissions occur outside road transport, where they face very low or zero effective carbon rates, with only 2% facing a price of EUR 30 or more.

Sources: OECD (2017); OECD (2016a).

Carbon pricing can also translate into effective **investment signals** and a driver for innovation: if well-designed, with credible longevity, carbon pricing can help to reorient investment decisions and encourage investment in innovation towards low-carbon technologies. However, evidence suggests that in many cases carbon pricing, even if implemented effectively and with material prices levels, will not in itself be sufficient to drive the transformational change and innovation required by the climate challenge.[7] Other policies such as specific technology incentives and direct support for innovation can effectively complement carbon pricing policies if implemented carefully, with due concern for direct overlap of instruments.[8] After all, in some sectors, we still do not have the low-carbon alternatives that will be required to meet the Paris goals (e.g. some energy-intensive industries).

Carbon pricing can **act to reveal the real costs of mitigation** in ways that may be less affected by lobbying and speculation than the alternative direct regulation of emissions. Pricing systems where the market sets the price, such as tradable carbon markets, can reveal the actual cost of achieving a target. This can inform decisions on future targets and help with winning support for further pricing. It can also allow for policy makers to compare price signals internationally and across sectors. Where the mitigation cost turns out to be lower than expected, well-designed schemes can react to further reduce the cap and therefore increase ambition of the overall policy. Pricing emissions through carbon taxes can also help to reveal mitigation costs over time, though policy makers need to decide on an initial price level.

Further, carbon pricing can facilitate **international co-operation** on climate. This can be through linking of systems, which can be carried out independently of co-operative approaches related to NDCs under Article 6 of the Paris Agreement**.** Because they can use a common trading unit (the allowance to emit a tonne of $CO_2$ equivalent), domestic carbon markets can link to form an international market and extend the coverage of the price signal. This emphasis on using pricing as a means to spur co-ordination has been a driving force behind international climate policy from the Kyoto Protocol to the Paris Agreement. By linking carbon markets directly, the exact same price signal is spread to economic actors in other countries. This can give assurance to emissions-intensive businesses competing internationally (e.g. steel, aluminium, chemicals) that competitors in those other jurisdictions will face the same cost

[7] Acemoglu et al. (2012).

[8] OECD (2017).

pressure to reduce emissions. Linking, however, poses technical and political challenges, as discussed in the following section. Carbon taxes can also stimulate international co-operation, though direct co-ordination requires jurisdictions to agree in advance on the same tax level, which may also be politically challenging.

Another way that carbon pricing can help international co-operation is through use of revenue raised though auctioning of emissions permits. For example, the Directive establishing the EU ETS specifies that countries shall implement financial support policies, including in particular in developing countries. In the EU ETS, at least the 50% of those proceeds should be used for certain climate-related activities.

Last but certainly not least, carbon pricing can also bring substantial **other local and regional benefits**. For example, as more carbon-intensive fuels are also often those that pose problems for local air pollution, carbon pricing can help to improve air quality in the jurisdictions where it is applied, in addition to the global benefits of reducing the risks from climate change.

## 3. Making prices work: the importance of policy design

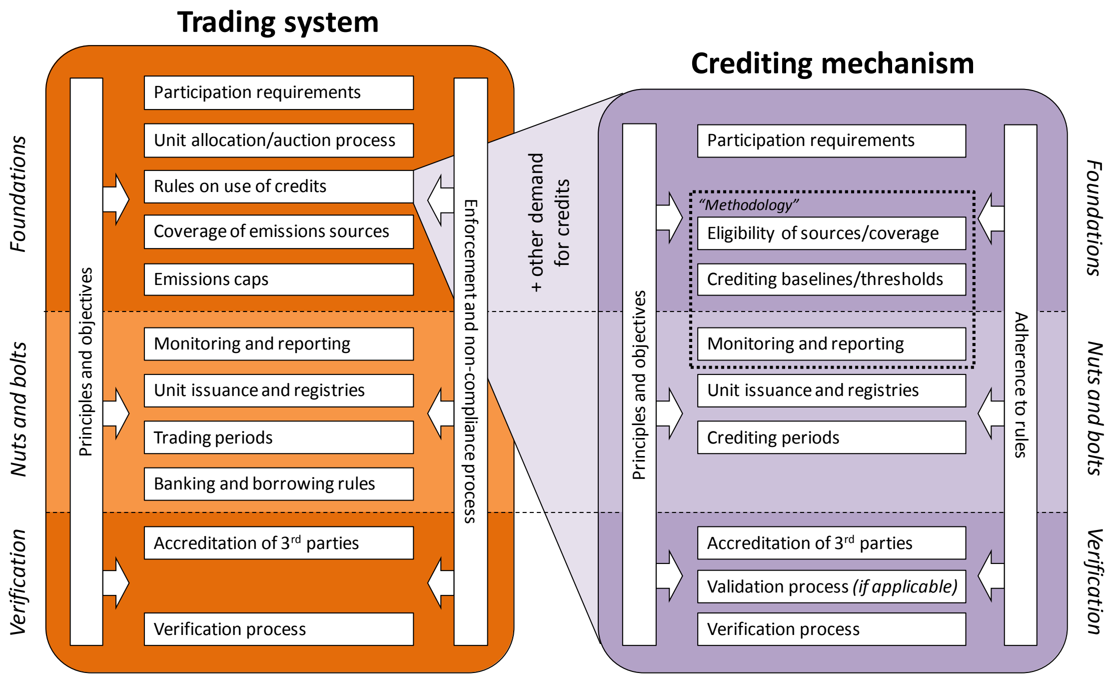
For carbon pricing to be a catalyst for increased ambition on climate, including as part of NDC renewal, the benefits described above must be clearly and quickly demonstrated in practice. For this, carbon pricing mechanisms require good policy design and careful implementation attuned to country circumstances. Fortunately, significant international experience of pricing mechanisms has now built up which can guide future policy making. The following sections describe critical design elements for different forms of carbon pricing. Whatever the type of mechanism chosen, a number of key principles can guide good policy design, such as the FASTER Principles for Successful Carbon Pricing[9]: **F**airness (ensuring that polluter pays); **A**lignment of policies and objectives (including complementary measures); **S**tability and predictability (including steadily rising prices over time); **T**ransparency; **E**fficiency and cost-effectiveness (to help increase ambition); and **R**eliability and environmental Integrity (to ensure real environmental benefits). Adherence to these principles is important to ensure that pricing can influence investment decisions and drive reallocation of capital.

### 3.1 Critical design elements of carbon market mechanisms

Figure 1 lays out a number of design elements important for ensuring that carbon market mechanisms are in line with the principles above. These include both trading systems and related crediting mechanisms that can supplement trading systems. This section covers some of the design features that are most critical for using carbon markets as a tool to raise ambition.

9 OECD and World Bank (2015).

**Figure 1: Elements of carbon market policy design**




Source: Prag et al. (2012).

The level of the **overall emissions cap** is central to the stringency and initial ambition of the instrument. At the outset, the total emissions target must be calibrated as accurately as possible with real emissions levels, and should be set on a downward trend that represents a departure from a business-as-usual trajectory. An emissions cap set in terms of absolute emissions (e.g. total tonnes of $CO_2$) rather than relative emissions (such as $tCO_2$ per unit of GDP) is the simplest form of cap and that with the clearest impact on reducing emissions over time. An absolute cap can operate even in the context of an NDC based on a national intensity target.

Mechanisms to limit price extremes by either **revising the cap or controlling the supply of allowances** are key design features. As total emissions levels are still closely related to macroeconomic factors and other outside influences, it is important that the emissions cap be reviewed at regular intervals. A balance is required between providing a long-lived price signal and being sure that the emissions cap remains relevant should economic or other conditions change markedly. An example of where an emissions cap was not sufficiently flexible was the second phase of the EU Emission Trading System (ETS), where the financial crisis led to an unexpected drop in economic activity, with a corresponding drop in electricity demand and emissions levels. This, combined with other factors such as a rapid uptake in renewable electricity and heavy use of offset credits, led to a significant surplus of permits and a rapidly falling price.[10]

Systems can be designed to counter these changes. One option is for the emissions cap itself to be regularly reviewed and, if necessary, revised. In this case the timeframe and method should be clearly and transparently defined in advance, and the revision should optimally be the responsibility of an independent authority acting on transparent criteria or rules. An alternative option is to design automatic response measures to alter either the number of allowances circulating in the market (a market reserve) or the price at which they are auctioned (a reserve auction price).

The **diversity of sectors and sources** covered by the scheme is important. Broader coverage makes a system more efficient at providing least cost emissions reductions, as well as helping to provide a more stable price. In some countries it may be politically challenging to extend coverage to all sectors

10 Koch et al. (2014).

immediately. Carbon markets can be designed to extend coverage sequentially, again in a transparent and predictable way. Coverage can be extended not only to more sectors but also to other GHGs (such as methane). However, care must be taken to reconcile broad coverage with the goal of instigating long-term economic transformation. Inclusion of sectors without commercially available options for deep decarbonisation helps to stimulate increased abatement in other, easier to decarbonise sectors, but will not necessarily provide the necessary incentives to bring forward innovation in those “difficult” sectors.

Another key design feature is the **method used to allocate emissions permits** to participants in the scheme. Economically, the most efficient method is to sell permits via auction. Entities having to pay for allowances are more likely to invest in mitigation options than those who receive them for free – with a clear impact on overall mitigation. In many cases, ETS were developed with free allocation of allowances provided initially to at least some sources, with sequential introduction of auctioning. While providing free allowances makes ETS introduction more politically acceptable for energy-intensive industries, evidence points to free allocation being more damaging to environmental effectiveness than previously thought.[11] This balance is discussed further in the following section on barriers.

In addition to the key design features listed above, all ETS need a reliable system for monitoring, reporting and verification, as well as the necessary electronic systems for issuing, tracking and trading emissions permits. These important design elements, sometimes described as “nuts and bolts”[12], are important for the good functioning of schemes but are not covered here in the interest of brevity.

Several design features of carbon market instruments are important if governments want **to link their carbon markets with systems in other countries**. Linking is however both technically and politically challenging. Technically, regulators need to be confident that the systems are compatible and that the design parameters – and therefore prevailing market prices – are similar enough not to cause price fluctuations when the link is activated. Coverage, ambition, and design of price controls and allocation methods are all important for linking.[13] Politically, a smaller country may be wary of linking to a system in a larger economy for fear of becoming a “price taker”, with less control over the price of emissions going forward. However, successful linking of the California and Québec trading systems show that these challenges can be overcome. There is no experience to date of jurisdictions agreeing to a common carbon price level using taxes, though the European Union has an agreement on minimum taxes for mineral oil products.[14]

If full linking – whereby permits from two different systems are made fully fungible with one another – is not possible, governments can choose to begin with more indirect forms of linking. One such way is for both systems to agree to adopt the same types of offset credits. As highlighted in Figure 1, systems for creating offset credits – often known as crediting mechanisms – are in themselves complex systems with numerous design features. Perhaps the most important are the features used to guarantee the environmental integrity of a credit, including the methods used to establish the baseline scenario.[15]

### 3.2 Critical design elements for carbon taxes

In the case of specific carbon taxes levied on GHG-emitting fuels, key design features related to the ambition of the scheme are the effective tax rate (how much users actually pay on top of the fuel price), the tax coverage (which sectors) and exemptions (which users are not subject to all or part of the tax). Carbon taxes are transparent and relatively easy to design and implement, because emissions are strictly proportional to fuels used.

11 Goulder and Schein (2013).

12 Prag A., G. Briner and C. Hood (2012).

13 Ellis and Tirpak (2006); OECD (2017).

14 OECD (2017).

15 See accompanying CMP paper.

Governments need to choose a tax rate that is high enough to provide a strong incentive for abatement – including investment and innovation in new technologies – while not excessively penalising certain economic actors. The tax rate can be introduced at a low level and then increased, as was done successfully in British Columbia in Canada.[16] In general, the effect on emissions will depend on how users react to the tax (elasticity), meaning that it can be difficult to estimate the overall impact on emissions in advance. Once a carbon tax is in place, however, average elasticity can be observed, allowing for subsequent changes in the tax rate if necessary. Also, the success of climate policies depends on the credibility of a long-term price signal, which may be more easily provided by a predictable tax than an ETS with high volatility of prices.

Specific carbon taxes on GHG-emitting fuels often come on top pre-existing taxes such as fuel excise duties. These fuel taxes create an implicit price on carbon, contributing to the effective carbon rate levied on that fuel (see Box 1 on Effective Carbon Rates). Fuel taxes are however based on a volume or energy-content basis rather than calculated according to carbon content, so they do not provide an equal abatement incentive for all GHG sources covered. However, tax rates on transport fuel are often high when compared to heating and process use, and electricity.[17] This may be explained by the range of policy goals governments may be attempting to address by taxing transport sector energy products (e.g. congestion, traffic accidents and noise; road construction and maintenance), rather than GHGs specifically. When designing a carbon tax, the impact of these other pollutants and policy goals can be considered when setting the tax rate. This can also be achieved with vehicle purchase taxes, such as in Israel where the tax is calculated according to a range of pollutants including $CO_2$.[18]

Tax variations by sector, and potential specific exemptions are important not only for their emissions effect but also because they are sources of revenue. A key design issue is how the revenue is used and what other taxes or charges are reduced as a result. By their nature, carbon taxes are sometimes regressive, in that they can have a disproportionate effect on poor sections of society who spend a higher proportion of their income on basic services such as energy. This can tempt policy makers to improve acceptability by introducing exemptions on the carbon tax, though such exemptions are distortion and make the tax less effective. A potentially more effective approach is to preserve the tax signal through fuel taxes and to address social impacts by other means (e.g. cash transfers to low-income families). Evidence shows that well-designed redistribution of just a portion of tax revenues to the poorer users is enough to more than offset the regressive effect, while maintaining the overall incentive to lower emissions and switch to cleaner technology.[19]

Elements of carbon tax design can be incorporated into emissions trading, and vice versa, to create **hybrid systems**. For example, a minimum price "floor" can be applied with an ETS, resembling a carbon tax at that price level, as is the case in the UK. Alternatively, carbon taxes can be complemented with an offset system using credits normally destined for an emissions trading system, so that taxed entities can choose to purchase credits in place of part of their tax obligation. These hybrid systems can be effective at smoothing the political path of implementation for carbon pricing, though co-ordination in policy design becomes important.

Beyond taxes and carbon markets implemented for end users, the concept of carbon pricing can also be used to encourage mitigation through other policy levers. For example, governments can choose to apply a carbon price internally when conducting cost-benefit analyses of public infrastructure choices, in order to monetise the cost of $CO_2$ emissions related to infrastructure choices. Separately, using a carbon footprint or other $CO_2$-related metric when making public procurement appraisals can encourage competition for the use of low-carbon inputs, with a positive effect on innovation.[20]

16 Harrison (2013).

17 OECD (2015).

18 OECD (2016b).

19 OECD (2017).

20 OECD (2016c); Smith and Braathen (2015).

## 4. Understanding and overcoming common barriers to more ambitious pricing

Carbon pricing in its various forms has long been recognised as the most efficient and cost-effective policy to initiate the transition to low-carbon economies. Many governments have initiated pricing schemes, some now dating back two decades or more. Why then have we not seen greater roll-out of carbon pricing with stronger price signals?

In general, a key political barrier to climate action in general – and carbon pricing in particular – has been the perception that limiting GHG emissions will be harmful for economic growth. Recent analysis for the G20 suggests that if governments combine action on climate change, including carbon pricing, with strong pro-growth policies this can be better for economic growth than continuing with the status quo.[21] Nevertheless, various technical and political barriers have prevented policymakers from going further with cost-effective carbon pricing. In addition to barriers related to the specific design features of carbon pricing, empirical evidence also points to the importance of ensuring that the broader policy landscape is not misaligned with carbon pricing objectives.[22] Jointly addressing both specific and misalignment barriers is the key to realising the cost-effective potential of carbon pricing – and therefore its ability to increase ambition.

### 4.1. Barriers specifically related to carbon pricing

Concern for industrial competitiveness is often put forward as a key barrier to more ambitious carbon pricing. Some firms in energy-intensive industries that are exposed to international competition argue that increased energy costs due to carbon pricing would harm their competitiveness relative to firms in other countries not exposed to carbon pricing. The result would be a loss of business – leading to "carbon leakage" as the market share is taken up by firms in other countries – and eventual closure of plants with corresponding job losses. It has been suggested that firms have actively lobbied against stronger climate policy for fear of competitiveness losses.[23]

To date, empirical studies from countries with carbon pricing in place, notably the EU, have generally found only limited evidence for any signs of carbon leakage.[24] Reasons cited are that energy costs are only one small part of a firm's relocation decision, and that carbon prices have so far been too low to have a material effect on relocation.[25] However, this may not be the case for the high and rising carbon prices required to deliver on the Paris Agreement objectives.

Several strategies exist for overcoming competitiveness concerns. Mechanisms to shield certain firms from carbon price impacts in the short term can be used, such as the **free allocation of permits** described in Section 3. Free allocation can play a transitory role to avoid sudden impacts on affected industries and to accommodate the transition of the existing emissions-intensive capital stock. However, in some cases over-allocation has led to permit surpluses and windfall profits for certain participants.[26] On the contrary, full auctioning of permits sends a stronger signal to invest in low-emission technologies and to develop new ones, as it avoids the creation of rents that can favour carbon-intensive investment choices. It also sends a strong positive signal to existing low-carbon firms who may be disfavoured under free allocation due to their lack of historical emissions.[27]

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21 OECD (2017).

22 Ang G., D. Roettgers and P. Burli (2017); OECD/IEA/NEA/ITF (2015).

23 Influencemap (2016).

24 See for example Martin et al. (2016).

25 Arlinghaus (2015); Ward et al. (2015).

26 OECD (2017).

27 In theory, under perfect competition permit allocation rules would not affect marginal mitigation Incentives, as permits carry opportunity costs. However, in reality free allocation of permits is likely to be a source of economic rents, which will affect investment choices.

A second strategy for governments to address competitiveness concerns is to emphasise **international co-operation** on carbon pricing, given that concerns arise when competing firms in other countries are not subject to equivalent carbon prices. This co-operation can include linking of trading systems as described in Section 3. As well as lowering costs, co-operation on carbon pricing can increase ambition by establishing trust and reciprocity on climate policy, such as through agreed minimum carbon prices.[28]

The energy-intensive sectors most often cited for competitiveness concerns are also those for whom low-carbon technological options do not yet exist, such as cement, steel and chemicals. With a view to both long-term ambition and short-term implementation, governments need to place an emphasis on **support for technological innovation**. This can be directly linked to carbon pricing – through use of revenues – as well as through other innovation policies, including via public procurement (see next section).

Where costs are passed through to consumers, notably for electricity and heating fuels, concerns are also raised about **the impacts on households**, in particular the poorer parts of society. Energy bills are a key political issue in many countries, meaning resistance to policies that may increase prices, including carbon pricing. As mentioned above, while carbon taxes may be regressive in some cases (affecting the poor to a greater degree), using revenues from pricing to compensate poorer households can overcome this effect. More generally, if carbon pricing is combined with a push on domestic energy efficiency – potentially employing some of the revenue raised through carbon pricing – this can lead to lower average energy bills, even if unit prises rice due to the carbon price.

Another barrier to implementation can be the **institutional capacity of the government** and its agencies. Designing, implementing and operating a fully-fledged carbon market requires significant capacity and cross-government collaboration. Not all countries are equipped with institutions, monitoring mechanisms and enforcement capability to roll out domestic carbon market mechanisms and then link to an international market. International good-practice sharing can be beneficial, such as initiatives organised under the World Bank Partnership for Market Readiness, the International Carbon Action Partnership and the Carbon Pricing Leadership Coalition. Carbon taxes tend to be simpler to implement, but nevertheless require strong institutions with good enforcement capacity to ensure tax collection.

While carbon pricing is usually an effective route to more ambition on climate change, it is important to note **circumstances where the use of carbon markets could hamper ambition**. Clearly if political compromise leads to an overly generous emissions cap, this would result in higher emissions. Similarly, if trading systems are linked internationally – whether directly or via the Paris Agreement's Article 6 provisions – the integrity of each system is important. If one system has an overly generous cap, or if the scope of sources means permits are much cheaper with possible integrity concerns (such as can arise with forestry) then the flow of cheap permits may discourage investments required for long-term mitigation. Put differently, there is a greater risk of locking-in future emissions due to low prices in the short-term.

## 4.2 Aligning policies for more effective carbon pricing instruments

Carbon market instruments and carbon taxes do not exist in a policy vacuum. They are invariably introduced into a regulatory environment containing many policies and regulations that pre-date climate change as a policy issue. Some of these may interact directly with carbon pricing, such as energy taxes (or the absence thereof). Others do not obviously overlap but may inadvertently contradict climate policy goals by favouring carbon-intensive technologies and infrastructure choices. In carbon pricing terms, such policy misalignments imply that a higher price is needed for the same environmental outcome.[29] In other words, the cost-effectiveness of the instrument is reduced.

[28] Cramton et al., 2017.

[29] OECD-IEA-NEA-ITF (2015).

Such misalignments can occur right across the policy spectrum in areas such as tax, financial regulation, trade, land-use planning and electricity markets. Decades of fossil-fuel-based economic development means that fossil-fuel technologies enjoy incumbency advantages and that most countries' economies are "entangled" with fossil fuels. Government revenues are reliant in differing degrees on fossil-fuel taxes and royalties, and pension funds and financial markets often have fossil-fuel activities at their centre. This entanglement can be a barrier to implementing strong climate policies, and can render those policies less effective unless governments adopt an inter-ministry, cross-cutting approach to climate action. However, fears within government about losing revenue from lower fossil fuel are likely to be unfounded. New revenues raised through carbon pricing will more than compensate the loss (at least over the next few decades), even with a gradually shrinking tax base as the economy decarbonises.

Subsidies to fossil-fuel production and consumption are a major area of misalignment relevant to the effectiveness of carbon pricing. They are still widely prevalent and create negative carbon price signals, acting directly counter to carbon pricing initiatives. In 2014, G20 countries collectively provided subsidies amounting to USD 354 billion for fossil-fuel consumption, and USD 18 billion for fossil fuel production.[30] These subsidies translate into large fiscal costs for governments (contrary to the revenue from carbon pricing). For example, the fiscal burden of fossil-fuel subsidies reached as high as 1.4% and 4.1% of GDP in Mexico and Indonesia respectively before both countries started reforms. Globally the most common subsidies are those maintaining artificially low prices for electricity and primary fuels. Some countries also subsidise the production of fossil fuels, e.g. through concessional loans and special tax arrangements. Removing subsidies tends to increase prices – as does the introduction of carbon pricing – so the timing of reform is important. In general, governments can make fossil fuel subsidy reform more acceptable if they precede reform by improving energy services and introduce measures aimed at supporting the poor.

Another area of misalignment important for carbon pricing is where fiscal incentives not directly linked to energy use nonetheless lead to higher energy use and $CO_2$ emissions. One example widely prevalent is that of the tax treatment of company cars.[31] Another relates to property taxes and their knock-on effects not only for domestic energy use but also for travel-related emissions.

One specific misalignment present in many different countries relates to the way electricity is bought and sold and the implications it has for investment in and operation of electricity generating technology.[32] In liberalised electricity markets, investment decisions are meant to be driven by wholesale power market prices, incorporating explicit carbon prices where they exist. But in many cases markets are no longer delivering accurate price signals because they were not designed to mix conventional power generation with high proportions of zero-marginal-cost renewable electricity.[33] Significant renewables capacity has been added, often remunerated through fixed-price tariffs operating independently of the wholesale market price (and therefore also of the carbon price). This forces down market prices, hindering the investment capability of utilities, including for low-carbon investments. In addition, the variable and non-dispatchable nature of some renewable technologies can make it more difficult to balance system-wide demand and supply. Addressing this challenge requires equipping power markets with features such as high-resolution prices (including carbon pricing), better incorporating system and reliability costs into pricing, and more demand response.[34] Regulated power markets, which exist fully or partly in many emerging economies, face different design issues relevant to the low-carbon transition, including how to transmit carbon price signals where consumer power tariffs are regulated and set by government.

In addition to removing misalignments that act in opposition to carbon-pricing objectives, governments also need to assess where complementary policies can be introduced that reinforce carbon

30 OECD (2017).

31 OECD-IEA-NEA-ITF (2015).

32 OECD-IEA-NEA-ITF (2015).

33 IEA (2016).

34 IEA (2016).

pricing to support low-carbon objectives. Such instruments need to be introduced with care, or they too may act to undermine the cost-effectiveness of carbon pricing. For example, any complementary measure introduced within an overall emissions cap will not help to reduce overall emissions in the near term, assuming that the cap is binding, will not be modified and will be enforced. However, in some cases complementary policies can be justified and are even required to overcome non-economic barriers and to maintain dynamic efficiency. Even rising carbon prices may not by themselves be sufficient to drive the cost reductions necessary to bring forward low-carbon technologies in sectors difficult to decarbonise.

Externalities associated with technological progress – such as knowledge spill-overs, meaning inventors cannot fully capture the benefits of their inventions – can lead to underinvestment in innovation. The existence of an innovation externality in addition to the climate change externality may mean that using carbon pricing alone at a level that is politically feasible may not generate sufficient investment in new technologies.[35] Research, development and demonstration (RD&D) and technology deployment policies may therefore have an important role to play. They can accelerate the development and cost reduction of new technologies, acting to reduce the longer-term costs of the transition and reducing the competitive gap with carbon-intensive technologies. While targeted support policies can be an expensive abatement policy option in the short term,[36] government support for RD&D and deployment is an important complement to carbon pricing, and can be partly funded using carbon pricing revenues.

In the context of making carbon pricing more effective as a means to increase climate ambition, governments should identify the most significant policy misalignments running counter to carbon pricing objectives, while simultaneously assessing where complementary policies can act to enhance carbon pricing objectives.

## 5. Issues for discussion

Achieving climate goals is about major economic transformation rather than behavioural change at the margin. Carbon pricing is an important basis for this transformation, and it can also bring other benefits such as improved air quality. Although the design of carbon pricing instruments is crucial to their effectiveness, even well-designed systems are unlikely to deliver the necessary transformation on their own. Complementary measures are also necessary, such as to support innovation and commercialisation of new technologies. In addition, misalignments existing in the broader policy landscape need to be addressed, where pre-existing policies or regulations may be acting counter to the effects of carbon pricing.

Addressing misalignments and amassing political support for robust and increasingly stringent carbon pricing requires building strong political coalitions and communicating effectively on the benefits of carbon pricing for economic transformation and future economic growth. The means of communicating on carbon pricing may evolve over time. For example, while building political support for initial, low-level carbon prices may involve convincing political opponents that the initiative need not be harmful for growth, the case may be different when carbon prices are high and sustained; by that time, revenue from carbon pricing may have replaced tax receipts from fossil fuels as a major source of government funds.

In the near term, while many of the actions required to overcome barriers to better carbon pricing are at the national level (or regional in the case of the EU), international co-operation is crucially important for economic efficiency and environmental effectiveness. However the Paris Agreement is underpinned by a diverse range of NDCs with varying implicit future carbon prices, presenting challenges

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35 Acemoglu et al. (2012).

36 OECD (2013).

for formal linking of carbon markets and also for transparency, both important for addressing concerns about impacts of carbon pricing on competitiveness and comparability of national efforts.

The following questions are suggested for discussion:

- What are the key political constraints to increase the coverage of pricing carbon, and what role for the Carbon Market Platform in overcoming those constraints?
- How can countries better co-ordinate on the stringency of their carbon pricing policies (whether price levels or caps) in order to be in line with long-term mitigation goals? Are there ways that the Carbon Market Platform could facilitate this debate?
- Which carbon pricing designs are most effective in raising ambition in which country circumstances? Which sectors should be covered? Where are hybrid schemes most effective?
- Which are the most important policy misalignments affecting carbon pricing, and how can they be overcome?

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