Tax Policy and Climate Change

IMF/OECD REPORT FOR THE G20 FINANCE MINISTERS AND CENTRAL BANK GOVERNORS

April 2021, Italy

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Table of contents

FIGURES

TABLE

Overview

A progressive transition to net zero greenhouse gas emissions by around the middle of the century is essential for containing the risks of dangerous climate change. Limiting global warming to 1.5°-2°C, the central goal of the 2015 Paris Agreement, will require climate policy packages that drive transformative changes in production and consumption patterns.

Current emissions commitments and policies fall short of the ambitious policy action that is needed (see Annex A). Global carbon dioxide (CO_2) and other greenhouse gases must be cut by a quarter to a half below projected levels in 2030 to put the world on an emissions pathway consistent with climate stabilisation targets. Parties to the 2015 Paris Agreement are in the process of submitting revised mitigation commitments in their Nationally Determined Contributions (NDCs) ahead of COP26 in November 2021. Many are announcing emission neutrality targets by mid-century, though at present many intermediate emissions targets for 2030 are not aligned with these longer run neutrality goals. Much stronger policy action is needed—containing temperature rises to below 2°C will require measures equivalent to a global carbon price, on top of existing policies, rising to around USD 25-75 per tonne of CO_2 or more by 2030 and increasing further beyond 2030. In general, the policies announced or implemented by countries to date are only scratching the surface of what is needed to implement intermediate, and ultimately net zero, emissions targets.

Pricing of greenhouse gases, including carbon, will be an indispensable tool in any cost-effective climate change mitigation strategy, provided that it is inclusive and supports economic development. Pricing could be applied to all greenhouse gases in principle but in practice is being applied principally to carbon emissions. While countries have many mitigation instruments available to them, carbon pricing has a central role as it is the only instrument that automatically promotes all mitigation opportunities, and strikes a cost-effective balance across these responses. At present, many of the cheapest energy sources generate high carbon emissions, but the harm to the climate is not reflected in their price. Carbon pricing—charging for the carbon content of fossil fuels or their emissions—corrects for this, thereby providing across-the-board incentives for businesses and households to make production and consumption decisions that support lower emissions. To achieve maximum cost-effectiveness, pricing should comprehensively cover fossil fuel and process emissions across the power, industry, transport, and building sectors, and other sources where practical. Synergies between phasing out fossil fuel subsidies and carbon pricing should be exploited. Among other strengths (see Box 1), a robust and rising carbon price helps to mobilise private finance for mitigation investment and drive innovation in low-carbon alternative energy sources and processes, while at the same time being a valuable source of revenue. Where practical, pricing could be extended to other emissions sources, for example, fugitive emissions from extractives, net emissions from land use change, and agriculture, as emissions monitoring capacity is developed or on a proxy basis (i.e., based on outputs and default emission rates).

Box 1. Strengths of carbon pricing

Carbon pricing:

- **Provides across-the-board incentives for firms and households to reduce carbon-intensive energy use and shift to cleaner fuels:** this occurs as carbon pricing increases the price of carbon-intensive fuels, electricity, and consumer goods produced with fuels and electricity.
- **Provides the essential price signal for mobilising private investment in clean technologies:** pricing levels the playing field for emissions-saving technologies and helps to avoid lock-in of fossil fuel intensive investments (like coal generation plants), contributing to cost-effective abatement.
- **Is more flexible than regulatory approaches:** Unlike energy efficiency standards and other regulations, prices leave households and businesses a wide range of choices on how to cut emissions. This greater flexibility reduces costs because the government is generally less well informed about the options available to emitters, particularly where different emitters would prefer different responses.
- **Provides ongoing mitigation incentives:** In the case of some policy tools, such as standards, the pressure to reduce emissions disappears once compliance with a standard is reached, whereas prices continue to induce mitigation effort as long as emissions are positive.
- **Reduces rebound effects:** Some instruments, such as energy efficiency standards, lead to increased energy usage. For example, improving the energy efficiency of an air-conditioning unit makes it cheaper to run and may therefore result in it being used more often, undoing some of the energy savings from the efficiency improvement, unless the price of energy use or of the emissions from energy use increase simultaneously.
- **Mobilises government revenue:** Unlike most other mitigation instruments, carbon pricing raises government revenues, and administrative costs of revenue collection are much lower than for broader fiscal instruments.
- **Generates domestic environmental co-benefits like reductions in local air pollution mortality:** Pricing carbon, like other mitigation instruments, results in cleaner air which is a tangible and immediate benefit of reduced combustion of coal and motor fuels, especially in metropolitan areas.

Carbon prices are well below the levels that will be needed to drive decarbonisation and meet the objectives of the Paris Agreement. Recent analysis shows that 55% of CO_2-emissions from energy use across OECD and G20 countries remain completely unpriced (i.e. no carbon tax, emissions trading system or fuel excise tax; OECD, *Effective Carbon Rates 2021*, forthcoming April 2021). Rates are lowest in the industry and electricity sectors, and are further weakened by fossil fuel support and where free permit allocation rules provide an advantage to carbon-intensive technologies. While the level of increased policy action needed varies from country to country, depending upon their level of ambition, energy mixes, and different starting points, reaching the emissions abatement objectives defined in NDCs requires measures equivalent to carbon price increases of USD 25-75/tCO_2 or more by 2030 in many G20 countries.[1]

[1] IMF staff estimates.

Although carbon pricing is an effective instrument, a comprehensive package of measures is needed to enhance the overall effectiveness and acceptability of mitigation strategies. Key elements potentially include a balance between carbon pricing and reinforcing sectoral instruments; supporting public investment and technology policies; productive and equitable use of carbon pricing revenues; and measures for a just transition, to address industrial competitiveness, and to reduce broader greenhouse gas emissions.

Judicious use of carbon pricing revenues can make climate policy more inclusive and effective while containing the costs of clean energy transitions to the economy. Increasing carbon prices, as part of a policy package that cushions adverse impacts by delivering immediate benefits to vulnerable households, workers, firms and regions, can increase the chances of successful implementation. Appropriate revenue use will depend on countries' specific circumstances, but where they are used to lower burdensome taxes on work effort, or boost productive investment, this provides a benefit to the economy that counteracts the harmful effects of higher energy prices.

Action to scale up carbon pricing is hampered by concerns about competitiveness, "carbon leakage" and free-riding, which underscores the importance of international coordination.[2] Existing measures to address competitiveness and leakage impacts of carbon pricing (e.g., free allowance allocations) become less effective with deeper decarbonisation and greater dispersion in carbon prices across jurisdictions for carbon-intensive and trade-exposed sectors. Countries and regions are also concerned that others may not meet their mitigation pledges. Both concerns can be addressed by international collaboration, though the scope and the nature of such coordination needs to be established.

The G20 Finance Ministers are well placed to advance a dialogue on pricing of greenhouse gases and appropriate environmental policy mixes. With its ability to consider jointly the incentive, revenue use, and international coordination aspects of the policy challenge, G20 Finance Ministers and Central Bank Governors (FMCBG) have the potential to promote the use of pricing and ensure a better alignment between pricing and decarbonisation goals. Such action would support ongoing efforts by G20 Energy and Environment Ministers, along with G20 Sherpas, to spur fossil fuel subsidy reform. The G20 is also well placed to ensure the coherence of mitigation policies differentiated across countries, taking into account that the ultimate collective goal of net-zero emissions can only be reached with patterns and speed of adjustment that aligns with country-specific circumstances. Given that the G20 accounts for more than 80 percent of global carbon emissions, dialogue at FMCBG level would be conducive to advancing the global agenda.

To support an ongoing G20 dialogue on emissions pricing, Ministers may wish to request:

- continued monitoring of greenhouse gas emissions pricing, energy taxation and fossil fuel subsidies;
- sharing metrics and indicators for measuring countries carbon footprints;
- regular updates on pricing consistent with countries' mitigation pledges and the impacts of pricing (e.g., on emissions, revenue, local air pollution mortality, economic welfare, energy prices);
- assessments of the trade-offs between pricing and other mitigation instruments (e.g., energy efficiency standards, emission regulations, feebates, clean energy subsidies, taxes on individual fuels, sectoral-based emissions pricing);

[2] Carbon leakage, whereby foreign emissions increase because of the introduction of domestic climate policies, weakens the effectiveness of climate policies at reducing global emissions. It can also undermine political support for the implementation of climate policies.

- analysis of the incidence of energy price changes on households, industries, and employment in vulnerable sectors and regions, and of assistance measures designed to alleviate adverse consequences;
- dialogue on mechanisms to promote coordination, e.g. on minimum emissions pricing, among large emitting G20 members;
- other areas of collaboration to elevate the role of emissions pricing in the transition to carbon neutrality, taking into account countries' different starting points and contexts, and avoiding negative spill-overs on trade relations;
- discussion of the role of border carbon adjustments (BCAs) including their pros and cons versus other compensation measures, design issues, and impacts; and
- further analysis of the potential impacts of rising disparities in carbon prices on carbon leakage and on countries' imports, exports, output and employment.

The rest of the note provides: (i) a stocktake of the carbon pricing landscape today; (ii) an assessment of the extent to which carbon pricing or equivalent measures are needed, and their environmental and broader economic impacts; (iii) a discussion of comprehensive mitigation strategies; and (iv) a discussion of BCAs and international price coordination.

Stocktake: Effective carbon rates in OECD and G20 countries

Policymakers seeking to price carbon can use carbon taxes or emissions trading systems. In addition, fuel excise taxes can also be used as they result in a *de facto* carbon price, even if the rationale for these taxes may not be principally climate-related and the tax rate often is not aligned with each fuel's carbon content. Fossil fuel subsidies that effectively lower carbon prices, can also be phased out.

Current carbon price signals are often too low and poorly aligned with fuels' carbon content. A stocktake of the effective carbon rates resulting from fuel excise taxes, carbon taxes and emissions trading systems, and including subsidies delivered through preferential excise or carbon tax rates, shows that carbon pricing is gaining momentum. However, current prices generally remain low and vary across sectors and fuels in ways that align poorly with carbon emissions or with pollution profiles more broadly (Box 2). Fossil fuel subsidies continue to distort price signals and weigh on public budgets (Box 3). The stocktake points to reform options and priorities, as from a climate point of view – net of domestic environmental benefits – effective carbon prices should be the same per unit of carbon content of all fuels in all sectors to minimise the costs of reducing carbon emissions.

Box 2. Stocktake – Effective carbon rates from carbon taxes, emissions trading systems and fuel excise taxes

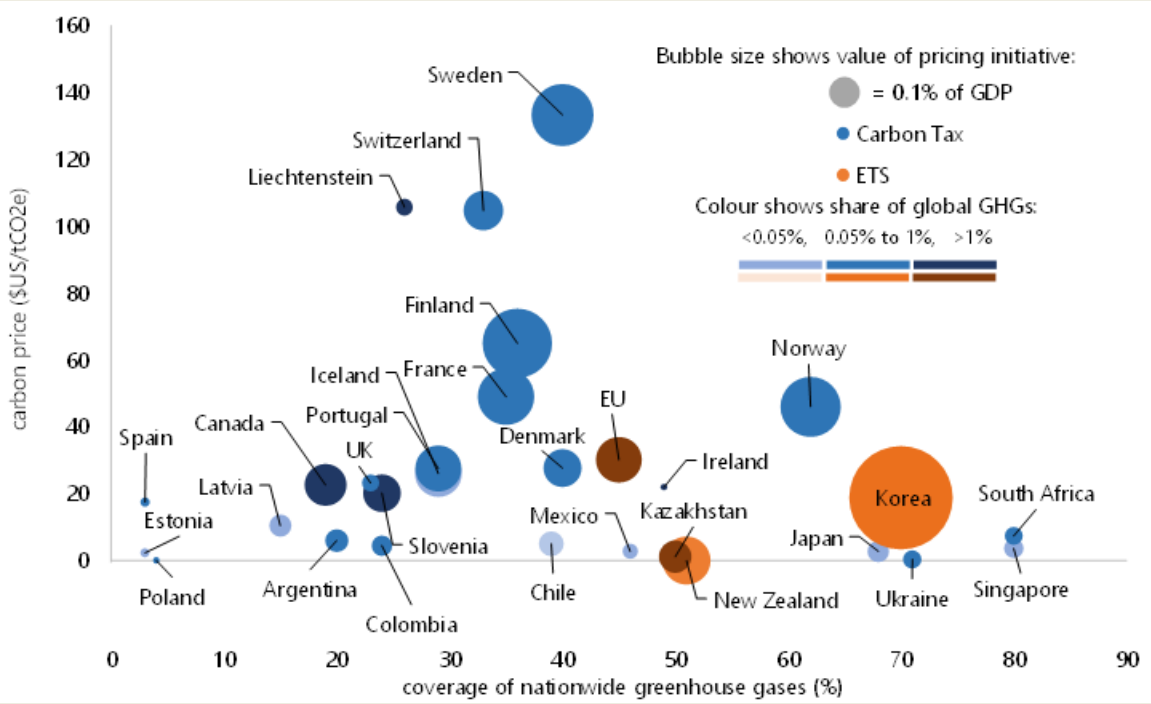
Carbon taxes: By imposing a charge on the carbon content of fossil fuel supply, carbon taxes are a straightforward carbon pricing instrument from an administrative perspective. They can be comprehensively applied, for example, at the point of processing or refining for coal, petroleum products, and natural gas. In addition, carbon taxes can provide certainty over the future trajectory of emissions prices, and revenues accrue directly to finance ministries.

Emissions trading systems: Under an emissions trading system (ETS), firms must acquire allowances to cover their emissions, the government fixes the supply of allowances, and allowance trading establishes the emissions price. Although trading systems to date have largely been applied to power generators and large industries, they could be extended midstream to include heating and transport fuels (the latter already being covered in a few systems). Mechanisms like price floors can reduce price uncertainty and allowance auctions can generate government revenues.

Fuel excise taxes: Fuel excise taxes create economic incentives similar to those of carbon taxes and emission permit prices, even if their primary objective may be to raise revenue. The strength of price-based incentives to reduce emissions depends on the rate and the base of the incentive, and on fuel price responsiveness, not on the stated policy intention. Fuel excise taxes can be seen as implicit carbon taxes.

Carbon pricing is gaining momentum: For example, prices in the European Union's (EU) ETS have recently increased, Canada has announced it will increase its carbon prices to CAD 170 by 2030, Germany and China have introduced major pricing schemes this year, and Korea has a comprehensive pricing scheme. Figure 1 summarises explicit carbon pricing instruments (carbon taxes, emissions trading systems) at the national level as of 2020.

Figure 1. Selected carbon pricing schemes, 2020



Note: Updated as of Nov. 2020. GHGs from 2017. EU includes Norway, Iceland, Liechtenstein. Values less than 0.0005 percent of GDP are of equal size for illustrative purposes.
Source: World Bank, Climate Watch, Fund Staff Estimates.

Carbon pricing discussions are often limited to explicit carbon pricing instruments (carbon taxes and emissions trading systems), but it is useful for a stocktake to also consider fuel excise taxes. Effective carbon rates for a particular fuel or sector, the sum of any applicable emission permit prices, carbon taxes and fuel excise taxes, captures this broader view of abatement incentives resulting from price-based policies.[3]

Effective carbon rates measure the prevailing carbon price signal. They describe the policies to take into consideration, when seeking energy pricing reforms that strengthen carbon price signals or more broadly the environmental performance of taxes on energy use and emissions trading systems. The OECD's database on effective carbon rates covers 44 countries, including all OECD countries and G20 countries (except for Saudi Arabia), representing more than 80% of global energy use and CO_2-emissions from energy use.

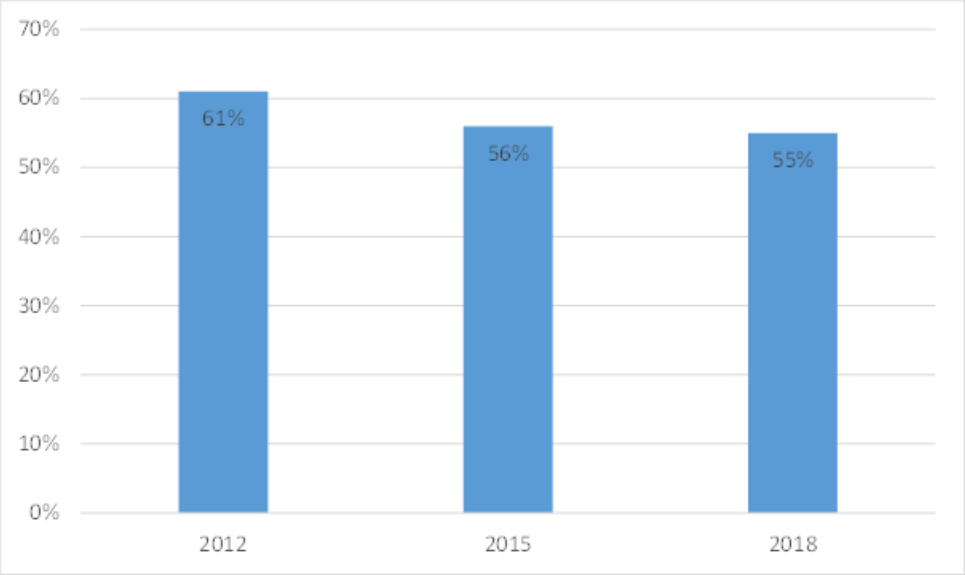
[3] Effective carbon rates in this paper account for fossil fuel support in the form of energy excise rate reductions or exemptions. Other subsidies can also affect these rates and this will be considered in future work.

Effective carbon rates have been rising slowly overall and across sectors

More than half of all emissions from energy use remain unpriced as of 2018. The decline in the share of unpriced emissions has been slow (Figure 2) and has mostly been attributable to rising coverage of carbon taxes and emissions trading systems.

Excise taxes cover a larger share of emissions than carbon taxes and emissions trading systems. In 2018, 6% of emissions were subject to a carbon tax, 12% of emissions were covered by an ETS, and 35% were subject to a fuel excise tax. With the exception of road transport, where coverage by excise is near complete at 95%, the three components of the carbon rate only cover a limited part of the base. Coverage by carbon taxes is highest in road transport (13%), followed by residential and commercial use (7%). Emissions trading systems cover more emissions in industry (14%) and electricity (18%) than in other sectors (less than 4%). These averages hide strong variation across countries.

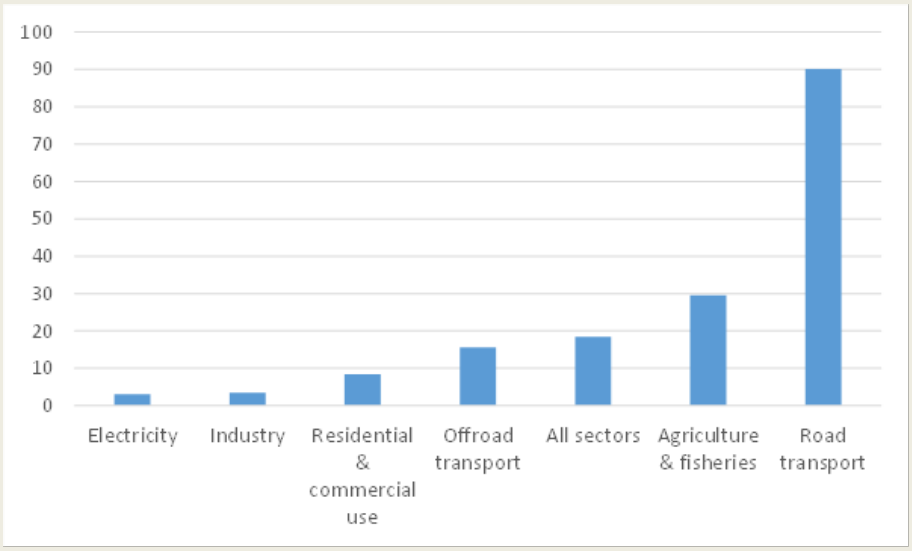
Figure 2. Share of emissions for which the effective carbon rate is zero, 41 OECD and G20 countries, 2012 – 2015 – 2018



Note: Excludes Colombia, Latvia and Lithuania for comparability across time.
Source: OECD Effective Carbon Rates database.

Effective carbon rates are highest in road transport and lowest in the industry and electricity sectors

Figure 3. Average effective carbon rate by sector, 44 OECD and G20 countries, EUR/tCO_2, 2018



Note: The effective carbon rates pertain to fuel combustion in the sector, not all greenhouse gas emissions.
Source: OECD Effective Carbon Rates database.

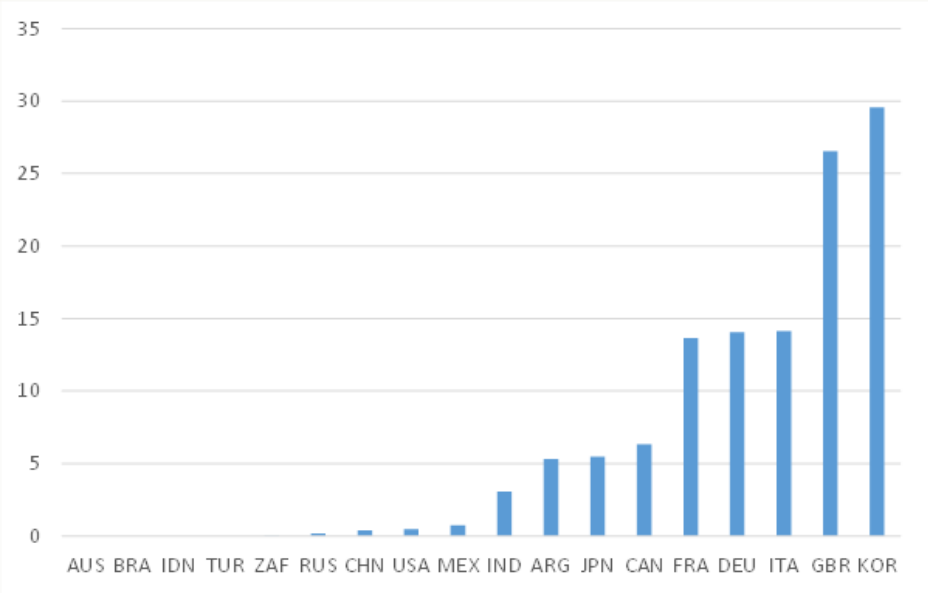
Across all countries, and fuels, the effective carbon rate in road transport is EUR 90/tCO_2. This is because of the broad coverage, and relatively high rates, of excise taxes in this sector. The share of road transport emissions priced at EUR 60/tCO_2 or more, is higher than 90% in the majority of G20 countries. Correspondingly (but not shown in the graph), effective carbon rates on road transport fuels are significantly higher than those on other fuels, with coal subject to the lowest rate on average (at less than EUR 10/tCO_2). In other sectors rates are much lower on average, with the lowest averages in electricity and industry, where inter-country heterogeneity is large, as can be seen from Figure 4 and Figure 5.

In the electricity and industry sectors, emissions pricing often takes the form of emissions trading systems. Emission permits can be auctioned, but free allocation remains common in industry and to a lesser extent in electricity, and this reduces the average effective carbon rate (i.e., the marginal rate corrected for the share of free allocation). Across the countries shown in Figure 4 and Figure 5, the average rate measures 80% of the marginal rate in the electricity sector, and 70% in industry. Free permits may be contributing to their intended objective of limiting carbon leakage and competitiveness risks, but this potentially comes at a cost in terms of environmental effectiveness[4].

The effect of carbon pricing depends on price levels but also on the responsiveness of fuel use to greenhouse gas emissions pricing. This responsiveness differs between countries, sectors and fuels. In road transport, pre-existing taxes tend to be high, so that an increase in the carbon price has a small effect on the fuel price compared to other fuels and uses, e.g. coal. In addition, the carbon content of coal is relatively high, so that a carbon tax implies relatively large price increases. Combined with – so far – relatively limited substitution possibilities in road transport, this implies that higher prices can be expected to have a significantly smaller effect on road transport fuel demand than on the demand for coal or other fuels. Apart from fuel taxes, vehicle ownership and usage taxes also affect vehicle use and fuel efficiency. In several countries these are designed to reduce CO_2 and sometimes other

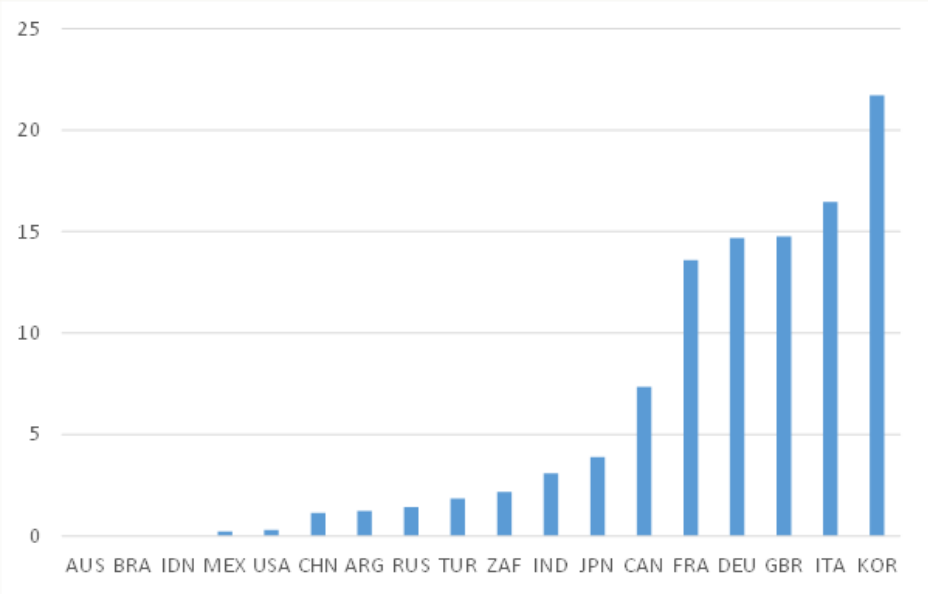
pollutant emissions, with often strong impacts on purchase decisions and hence vehicle fleet characteristics.

Figure 4. Effective carbon rate, electricity sector, EUR/tCO$_2$, 2018



Source: OECD Effective Carbon Rates Database.

Figure 5. Effective carbon rate, industry sector, EUR/tCO$_2$, 2018



Source: OECD Effective Carbon Rates Database.

[4] Flues, F. and K. van Dender (2017), "Permit allocation rules and investment incentives in emissions trading systems", *OECD Taxation Working Papers*, No. 33, OECD Publishing, Paris, https://doi.org/10.1787/c3acf05e-en.

Box 3. Greenhouse gas emissions pricing and fossil fuel subsidy reform[5]

At the 2009 Pittsburgh summit, G20 leaders committed to rationalising and phasing out "Inefficient Fossil Fuel Subsidies that encourage wasteful consumption" over the medium term, while ensuring targeted support for the poorest. This commitment was reiterated several times, including in the Riyadh Leaders' Declaration of 22 November 2020. Phasing out these subsidies proves to be difficult, however, as support levels essentially remain on par with 2010 levels, having increased substantially (to 2013) then receded in the interim as of 2019. The G20 peer review mechanism to support fossil fuel subsidy reform remains active, with Argentina and Canada reviews expected to be launched in 2021-22, and France and India have committed to follow suit. The Italian G20 Presidency has signalled intent to reinvigorate the G20 focus on subsidy reform in 2021, with several deliverables anticipated during its Presidency year.

The OECD estimates fossil fuel support through an inventory of now 1300 support measures, focussing on budgetary costs and revenue forgone.[6] It distinguishes between consumer support, producer support and general service support estimates. By this measure, total fossil fuel support across 50 countries covering all OECD, G20 countries (except for Saudi Arabia) and 6 Eastern European partnership economies rose by 5% year-on-year to USD 178 billion in 2019, reversing a five-year downward trend also highlighted by previous editions of the OECD Companion to the Inventory of Support Measures for Fossil Fuels. The increase in support was driven by a 30% rise in direct and indirect support for the production of fossil fuels, notably oil and gas, primarily in OECD countries. The most significant increases in producer support were observed in Mexico, the United States, and the United Kingdom. However, in the European Union, support for coal production was scaled back. Consumer support is largest in the transport fuels sector, partly because large shares of support are delivered through preferential tax rates (see below).

In addition to the OECD's inventory-based support estimate, there is a combined OECD-IEA support estimate for 81 countries. It integrates IEA's consumer support estimates, which compare domestic prices to international reference prices. This estimate shows a decline of support from 2018 to 2019 by 18%, mainly as a consequence of the drop in crude oil prices as opposed to reform. Support had increased from 2016 through 2018, also mainly because of oil price fluctuations.

Fossil fuel support can influence effective carbon rates in several ways. For example, preferential excise tax rates are included in the inventory of support measures, and they also directly affect - and are accounted for in - the effective carbon rates. While in OECD countries, around 75% of support comes from preferential excise tax treatment, the situation is different outside the OECD area. In G20 non-OECD countries, for instance, transfers are more important, and these may or may not directly affect prices. Still, tax expenditures remain an important avenue for support, providing 43% of the total value of support. Increasing effective carbon rates, and reducing fossil fuel support, particularly in the OECD, is to a considerable degree a matter of removing preferential tax treatment, and putting in place better policies to achieve the goals of the tax preference.

[5] This section draws from the *OECD Companion to the Inventory of Support Measures for Fossil Fuels 2021*, OECD, https://doi.org/10.1787/e670c620-en.

[6] There are various other notions of energy subsidies. For example, Coady and others, 2019, "Global Fossil Fuel Subsidies Remain Large: An Update Based on Country-Level Estimates", IMF working paper 19-89, estimated global fossil fuel subsidies amounted to $5.2 trillion (6.5 percent of GDP) in 2017, as measured by undercharging for supply costs, environmental costs, and general consumption taxes.

The potential impacts of carbon pricing

(See Box 4)

Decisive policy action is required by G20 countries to reduce emissions over the next decade in line with intermediate emissions commitments, though the carbon prices or equivalent measures needed differ substantially across countries. While countries have many policy instruments at their disposal, assessing the increase in carbon pricing needed to achieve climate objectives provides a useful benchmark—all policies combined must have the equivalent impact on emissions as this implicit carbon price is estimated to have, and their costs can be compared with that of carbon pricing. The carbon price increases that are estimated to be needed for G20 countries to achieve their NDC commitments through pricing alone vary from less than USD 25 per tonne of CO_2 in 2030 in five countries, to between USD 25 and USD 75 per tonne of CO_2 in seven countries, and over USD 75 per tonne of CO_2 in seven other cases (Figure 6). To some degree, this variation reflects responsibilities that differ with the level of country development. Increased ambition for 2030, needed to attain Paris Agreement goals, would require stronger price increases or equivalent measures.

The potential revenue gains from carbon pricing are significant. For example, a USD 50 per tonne of CO_2 carbon price in 2030 would generate revenue increases of around 1% of GDP for many G20 countries and substantially more than that in a few cases (Figure 7). OECD estimates[7] suggest similarly significant short run revenue potential from increasing prices to EUR 30/tCO_2 where they are currently lower.

Domestic environmental benefits can outweigh the economic efficiency costs of pricing. Carbon pricing is in many countries' own domestic interests before even counting the global climate benefits because, up to a point, the domestic environmental and health co-benefits can outweigh the economic efficiency costs—this is especially the case for countries with chronic mortality risk from local fossil fuel air pollution (Figure 8).

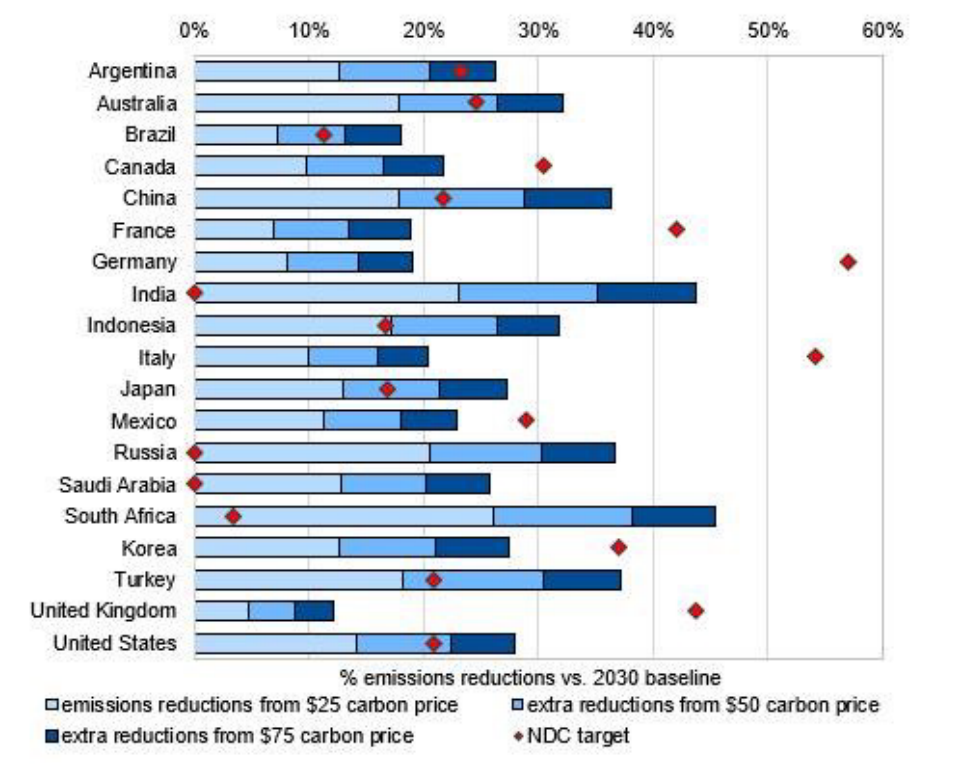
The impacts of carbon pricing on energy prices are of particular concern as, in turn, this affects the distributional burden on households and industries. Carbon pricing has a disproportionately large impact on the price of coal (given its high carbon intensity), but coal is largely an intermediate input. Carbon pricing has intermediate impacts on the price of natural gas, and more moderate impacts on pump prices for motor fuels. The impact on electricity prices will depend on the country's mix of power generation fuels. See Table 1.

[7] Marten, M. and K. van Dender (2019), "The use of revenues from carbon pricing", OECD Taxation Working Papers, No. 43, OECD Publishing, Paris, https://doi.org/10.1787/3cb265e4-en. OECD (2021), "Taxing Energy Use for Sustainable Development: Opportunities for energy tax and subsidy reform in selected developing and emerging economies", OECD Publishing, Paris, http://oe.cd/TEU-SD.

Box 4. Carbon prices implicit in mitigation pledges and the impact of pricing

Carbon prices implicit in countries' mitigation pledges for 2030 vary substantially across G20 countries for two reasons (Figure 6). First is because the stringency of pledges, as implied by the reductions in 2030 levels below baseline levels (with no change in current mitigation policies), differs substantially across countries. Second is because the price responsiveness of emissions differs across countries — for example, emissions are generally more responsive to pricing in countries that consume a lot of coal. Besides the price level, the fiscal impacts of carbon pricing (see Figure 7) depend on the baseline emissions intensity of GDP, adjusted for how much pricing causes emissions to fall and any erosion in pre-existing fuel tax bases.

Figure 6. NDC goals and emissions reductions by pricing scenario

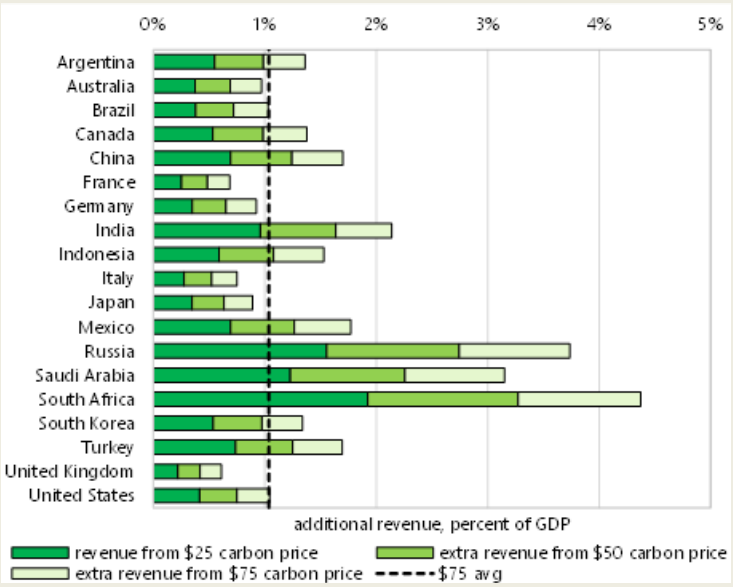


Note: NDCs targets are from first-round or (if applicable) second-round Paris pledge. Pledge assumes fossil fuel CO_2 falls in proportion to total greenhouse gases. Where a country has a conditional NDC the target is defined as the average between the conditional and unconditional target. France, Germany and Italy are assumed to reduce emissions at the EU-side revised NDC level (5.5% vs. 1990 emissions). US target is the level needed by 2025 under its previous NDC.
Source: IMF staff.

The economic efficiency costs of carbon pricing (at least as measured by the value of foregone fossil fuel consumption less savings in supply costs) are manageable—typically around 1 percent of GDP for a carbon price of USD 50 per tonne of CO_2 in 2030 for emissions intensive countries, and much less than that in other cases. For most countries, however, the domestic environmental co-benefits of carbon pricing (primarily reductions in local air pollution deaths and reductions in traffic congestion/accident externalities) are about as large, or in a few cases are much larger, than the economic efficiency costs.

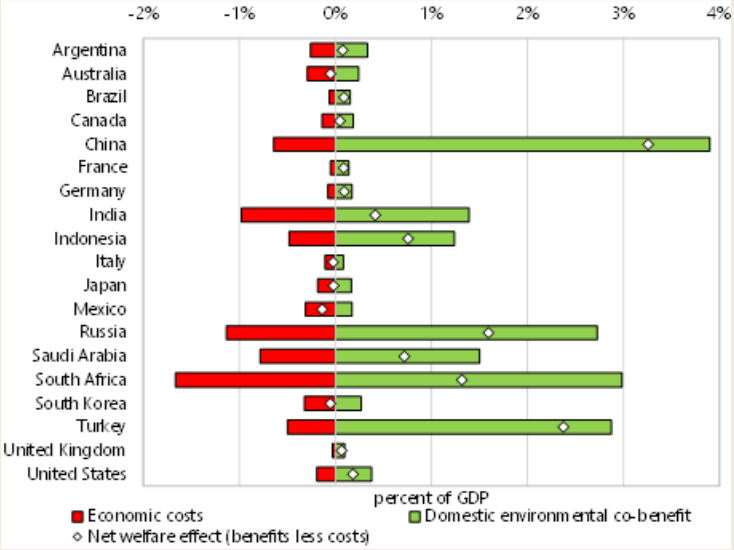
In absolute terms, the energy price impacts of carbon pricing are broadly similar across countries for coal, natural gas, and gasoline (given similar emissions factors for these fuels), but the proportionate price increases differ considerably due to large differences in baseline prices. For electricity, the absolute price increases vary by country depending on the emissions intensity of generation. See Table 1.

Figure 7. Fiscal Revenues from Alternative Carbon Pricing Scenarios, 2030



Note: Estimates are relative to a baseline with any existing carbon pricing and fuel taxes fixed at 2020 levels – that is, carbon pricing is imposed on top of any existing pricing. Estimates take into account losses due to erosion of tax bases for pre-existing carbon pricing and fuel taxes.
Source: IMF staff.

Figure 8. Efficiency costs and domestic environmental co-benefits for a $50 carbon price, 2030



Note: Costs are comparative static calculations of changes in consumer and producer surplus and government revenue, in fossil fuel markets, accounting for pre-existing fuel taxes. Domestic benefits include reductions in local air pollution morality and traffic congestion/accident externalities.
Source: IMF staff.

Table 1. Energy Price Impacts for a $50 Carbon Price, 2030

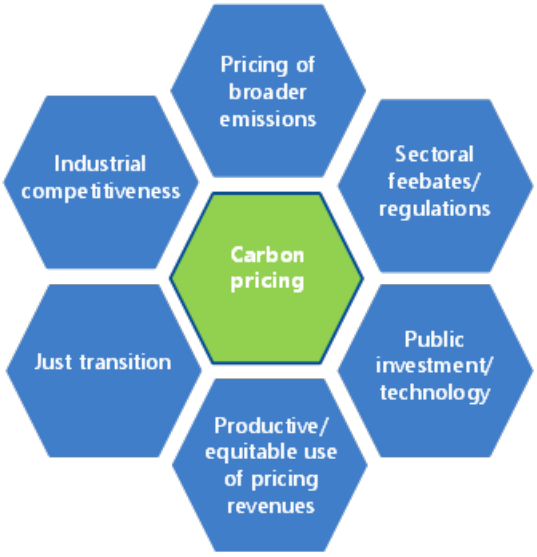
Country	Coal		Natural gas		Electricity		Gasoline	
	BAU price, $/GJ	% increase	BAU price, $/GJ	% increase	BAU price, $/kWh	% increase	BAU price, $/liter	% increase
Argentina	2.5	192	2.6	105	0.1	65	0.8	15
Australia	3.0	174	5.7	50	0.1	72	1.3	10
Brazil	3.1	155	11.0	22	0.1	8	1.3	9
Canada	3.2	156	3.7	72	0.1	10	1.4	9
China	4.0	125	3.9	67	0.1	34	1.1	11
France	4.0	129	11.9	27	0.2	7	2.2	6
Germany	5.3	101	8.6	31	0.2	11	2.1	6
India	1.0	462	2.3	157	0.1	50	1.4	4
Indonesia	2.7	174	4.9	48	0.1	75	0.7	17
Italy	3.9	138	9.6	34	0.1	31	2.4	5
Japan	4.0	123	8.6	33	0.1	41	1.9	6
Mexico	1.7	286	3.0	85	0.1	65	1.1	10
Russia	1.2	395	2.5	101	0.1	58	0.6	21
Saudi Arabia	0.0		3.1	81	0.1	79	0.5	24
South Africa	2.4	202	3.5	70	0.1	61	1.0	12
South Korea	5.3	90	12.5	22	0.1	53	1.7	6
Turkey	1.3	381	6.8	38	0.1	60	1.4	8
UK	9.5	54	10.8	28	0.2	7	2.1	6
USA	1.8	288	3.3	91	0.1	46	1.2	11

Note: BAU is business as usual. Prices are retail prices, including pre-existing energy taxes, and adjusted for projected changes in international energy prices. Impacts of carbon taxes on electricity prices depend on the emission intensity of power generation. GJ = gigajoule; kWh = kilowatt-hour.
Source: IMF staff calculations.

Comprehensive mitigation strategies

Although carbon pricing is an effective instrument, a comprehensive package of measures is needed to enhance the overall effectiveness and acceptability of the mitigation strategy. Key elements potentially include a balance between carbon pricing and reinforcing sectoral instruments; supporting public investment and technology policies; productive and equitable use of carbon pricing revenues; fossil fuel subsidy reform; and measures for a just transition, to address industrial competitiveness, and to reduce broader greenhouse gases.

Figure 9. Key elements of a comprehensive mitigation strategy



Sectoral feebates or regulations: Carbon pricing may be subject to acceptability constraints, not least because of the burden of higher energy prices on households and energy-intensive firms. A balance is likely needed between pricing and reinforcing sectoral measures, which are less efficient because they do not promote the same demand responses (e.g., reductions in driving diesel or petrol vehicles) but avoid large increases in energy prices. Traditionally, reinforcing instruments have taken the form of regulations, for example energy efficiency or emission rate standards. Another option is feebates, which provide revenue-neutral sliding scales of fees on products or activities with above average emission rates and sliding scale of rebate for products or activities with below average emissions rates. Feebates can cost-effectively promote all the behavioural responses for reducing emission intensity within a sector, they avoid

a fiscal cost to the government, and they do not impose a new tax burden on the average household or firm.[8] Elements of feebates have been integrated into some vehicle tax systems though they could also be applied to industry and power generation, and to promote clean heating systems, efficient appliances, and forest carbon storage.

Public investment and support for technology: Mitigation instruments need to be supported by public investments that would not be provided by the market, even with a robust carbon price. An important example is network infrastructure for clean technologies (e.g., power grid upgrades to accommodate renewables, charging stations for electric vehicles). Market failures at various stages during the development and diffusion of new (clean) technologies can warrant policy interventions. For example, support for basic research, and prizes and other incentives for applied private sector research and development, to address knowledge spill-overs; and transitory incentives to promote deployments which might otherwise be hindered by scale economies and learning-by-doing spill-overs.

Productive and equitable use of carbon pricing revenues: Insofar as possible, carbon pricing revenues should be used productively to benefit the economy to help offset the harmful effects of higher energy prices. Productive uses include, for example, cutting the labour tax wedge, funding clean infrastructure investment, or more general investments for Sustainable Development Goals. Use of revenues can also be calibrated to enhance the overall fairness of the mitigation strategy by reducing the net burden on different household income groups—for example, through using some revenue for targeted tax cuts and just transition measures.

Just transition: Just transition measures refer to protection for groups that are especially vulnerable to clean energy transitions. This includes low-income households for whom higher energy prices may be especially burdensome; displaced workers (e.g., from extractive industries, and energy-intensive firms competing in global markets); firms and vulnerable regions. Potential assistance measures might include stronger cash and in-kind social safety nets; extended unemployment benefits, training, and re-employment services; and assistance for reclaiming abandoned mining and drilling sites and temporary local government budget support. In addition, in order to facilitate the transition out of fossil fuels, alternatives need to made available. For instance, improved access to public transportation and cleaner cars (including charging facilities for electric vehicles) will strengthen households' ability to transition away from carbon-intensive transport. This can also help alleviate any regressive impacts of carbon pricing. Support for weatherisation and insulation of buildings similarly can facilitate shifts to lower energy use while simultaneously dampening adverse distributional effects.

Industrial competitiveness: The focus here has been on energy-intensive, trade-exposed (EITE) industries (e.g., metals, chemicals, cement) given that their costs are disproportionately increased by carbon pricing, demand for these products may shift significantly from domestic to foreign suppliers when their domestic prices rise, and these industries may also have political sensitivities, given the visibility of their employment effects. Existing assistance measures take the form, for example, of free allowance allocations (e.g. EU, Korea) and emission rate standards for industry in lieu of pricing (e.g., Canada). These measures, however, become less effective at preserving competitiveness for EITE industries with deeper decarbonisation, hence the current interest in BCAs (see below).

Pricing of broader emissions: Beyond pricing of fossil fuel CO_2 and industrial process emissions, there are various other sources of greenhouse gas emissions requiring pricing or related measures. For some G20 countries, fugitive (mainly methane) emissions from extraction, processing, and distribution of fossil fuels are a significant emissions source — these emissions might be priced using a default emissions rate pending more extensive development of metering technologies. Carbon storage in forests might be

[8] Feebates are the fiscal analogue of emissions regulations with extensive credit trading provisions. In the former case however the implicit carbon price is fixed and the emission rate is determined endogenously and vice versa in the latter case.

promoted through fees on landowners that reduce storage relative to a baseline year and corresponding rebates for landowners that increase carbon storage. Agricultural emissions are not directly measured, but some variant of emissions pricing might be viable based on farm level inputs or outputs and default emission rates.

BCAs and international coordination

Concerns about the leakage and competitiveness impacts of carbon pricing arise in the absence of effective international coordination on climate policies. The potential loss of competitiveness of domestic firms arises due to increased costs *vis-à-vis* foreign competitors in countries pursuing less ambitious environmental objectives. The additional compliance costs associated with domestic climate policies risk eroding support from industry and civil society. The two issues are intertwined: ambitious policies undertaken in a few countries may lead to production moving to countries that are given a perceived "unfair" competitive advantage by virtue of a less ambitious domestic carbon policy, potentially further exacerbating carbon leakage.

Dispersion in carbon pricing ambitions is prompting proposals for BCAs. Widely divergent mitigation pledges submitted for the Paris Agreement have led to concerns about achieving meaningful global greenhouse gas reductions and subsequently to some countries and regions pursuing stronger unilateral action. Many countries are considering which climate policies could be most effective at minimising adverse carbon leakage, while ensuring fairness by dampening any negative competitiveness effects. One of the policy options available to achieve these two goals is a border carbon adjustment (BCA). A BCA is a measure applied to traded products that seeks to make their prices in destination markets reflect the costs they would have incurred had they been regulated under the destination market's greenhouse gas emission regime.[9]

BCAs pose technical, administrative and political challenges. Designing BCAs is challenging. Policymakers will have to make several critical decisions, most of them involving trade-offs between effectiveness and feasibility. There are risks that BCAs could be perceived as instruments for exerting leverage on other countries to increase the level of ambition of their climate policies. They could also be perceived by some as a form of "green protectionism". Both concerns could lead to heightened geopolitical tensions, and affect global trade and investment.

Alternatives to BCAs may become less appealing as ambition rises. Alternative policy approaches to BCAs, ranging from multilateral to unilateral approaches, could be implemented either instead of, or in parallel with BCAs. While some of these may avoid some of the pitfalls of BCAs, their use also involves trade-offs. In particular, commonly implemented tools – such as free allocation of permits in emissions trading systems – imply a lower level of domestic climate ambition and are often incompatible with ambitious long-term climate objectives. As decarbonisation ambitions rise, free permits become increasingly problematic to the extent that they weaken abatement incentives. Annex C includes two tables

[9] Cosbey, A. et al. (2012), A Guide for the Concerned: Guidance on the elaboration and implementation of border carbon adjustment, International Institute for Sustainable Development, www.iisd.org/library/guide-concerned-guidance-elaboration-and-implementation-border-carbon-adjustment.

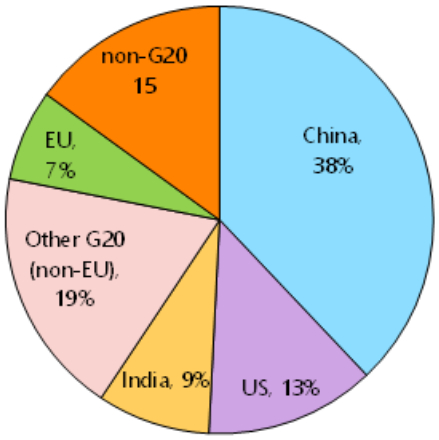
that summarise how design choices for BCAs affect policy objectives and how BCAs compare to alternative instruments, respectively.

BCAs should align with WTO and other rules. Any mechanism, BCA or its alternatives, needs to be designed carefully and take into account country commitments under the multilateral, rules-based, trading system and its transparent and enforceable nature. This is all the more important in today's highly interconnected world and given the already difficult environment for global governance.

Synergies between trade and climate policies should be strengthened. Making ambitious climate targets viable, in a globalised world, goes beyond the issues of carbon leakage and competitiveness. Governments should also consider other areas where trade and climate policies can be mutually supportive. For instance, existing trade-related policies that lead to increased carbon emissions (such as fossil fuel subsidies) should be reviewed. More coherence in the trade and environment policy space reduces the risk of exacerbating a sense of unjust global burden-sharing on the climate issue, notably between developed and developing countries. This can in turn increase countries' willingness to accept stronger commitments in climate negotiations. Ultimately, there is a need to restore trust in the multilateral systems (trade and climate) – especially in the wake of the COVID 19 crisis – so that they can both keep delivering substantial benefits.

An international carbon price floor (ICPF) could be a better mechanism for addressing climate goals while maintaining a level playing field. An ICPF has the potential to more effectively scale up global mitigation as it would apply to all covered emissions in participating countries, rather than emissions embodied in trade flows. Although not straightforward to agree, an ICPF could complement and reinforce the Paris Agreement. Under the Paris framework there are many parties (195), negotiating over many pledges (one per party, with the exception of EU countries), and unilateral action on mitigation is difficult due to concerns about competitiveness and free riding. Focusing on coordination among a smaller number of key emitting countries (see Figure 10), and a single and transparent parameter, could facilitate negotiation and enhanced mitigation. [10]

Figure 10. Country shares in projected global CO_2 emissions, 2030



Source: IMF staff calculations.

[10] For further discussion of the rationale for and design of an ICPF, and flexibility provisions to accommodate equity concerns and differing policy approaches at the national level, see IMF (2019), *How to Mitigate Climate Change*, Fiscal Monitor.

Support for continued dialogue on greenhouse gas emissions pricing and related climate policy instruments

Evidence on carbon prices shows they do not match policy ambitions. This report has shown that current fuel excise taxes, carbon taxes and emissions trading systems result in effective carbon rates that are low and poorly aligned with fuels' carbon content. More stringent carbon pricing policies or equivalent policies will be needed for countries to reach their nationally determined targets. This will be possible only if such policies do not compromise energy affordability or disproportionally affect lower income households, and if carbon leakage and competitiveness risks associated with differences in policy stringency in countries can be managed. Addressing these challenges requires a fiscal policy perspective and international dialogue.

The G20 Finance Ministers are well placed to strengthen the domestic and international greenhouse gas emissions pricing dynamic. They can consider jointly the incentive, revenue use and international coordination aspects of the policy challenge, which is needed to improve the use of carbon pricing or equivalent policies by broadening its coverage and aligning rates better with fuels' carbon content, and ensuring that it is embedded in policy packages that support growth and avoid adverse effects on households and businesses. Through this channel, carbon pricing will be able to play its appropriate role in the overall policy response to the challenge of climate change.

To support an ongoing G20 dialogue on greenhouse gas emissions pricing, Ministers may wish to request the following:

1. Continued monitoring of greenhouse gas emissions pricing, energy taxation and related policies.

   Systematic mapping of: (a) countries' use of emissions trading systems, carbon taxes, other greenhouse gas taxes and excise taxes on energy use; and (b) the key design characteristics of these policies required to make possible comparison of countries' policy settings. Such comparability can bring transparency to international dialogue. Related policies, including excise taxes on electricity use, network charges, renewable charges, and vehicle ownership and usage charges could also be tracked.

2. Regular updates of greenhouse gas emissions price paths consistent with countries mitigation pledges.

Translating countries' mitigation pledges into the price paths or alternative instrument settings needed to reach them clarifies the size of the effort required. The macroeconomic effects of the effort can be gauged further by estimates of the impacts of pricing on emissions, revenue, local air pollution mortality, economic welfare, and energy prices.

3. Assessments of the synergies and trade-offs between emissions pricing and other mitigation instruments.

   Pricing needs to be complemented with and to some degree can be replaced by alternative policies, e.g., energy efficiency standards, emission regulations, feebates, clean energy subsidies, taxes on individual fuels, and sectoral-based carbon pricing. Better understanding of these complementarities and trade-offs helps countries select the policy packages best suited to their economic and political economy circumstances.

4. Analysis of the incidence of energy price changes on households, industries, and employment in vulnerable sectors and regions, and of assistance measures designed to alleviate adverse consequences.

   Distributional and affordability impacts need to be mapped to make well-targeted accompanying policies possible. The increased availability of microdata allows detailed impact analysis, a step towards effective compensation packages. This work would account for countries' particular circumstances as related to their starting points and level of development.

5. Dialogue to promote pricing coordination among large emitting G20 members.

   Coordination on pricing, e.g. on minimum price levels or minimum price changes, has the potential to significantly elevate the contribution of emissions pricing to the transition to carbon neutrality, taking into account countries' different starting points and contexts, and avoiding negative spill-overs on trade relations. Related discussion on the role of carbon border adjustment mechanisms including their pros and cons versus other compensation measures, design issues, and impacts can be included in this dialogue.

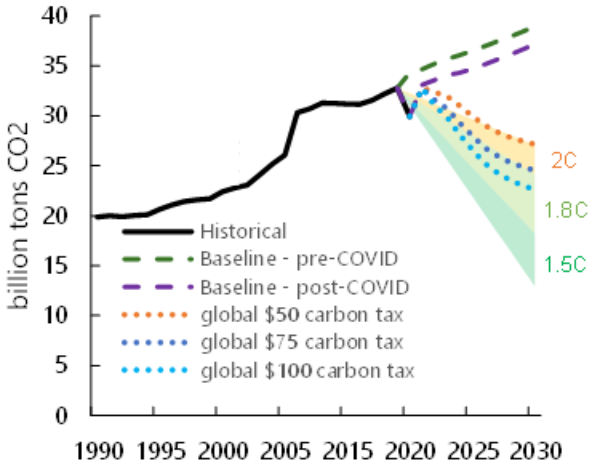
It is crucial for the success of monitoring and assessment efforts that they are systematically based on transparent and coherent methodologies. This work could potentially take the form of peer reviews. The IMF and the OECD have developed relevant capacities, on which they can build further to support the G20 FMCBG's initiatives on greenhouse gas emissions pricing and related climate policy instruments.

Annex A. Global and G20 emissions commitments

Under existing mitigation policies, post-COVID projections suggest global CO_2 emissions will reach 37 billion tonnes in 2030 – illustrative pathways for containing warming to 1.5-2°C would require global CO_2 emissions in 2030 to be limited to around 16-26 billion tonnes (see Figure A.A.1). Without these emissions reductions, meeting temperature stabilisation goals will be extremely difficult, especially if there is lock-in of long-lived fossil fuel capital (e.g., coal plants) over the next decade.

First-round commitments for the Paris Agreement are consistent with containing projected warming to approximately 3oC (UNEP 2020), are partially dependent (for some developing countries) on external finance and are not legally binding. Countries are, nonetheless, required to report progress on meeting their NDCs, and to submit revised NDCs every five years starting in 2021. Table A.A.1 summarises mitigation contributions for G20 countries, which are mostly for 2030. Pledges differ in nominal stringency and baseline years against which targets apply.

Figure A A.1. Global CO_2 projections and pathways for warming targets



Note: Carbon tax starts at $10/$15/$20, rising steadily thereafter 2022-2030. Warming pathways assume CO_2 emissions are reduced in proportion to total GHG emissions.
Source: UNEP (2020), IEA (2020), and IMF staff estimates.

Table A A.1. Paris mitigation contributions

Country	Submitted Revised NDC for COP26	Paris Mitigation Contributions	Year of Net-Zero Pledge
Argentina	Yes	Net emissions cap of 359 $MtCO_2$ in 2030	2050 (under discussion)
Australia	Yes	Reduce GHGs 26-28% below 2005 by 2030	N/A
Brazil	Yes	Reduce GHGs 37%-43% below 2005 by 2025 and 2030	N/A
Canada	No	Reduce GHGs 30% below 2005 by 2030	2050
China	No	Reduce CO_2/GDP 60-65% below 2005 by 2030	2060
France	Yes	Reduce GHGs 55%* below 1990 by 2030	2050
Germany	Yes	Reduce GHGs 55%* below 1990 by 2030	2050
India	No	Reduce GHG/GDP 33-35% below 2005 by 2030	N/A
Indonesia	No	Reduce GHGs 29%(41%) below BAU in 2030	N/A
Italy	Yes	Reduce GHGs 55%* below 1990 by 2030	2050 (under discussion)
Japan	Yes	Reduce GHGs 25.4%(28.5%) below 2005 by 2030	2050
Korea	Yes	Reduce GHGs 24.4% below 2017 by 2030	2050
Mexico	Yes	Reduce GHGs 22%(36%) below BAU in 2030	2050 (under discussion)
Russia	Yes	Reduce GHGs 70% below 1990 by 2030	N/A
Saudi Arabia	No	Reduce GHGs 130 million tonnes below BAU by 2030	N/A
South Africa	No	Reduce GHGs 398-614 million tonnes in 2025 and 2030	2050
Turkey	No	Reduce GHGs 21% below BAU in 2030	N/A
United Kingdom	Yes	Reduce GHGs 68% below 1990 by 2030	2050
United States	No	Reduce GHGs 26-28% below 2005 by 2025	2050
European Union	Yes	Reduce GHGs 55%* below 1990 by 2030	2050

Note: Some countries have specified both conditional and unconditional pledges, where the former are contingent on external finance and other support – in these cases the conditional pledges are in parentheses. Asterics shows the European Union's regional commitment.
Source: UNFCCC, Energy & Climate Intelligence Unit. UNEP, 2020. Emissions Gap Report 2020. UN Environment Programme, Nairobi, Kenya.

Annex B. The carbon pricing score

Box 2 described current effective carbon rates, i.e. prevailing price signals from taxation and emissions trading systems that effectively result in carbon pricing signals, across OECD and G20 economies. This annex discusses comparisons of these effective carbon rates to benchmark values. Specifically, it looks at the Carbon Pricing Score (CPS), which measures the extent to which countries have attained the goal of pricing all energy related carbon emissions at certain benchmark values for carbon costs. Energy related carbon emissions include emissions from fossil fuel and biofuel combustion.

The closer effective carbon rates across the base are to a benchmark value, the higher the CPS. For example, a CPS of 100% against a EUR 30 per tonne of CO_2 benchmark means that all effective carbon rates in the sector or country under consideration reach EUR 30 or more. A CPS of 0% means that no emissions are priced. An intermediate CPS between 0% and 100% means that some emissions are priced, but that not all emissions are priced at a level that equals or exceeds the benchmark. Similarly, a EUR 60 or EUR 120 CPS of 100% means that all emissions are priced at a level that equals or exceeds the benchmark of EUR 60 or EUR 120 per tonne of CO_2.

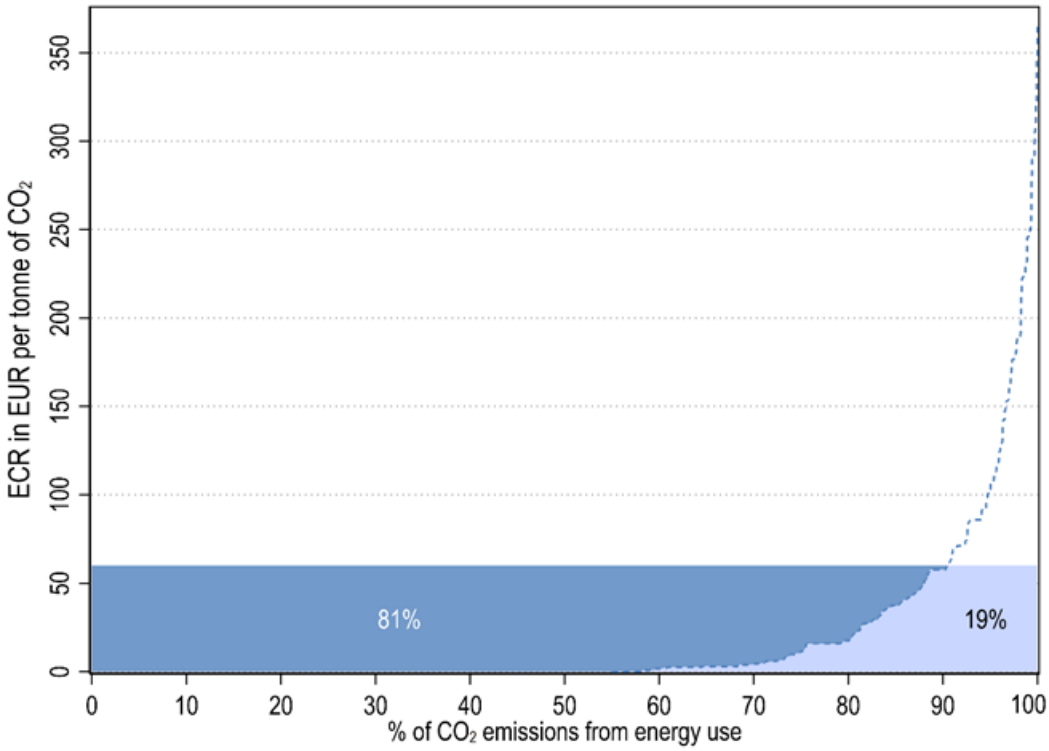
Greenhouse gas emissions pricing benchmarks

Aiming to limit global temperature increases to 1.5°C, as called for in the Paris Agreement, requires decarbonisation by about mid-century. Against this background, this section introduces three carbon price benchmarks:

1. EUR 30 per tonne of CO_2, a historic low-end price benchmark of carbon costs in the early and mid-2010s.
2. EUR 60 per tonne of CO_2, a low-end 2030 and mid-range 2020 benchmark according to the High-Level Commission on Carbon Pricing.
3. EUR 120 per tonne CO_2, a central estimate of the carbon price needed in 2030 to decarbonise by mid-century under the assumption that carbon pricing plays a major role in the overall decarbonisation effort.

In 2018, the 44 OECD and G20 countries analysed had a Carbon Pricing Score at the EUR 60 benchmark (CPS_{60}) of 19%, see the area shaded in light blue in Figure A.B.1. The area shaded in dark blue shows the Carbon Pricing Gap_{60}, i.e. the shortfall to pricing all emissions at EUR 60 per tonne CO_2 or more. The gap was 81% in 2018.

Figure A B.1. The carbon pricing score



Source: OECD, Effective Carbon Rates 2021, forthcoming April 2021.

Compared to the more moderate EUR 30 benchmark, the CPS30 is just under a quarter (24%). Considering the more ambitious and forward-looking central carbon pricing benchmark of EUR 120 in 2030, the CPS_{120} was only 13% in the 44 countries in 2018.

The strength of carbon pricing varies across sectors

In the road sector, in 2018 the CPS_{60} was 80%, the CPS_{30} was 91%, while the CPS_{120} stood at 58%. The other external costs of road usage (such as accidents, noise, local air pollution and congestion) may justify charging effective carbon rates that are substantially higher than low-end and mid-point estimates of climate costs in the road sector.

Table A B.1. The carbon pricing score varies significantly across sectors

Carbon Pricing Score			
Sector	EUR 30	EUR 60	EUR 120
Agriculture & Fisheries	43%	38%	23%
Electricity	10%	5%	3%
Industry	9%	5%	3%
Non-road Transport	34%	25%	13%
Residential & Commercial	14%	10%	6%
Road Transport	91%	80%	58%

Source: OECD, Effective Carbon Rates 2021, forthcoming April 2021.

In the electricity sector, the CPS_{30} was 10%, the CPS_{60} was 5%, and the CPS_{120} was 3% in 2018. However, some countries achieved significantly higher carbon pricing scores in the electricity sector. Both Korea and Iceland reached a CPS_{30} of 93%, and the United Kingdom scored 77% in 2018. All three countries also attained a CPS_{60} of 50%.

In the industry sector, in 2018 all countries combined scored a CPS_{30} of 9%, a CPS_{60} of 5%, and a CPS_{120} of 3%. Norway, Slovenia and Denmark reached a CPS_{60} of 40% and a CPS_{30} of 50% or more.

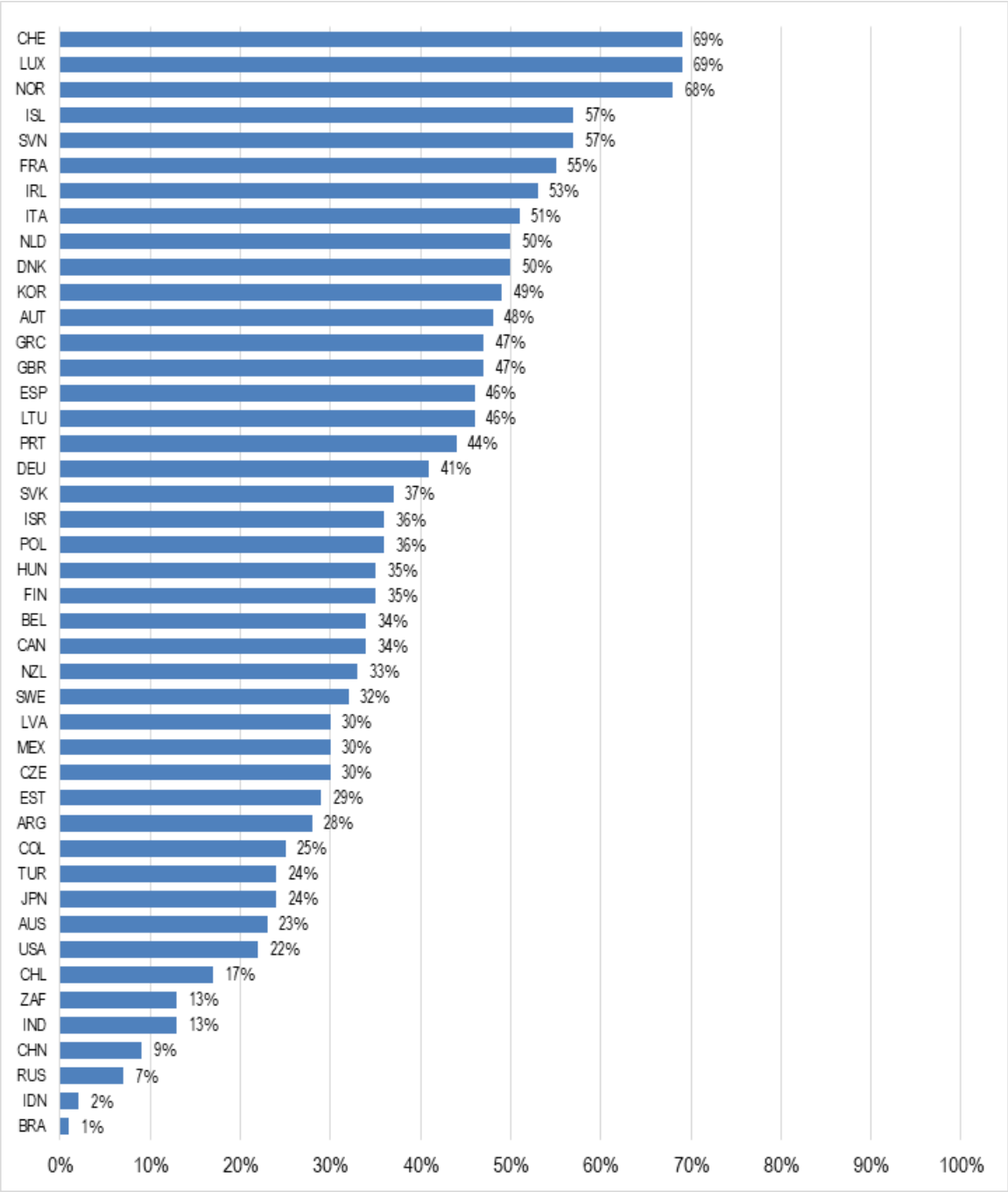
In the residential and commercial sector, the CPS_{30} was 14% for all 44 countries together in 2018. The CPS_{60} was 10% and the CPS_{120} was 6%. Some countries achieved a significantly higher carbon pricing level in the residential and commercial sector. The Netherlands reached a CPS_{60} of 90%, while Switzerland achieved a CPS_{60} of 78% and Italy, France and Greece achieved a CPS_{60} of about 50%. Five countries achieved a CPS_{30} of more than 70% (the Netherlands, Iceland, Switzerland, Korea and Ireland).

A handful of countries attain high carbon pricing scores

In 2018, Switzerland, Luxembourg and Norway reached a CPS_{60} of close to 70% (Figure A.B.2). In Switzerland, the high CPS_{60} is the result of fuel taxes in the road sector that are fully earmarked for road infrastructure purposes, a significant carbon incentive tax (CHF 96 or EUR 83 per tonne CO_2 since 2018) for fossil fuel use in the residential and commercial sector, a highly decarbonised electricity supply and few industrial emissions, that are largely subject to the Swiss ETS. In Norway, this is the result of a highly decarbonised electricity supply, significant taxes on fossil fuels used in the residential and commercial sector, but also on a large share of industrial sector emissions resulting from the offshore petroleum industry, that is subject to both a carbon tax and the EU ETS. In Luxembourg, a small country with a significant share of daily commuters who live abroad, a high share of transit traffic and considerable fuel tourism, the high CPS_{60} is largely due to the road sector dominating overall energy use.

Nearly a quarter of the analysed countries (10 out of 44) had a CPS_{60} of 50% or more in 2018. These countries have in common that they price emissions from the road sector significantly, have moderate to high carbon prices for fossil fuel use in the residential and commercial sector and participate in or are linked to the EU ETS, which prices emissions from electricity generation and industry. Korea follows closely with a CPS_{60} of 49% in 2018. Korea´s broad based emission trading system contributes 30% to its overall carbon pricing effort, while the remaining 70% results from taxes on fuel use.

Figure A B.2. Some countries attain a high carbon pricing score



Note: The carbon price score in the chart is measured against the EUR 60 benchmark.
Source: OECD, Effective Carbon Rates 2021, Forthcoming April 2021.

Signs of divergence in greenhouse gas emissions pricing progress

Countries with higher carbon pricing scores in 2018 increased their scores on average more between 2015 and 2018 than countries with lower carbon pricing scores.

The ten countries with the highest CPS_{60} of the 44 OECD and G20 countries shown in Figure A.B.2 achieved more than half (54%) of the goal of pricing all emissions at EUR 60 or more per tonne of CO_2 in 2018. These countries reached a CPS_{30} of 65% and a CPS_{120} of 44%.

Significant progress is observed for these ten leading countries between 2015 and 2018; they advanced by 7.2 percentage points towards the low-end 2030 benchmark of pricing all emissions at EUR 60 or more per tonne of CO_2, or 2.4 percentage points per year. If the ten leading countries continue to make similar progress on carbon pricing, their CPS_{60} would rise to 82 % by 2030. For pricing all emissions at EUR 60 per tonne of CO_2 or more by 2030, they would need to increase the CPS_{60} by 3.8 percentage points per year.

Progress at the EUR 30 benchmark was even stronger. The ten countries with the highest CPS_{30} in 2018 increased their score by 15.3 percentage points between 2015 and 2018, from 58% to 74%. Continuing to progress with carbon pricing at the same speed they would price all emissions at EUR 30 or more in early 2024.

Many of these leading countries participate in the EU ETS. The recent reform of the EU ETS with the introduction of the Market Stability Reserve (MSR) helped to increase permit prices in the EU ETS from about EUR 5 in 2017 to more than EUR 30 by early 2021. The higher permit prices are a major factor explaining the progress in carbon pricing by these countries. Other factors relate to stronger carbon prices in some countries for the residential and commercial sector. Korea's strong progress with carbon pricing is largely due to an increase in the permit prices of its broad-based emissions trading system.

By contrast, the 10 countries making the least progress in terms of carbon pricing had a CPS_{60} of 13% in 2018. The CPS_{30} was 16% and the CPS_{120} was 7% in 2018. These countries made no progress between 2015 and 2018 on the CPS_{60} or CPS_{30}.

Considering all G20 countries (except Saudi Arabia) together, the group reached a CPS_{60} of 17% in 2018. The CPS_{30} stood at 22% and the CPS120 at 11%. These scores reflect a 0.2 percentage point increase in the CPS_{60} since 2015 and a 0.5 percentage point increase in the CPS_{30}. The CPS_{120} declined by 0.2 percentage points in the same period.

Reforms are significantly increasing the carbon pricing score

While China had a CPS_{60} of only 9% in 2018, the introduction of a national ETS in 2021 is increasing its CPS significantly. In a first step, China has included the electricity sector in its national ETS. Assuming that the national ETS covers 3.6 billion tonnes of carbon emissions from the electricity sector in the first step (Zhang, 2020[23]) at an estimated carbon price of CNY 43 (EUR 5.51) per tonne of CO_2 (Slater et al., 2019[24]), this would increase its CPS_{60} to 12% and its CPS_{30} would increase to 16%. In a second step, China plans to also include emissions from industrial facilities into its national ETS. Together with an increased expected permit price of CNY 75 (EUR9.60) per tonne of CO_2 in 2025 (Slater et al., 2019[24]), the CPS_{30} would then increase to 30% and the CPS_{60} to 19%.

Table A B.2. ETS reform can increase the carbon pricing score

Country or group	Scenario	CPS_{30}	CPS_{60}
China	Status quo in 2018	10%	9%
China	National ETS covers 3.3. billion tonnes CO_2 from electricity generation at an estimated carbon price of CNY 43 (EUR 5.51) per tonne CO_2	16%	12%
China	National ETS covers 100 % of electricity sector emissions plus 60% of industrial emissions at an estimated carbon price of CNY 75 (EUR 9.60) per tonne CO_2	30%	19%
EU 23	Status quo 2018	58%	44%
EU 23	Permit prices increase to EUR 30 per tonne CO_2	75%	53%
EU 23	ETS expands to cover also residential and commercial emissions as well as emissions from small industrial facilities. Permit prices increase to EUR 30 (& EUR 60) per tonne CO_2 respectively	87%	63% (87%)

Source: OECD, Effective Carbon Rates 2021, forthcoming April 2021.

Prices in the EU ETS have increased since 2018 and exceeded EUR 30 per tonne of CO_2 in early 2021. With the increase of permit prices in the EU ETS to EUR 30, the CPS_{30} for the 23 EU countries considered in this document increases from 58% in 2018 to 75%. In addition, the CPS_{60} increases from 44% in 2018 to 53%. To close the carbon pricing gap entirely - pricing all emissions at EUR 30 (or EUR 60) or more per tonne of CO_2 - carbon prices would also need to increase in the sectors that are currently not covered by the EU ETS and that have low effective carbon rates.

If the EU ETS were expanded to include all fossil fuel emissions from the residential and commercial sector as well as from industry, the CPS_{30} would increase to 87%, assuming a permit price of EUR 30 per tonne of CO_2. The remaining gap to pricing all emissions at EUR 30 or more would result largely from biofuels, which often have an effective carbon rate of zero, or a substantially lower rate than those of comparable fossil fuels. The CPS_{60} would increase to 63%. In addition, if permit prices increased to at least EUR 60 per tonne of CO_2, the CPS_{60} would increase to 87%.

Looking forward, it is expected that the Canadian Carbon Pricing Backstop will significantly increase its carbon pricing score in the coming years (but estimates are not yet available).

Annex C. BCAs – design choices and alternatives

Table A C.1. Design Choices for BCAs and How They Affect Multiple Objectives

Metric	Design Feature						
	Sectoral coverage: EITE industries vs. broader (all manufacturing, services, etc.)	Measuring embodied carbon		Rebates for domestic exporters	Revenue use	Lowering import charges for carbon pricing abroad	Exemptions for low income countries
		domestic vs. country-specific benchmarks	rebates for foreign firms with lower embodied carbon				
Protecting competitiveness of EITE industries	Either approach provides same protection	Country-specific preserves relative domestic/foregin prices despite carbon pricing	Little relevance	Preserves competitveness of exports	Little relevance	Appropriate for preserving competitiveness	Little relevance
Limiting leakage	Broader coverage addresses leakage for more products but the benefits may be modest	Country-specific addresses leakage more efficiently	Little relevance	Reduces leakage (but increases domestic emissions)	Little relevance	Reduces leakage if encourages stronger pricing abroad	Little relevance
Promoting carbon pricing in other (large) countries	Broader coverage increases the base of charges on imports from trading partners	Country-specific imposes modestly higher burden on trading partners with higher embodied carbon	Little relevance	Little relevance	Little relevance	Promotes pricing but direct incentives may be modest	Little relevance
Mitigation incentives for domestic EITE industries	Either approach preserves incentives	Either approach preserves incentives	Preserves incentives	Removes mitigation incentives for EITE exporters	Preserves incentives	Preserves incentives	Preserves incentives
Raising revenue	Broader coverage increases revenue from import charges (and revenue losses from export rebates)	Country-specific raises more revenue if trading partners have higher emodiced carbon	Small reduction in revenue	Loses revenue	not applicable	Reduces revenue	Forgoes revenue
Administrative burden	Complex for broader coverage (more products, difficulties in measuring embodied carbon)	Administration for country-specific is more complex	Small if third parties provide verification	Additional burden but modest	Preserves incentives	Burdens limited by focussing on pricing for power/industry	Little relevance
Risk of legal challenge under WTO	Leakage rationale more questionable for broader BCA	Unclear: could be greater for country-specific depending on interpretation of like treatment across countries	Rebuttability provison should help with WTO compatibility	Little relevance	Using revenues for green transtion or international finance may reduce legal risks	Exemptions based on Paris-aligned pledges (rather than emissions) may be challenged	Most likely, little relevance

Source: IMF staff.

Table A C.2. Ensuring the effectiveness and fairness of ambitious climate policies in a fragmented world: strengths and weaknesses of selected instruments

Instrument	Can be applied unilaterally	Maintains domestic abatement incentive	Avoids carbon leakage and asymmetric cost increases for domestic producers	Is WTO compatible	Administratively within reach	Generates revenues for domestic government	Incentivises foreign firms to invest in clean production	Incentivises foreign countries to price carbon emissions	Allows scaling to level of development of foreign countries
Preferential rates	Yes	Weak (depending on size of discount)	Moderate to strong (depending on size of discount)	Strong	Strong	Weak (foregone revenue, depending on size of discount)	No	No	No
Free permits	Yes	Weak to moderate (depending on extent and design of free allocation)	Moderate to strong (depending on share of free allocation)	Strong (has not been challenged)	Strong	No (foregone revenue)	No	No	No
Compensating for input-cost increases	Yes	Weak to moderate (depending on extent and design of cost compensation)	Moderate to strong (depending on size and breadth of compensation)	Strong (has not been challenged)	Strong	No (requires government spending)	No	No	No
Abatement payments	Yes	Strong in theory, moderate in practice	Strong	Strong (has not been challenged)	Strong	No (requires government spending)	No (but this may occur with the related instrument of carbon offsets)	No	No
Feebates	Yes	Moderate (encourages switch to cleaner product categories; but does not provide abatement incentives at the margin)	Strong (but does not address potential leakage by accompanying carbon price)	Strong	Strong	No (if revenue neutral design)	Moderate (strengthens export market for cleaner products)	Weak	No

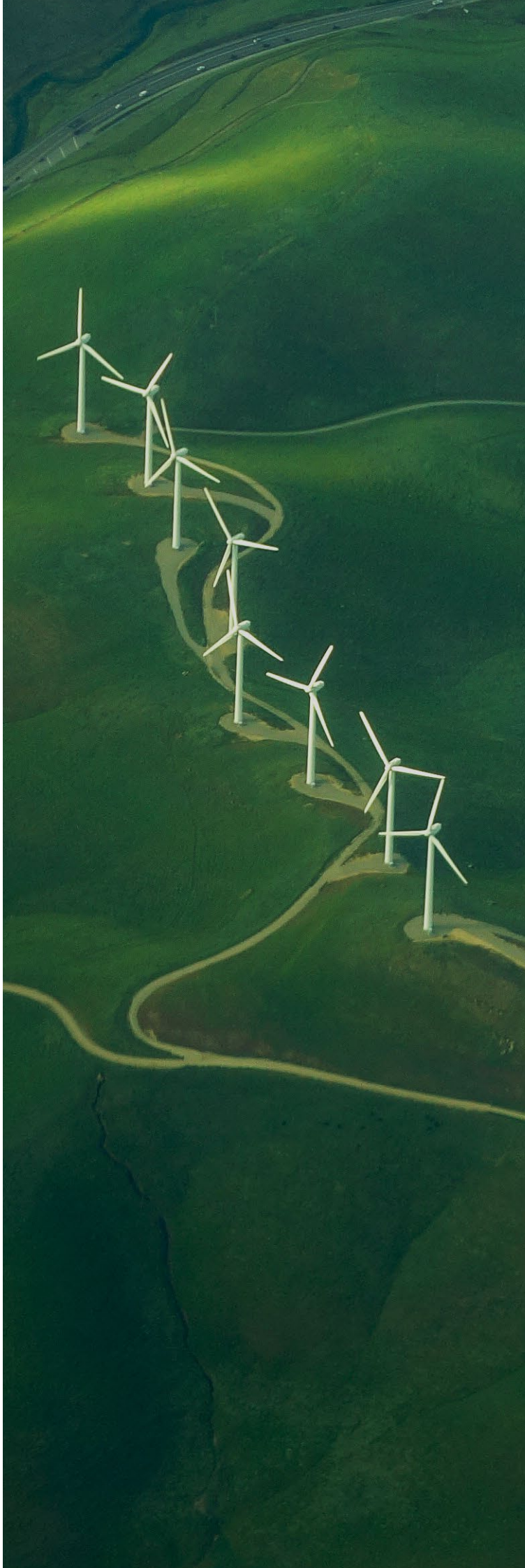
Instrument	Can be applied unilaterally	Maintains domestic abatement incentive	Avoids carbon leakage and asymmetric cost increases for domestic producers	Is WTO compatible	Administratively within reach	Generates revenues for domestic government	Incentivises foreign firms to invest in clean production	Incentivises foreign countries to price carbon emissions	Allows scaling to level of development of foreign countries
Excise taxes on carbon-intensive products, such as steel, cement & bulk chemicals	Yes	Moderate (encourage switch to cleaner substitutes; but not the use of cleaner production processes for a given product)	Strong (but does not address potential leakage by accompanying carbon price)	Strong	Strong	Strong	Moderate (strengthens export market for cleaner products)	Weak	No
Narrow BCA (Mehling et al.)	Yes	Strong	Moderate	Moderate to strong (depends on design)	Strong	No	Moderate	Moderate	Strong
Broad BCA (Flannery et al.)	Yes	Strong	Strong	Moderate to strong (depends on design)	Weak	Strong	Strong	Strong	Moderate
International sectoral agreements	No	Strong in principle but weak in practice due to difficulty of reaching ambitious agreement	Strong	Strong	Moderate	Variable (depends on agreement)	Strong	Strong	Strong (existing agreements include such provisions)
Linking existing carbon markets	No	Variable [1]	Variable [2]	Strong	Weak	Variable (depends on market)	Strong	Strong	Strong

Note 1: Linking carbon markets generally maintain or strengthen domestic abatement incentives, however they may weaken these domestic incentives in certain circumstances depending on their design.
Note 2: Linking carbon markets aims to reduce carbon leakage effectively, however, this will depend on the overall scope and coverage of the schemes linked. This depends on the initial carbon markets that are being linked.
Source: OECD (2020), Climate Policy Leadership in an Interconnected World: What Role for Border Carbon Adjustments?, https://doi.org/10.1787/8008e7f4-en.

Tax Policy and Climate Change

IMF/OECD REPORT FOR THE G20 FINANCE MINISTERS AND CENTRAL BANK GOVERNORS, APRIL 2021, ITALY

This report, by the IMF and OECD, was drafted to inform the G20 Finance Ministers and Central Bank Governors on the role of greenhouse gas emissions pricing in climate change mitigation policy packages. It focuses on carbon pricing, taking stock of current pricing patterns, identifying reform needs, impacts and opportunities, and comprehensive approaches to address political economy concerns.



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