Effective Carbon Rates 2021

OECD

BETTER POLICIES FOR BETTER LIVES

Introduction

Effective Carbon Rates 2021 is the most detailed and comprehensive account of how 44 OECD and G20 countries – responsible for around 80% of global carbon emissions – price carbon emissions from energy use. The *effective carbon rate* is the sum of tradeable emission permit prices, carbon taxes and fuel excise taxes, all of which result in a price on carbon emissions (Figure 1). This brochure summarises the main results of the report *Effective Carbon Rates 2021*.

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Why price carbon emissions?

Carbon pricing is a very effective decarbonisation policy. Carbon prices reduce emissions by making low- and zero-carbon energy more competitive compared to high-carbon alternatives, and by encouraging reduced use of carbon containing fuels. In addition, a strong commitment to carbon prices creates certainty for investors that it pays to invest in the use of available clean technologies and the development of new ones.

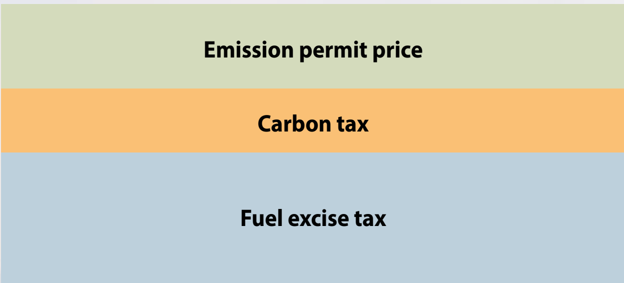
It is estimated that an increase in the effective carbon rate by EUR 1 per tonne of CO_2 leads on average to a 0.73% reduction in emissions over time.[1] This means that, for a country that starts with no carbon price at all, the introduction of a carbon tax of EUR 10 per tonne of CO_2 on its entire energy base would be expected to reduce emissions by an estimated 7.3%.

73% **One practical example is the carbon price support in the United Kingdom, which increased effective carbon rates in the electricity sector from EUR 7 per tonne of CO_2 to more than EUR 36 between 2012 and 2018. Emissions in the electricity sector in the country fell by 73% in the same period,[2] suggesting a strong response of UK utilities to higher effective carbon rates.**

Another practical example concerns the European Union Emissions Trading System (EU ETS). From 2018 to 2019, permit prices in the EU ETS increased by EUR 8.90 per tonne of CO_2, from about EUR 16 to EUR 25.[3] At the same time, overall emissions in the EU ETS decreased by 8.9%,[4] illustrating a significant short-term response of energy utilities covered by the EU ETS to higher permit prices.

Figure 1: **Components of effective carbon rates**

Effective Carbon Rate (EUR/tCO_2)



Source: Effective Carbon Rates 2021

1. Sen, S., & Vollebergh, H. (2018). The effectiveness of taxing the carbon content of energy consumption. *Journal of Environmental Economics and Management*, 92, 74-99.
2. UK Department for Business, Energy and Industrial Strategy (2020). Updated energy and emissions projections: 2018 - Projections of greenhouse gas emissions and energy demand from 2018 to 2035.
3. ICAP (2020). International Carbon Action Partnership (ICAP) – ETS Prices. Retrieved on 13 October 2020 from https://icapcarbonaction.com/en/ets-prices.
4. Marcu, A. et al. (2020). *2020 State of the EU ETS Report*. ERCST, Wegener Center, Bloomberg NEF and Ecoact.

Measuring progress with carbon pricing

The ***Carbon Pricing Score* (CPS)** measures the extent to which countries have attained the goal of pricing all energy related carbon emissions at certain benchmark values for carbon costs. The more progress that a country has made towards a specified benchmark value, the higher the CPS. For example, a CPS of 100% against a EUR 30 per tonne of CO_2 benchmark means that the country (or the group of countries) prices all carbon emissions in its (their) territory from energy use at EUR 30 or more. A CPS of 0% means that the country does not impose a carbon price on any emissions at all. An intermediate CPS between 0% and 100% means that some emissions are priced, but that not all emissions are priced at or above the benchmark price. Similarly, a CPS of 100% against a EUR 60 per tonne of CO_2 or EUR 120 CPS means that all emissions are priced at a level that equals or exceeds the benchmark of EUR 60 or EUR 120 per tonne CO_2.

This means that, together, they reached 19% of the goal of pricing all emissions at EUR 60 or more per tonne of CO_2; see the area shaded in light blue in Figure 2. The area shaded in dark blue shows the *Carbon Pricing Gap*$_{60}$, i.e. the shortfall between the current *Carbon Pricing Score* and pricing all emissions at or greater than EUR 60 per tonne of CO_2. In 2018, the *Carbon Pricing Gap* was 81%.

Stronger progress had been made towards the more moderate EUR 30 per tonne of CO_2 benchmark, however, the Carbon Pricing Score (CPS_{30}) was still just under a quarter (24%). Considering the more ambitious and forward-looking central carbon pricing benchmark of EUR 120 in 2030, the Carbon Pricing Score (CPS_{120}) was only 12%, on average across the 44 countries in 2018.

19%

In 2018, the 44 OECD and G20 countries analysed, which are responsible for about 80% of energy related global CO_2 emissions, had a Carbon Pricing Score of 19% at the EUR 60 benchmark (CPS_{60}).






BOX 1. **CARBON 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.[5,6] Against this background, *Effective Carbon Rates 2021* employs **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.[7] A carbon price of EUR 30 in 2025 is also consistent with a slow decarbonisation scenario by 2060 according to Kaufman et al (2020).[8]

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.[9] A carbon price of EUR 60 in 2030 is also consistent with a slow decarbonisation scenario by 2060 according to Kaufman et al (2020).

3. **EUR 120 per tonne of 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 (See Figure 2 , low complementary policies in Kaufman et al. (2020)). EUR 120 is also more in line with recent estimates of overall social carbon costs.

5. Rogelj, J. et al. (2018). Mitigation Pathways Compatible with 1.5°C in the Context of Sustainable Development. In V. Masson-Delmotte et al. (Eds.), Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C. IPCC.
6. Rogelj, J. et al. (2015). Energy system transformations for limiting end-of-century warming to below 1.5 °C. Nature Climate Change, 5, 519-527.
7. Alberici, S. et al. (2014). Subsidies and Costs of EU Energy – Final Report and Annex 3. Ecofys.
8. Kaufman, N. et al. (2020). A near-term to net zero alternative to the social cost of carbon for setting carbon prices. Nature Climate Change.
9. High-Level Commission on Carbon Prices. (2017). Report of the High-Level Commission on Carbon Prices. World Bank, Washington, D.C.

BOX 2. 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%. In the case of road transport, it is important to acknowledge that there are other external costs of road usage (such as accidents, noise, local air pollution and congestion) in addition to the climate costs. Thus, there are good reasons for charging effective carbon rates that are substantially higher than low-end and mid-point estimates of climate costs in the road sector.

Table 1: **Progress varies significantly across sectors, 2018**

Sector	EUR 30	EUR 60	EUR 120
Agriculture & fisheries	43%	38%	23%
Electricity	10%	5%	3%
Industry	9%	5%	3%
Off-road transport	34%	25%	13%
Residential & commercial	14%	10%	6%
Road transport	91%	80%	58%

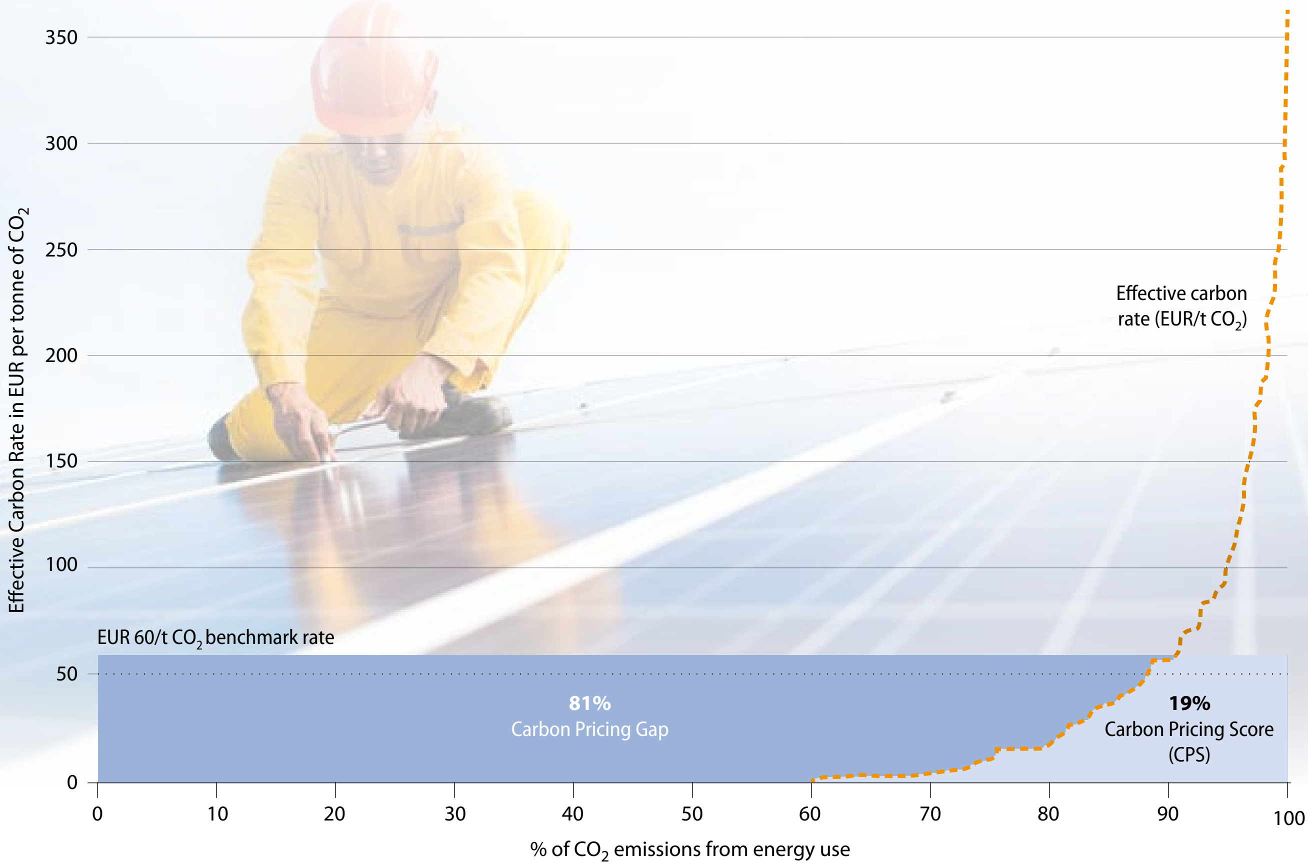
Source: *Effective Carbon Rates 2021*

In the electricity sector, for all countries together, the CPS_{60} was 5%, the CPS_{30} was 10% 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 nearly 50%.

In 2018, in the industry sector the CPS_{60} was 5%, the CPS_{30} was 9%, and the CPS_{120} was 3% for all the countries together. Norway, Slovenia and Korea reached a CPS_{60} of 33% and a CPS_{30} of 50% or more.

In the residential and commercial sector, the CPS_{60} was 10% for all 44 countries together in 2018. The CPS_{30} was 14% 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 89%, 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).

Figure 2: **The carbon pricing score, 2018**



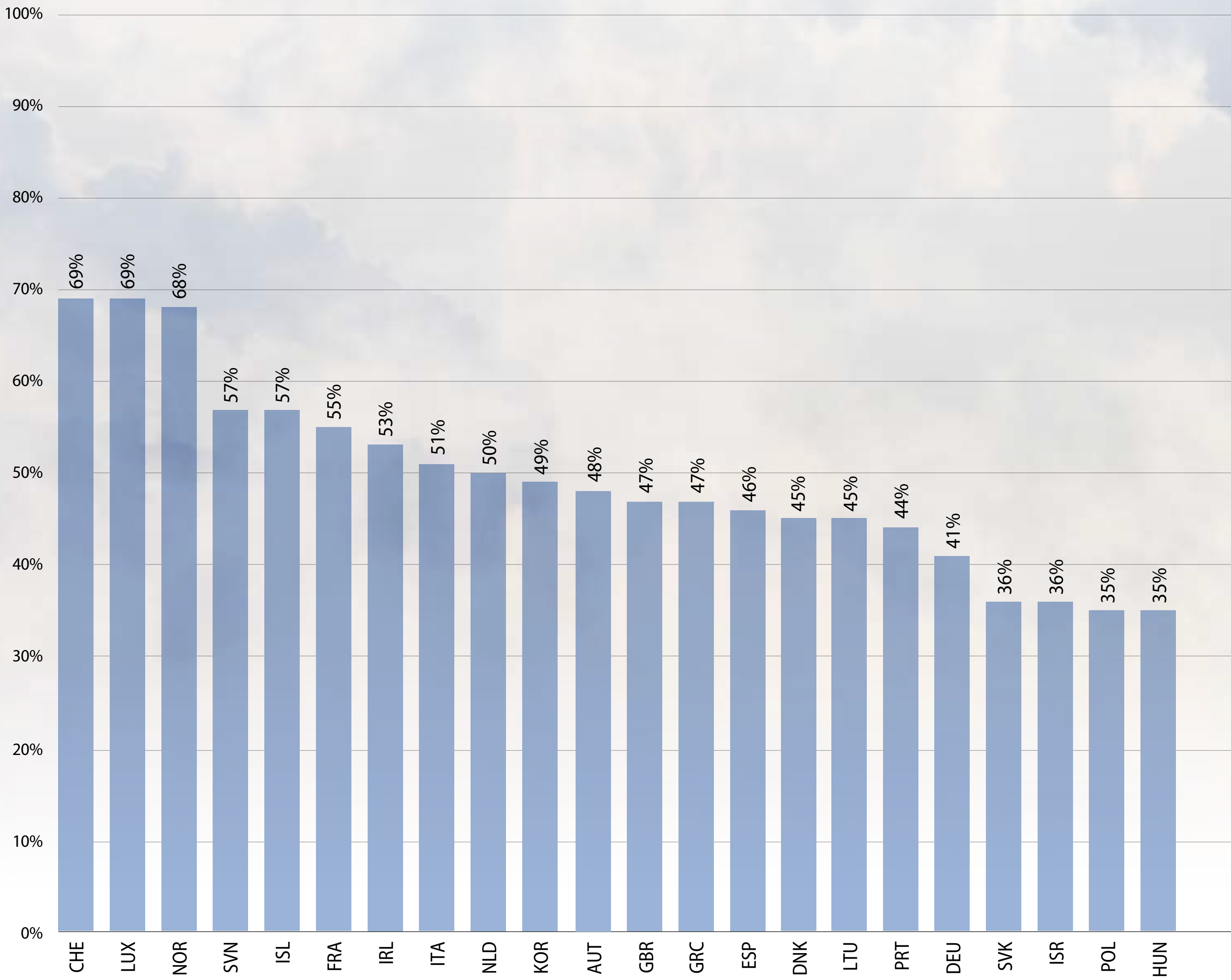
Source: *Effective Carbon Rates 2021*

A handful of carbon pricing leaders attained high carbon pricing scores

In 2018, Switzerland, Luxembourg and Norway reached a CPS_{60} of close to 70%, as shown in Figure 3. 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, which 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, as well as 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.

Figure 3: **Some countries attained high carbon pricing scores, 2018**

Carbon pricing score at EUR 60 per tonne CO_2

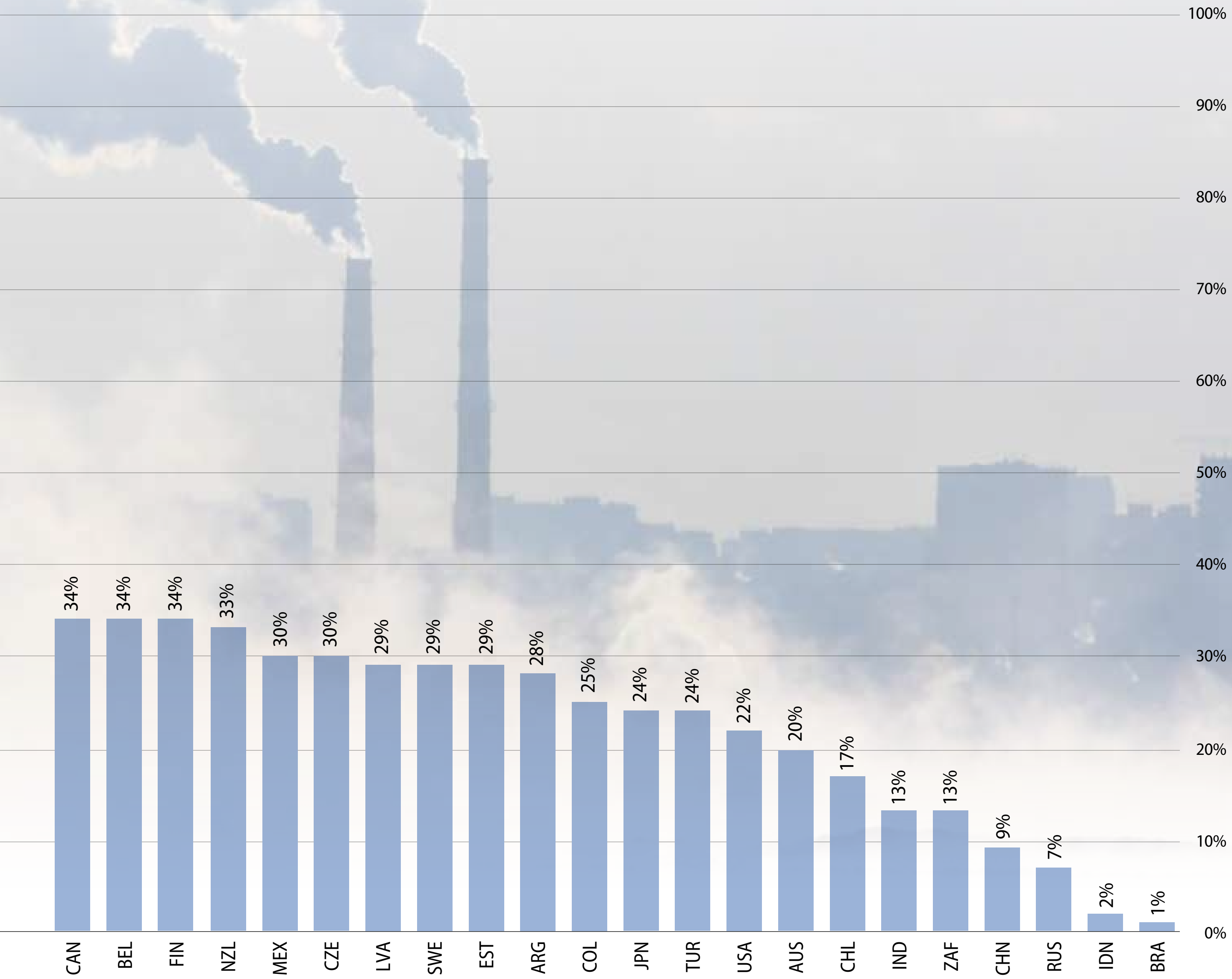


Nearly a quarter of the analysed countries (10 out of 44) had a CPS_{60} of around 50% or more in 2018.

These countries have a number of things in common, such as the fact 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 many participate in or are linked to the EU ETS, which prices emissions from electricity generation and industry. Korea, with a CPS_{60} of 49% in 2018, has a broad based emissions trading system, which contributes 30% to its overall carbon pricing effort, while the remaining 70% results from taxes on fuel use.

Note: The table includes emissions from the combustion of biomass. Results excluding emissions from the combustion of biomass are available on OECD.STAT. Annex 3.A of *Effective Carbon Rates 2018* (OECD 2018) discusses the implications of the combustion approach.

Source: Effective Carbon Rates 2021.0



Reforms can increase the carbon pricing score

While the People's Republic of China (China) had a CPS60 of only 9% in 2018, the introduction of a national emission trading system (ETS) in 2021 will increase its *Carbon Pricing Score* 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,[10] at an estimated carbon price of CNY 43 or EUR 5.51 per tonne of CO_2,[11] this would increase its CPS60 to 12% and its CPS30 would increase to 16%. In a second step, China plans to also include emissions from industrial facilities in its national ETS. Together with an increased expected permit price of CNY 75 (EUR 9.60) per tonne of CO_2 in 2025,[12] the CPS60 would then increase to 19% and the CPS30 to 29%.

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 CPS30 for the 23 EU countries considered in this brochure increased from 57% in 2018 to 73%. In addition, the CPS60 increased from 44% in 2018 to 52%. 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 sectors that are currently not covered by the EU ETS and that have low effective carbon rates, such as in the residential and commercial sector and for small industrial facilities.

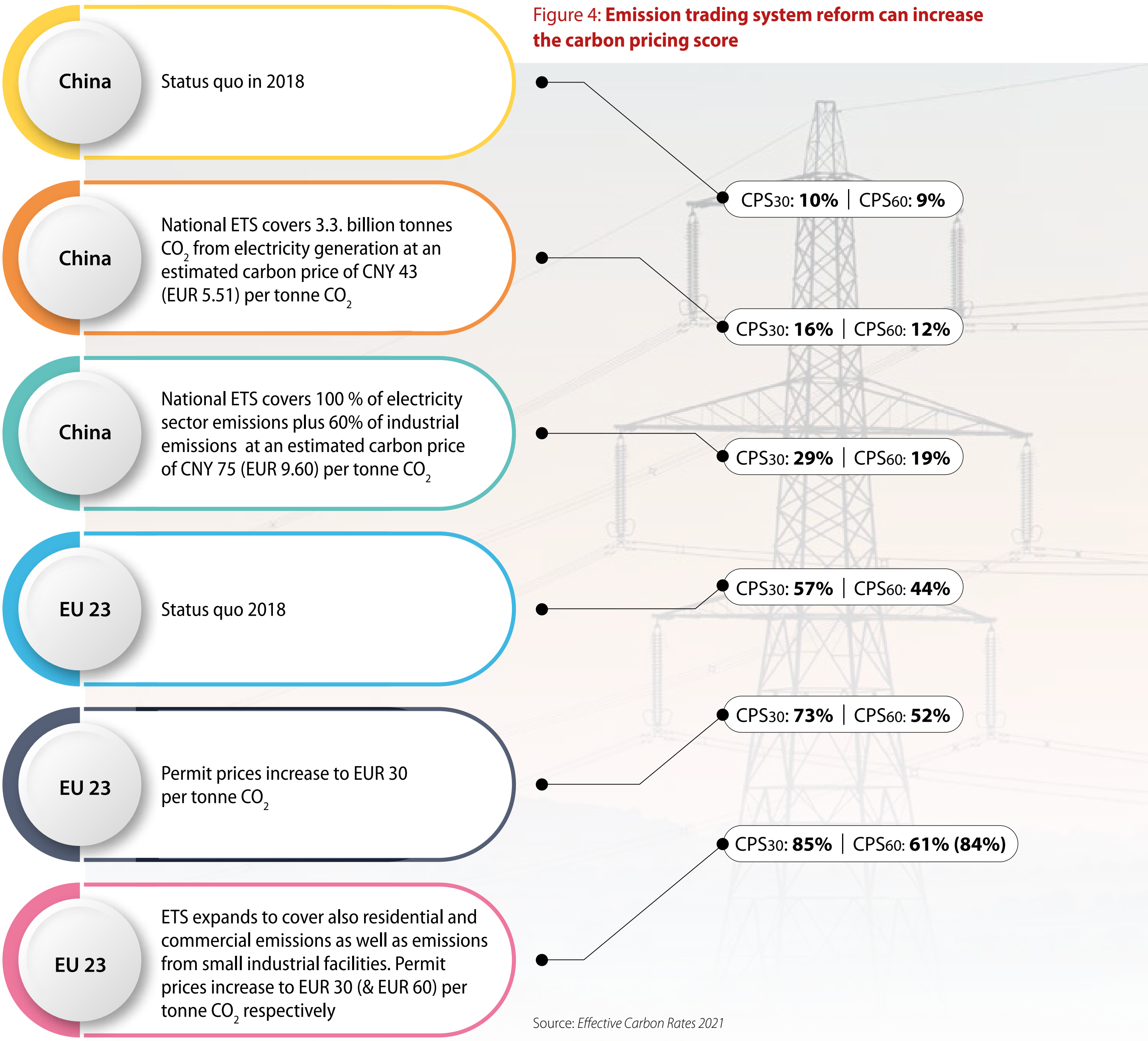
If the EU ETS was expanded to include all fossil fuel emissions from the residential and commercial sector as well as from industry, the CPS30 for the EU 23 would increase to 85%, assuming a permit price of EUR 30 per tonne of CO_2. Under this scenario, the CPS60 for the EU 23 would increase to 61%. Additionally, if permit prices increased to at least EUR 60 per tonne CO_2, the CPS60 for the EU 23 would increase to 84%. The remaining carbon pricing gap 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.

10. Zhang, X. (2020). Estimates for emission coverage of Chinese emissions trading systems.
11. Slater, H. et al. (2019). 2019 China Carbon Pricing Survey. China Carbon Forum.
12. Slater, H. ibid.






Figure 4: **Emission trading system reform can increase the carbon pricing score**



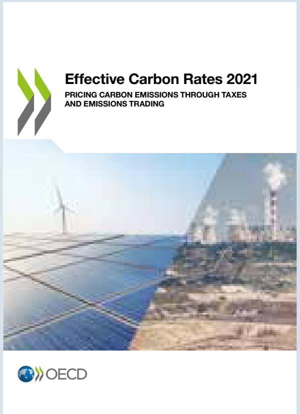
Source: *Effective Carbon Rates 2021*

Conclusion and outlook

Together, in 2018, the 44 OECD and G20 countries considered in *Effective Carbon Rates 2021* reached a *Carbon Pricing Score* of 19% against the benchmark of EUR 60 per tonne of CO_2. EUR 60 per tonne of CO_2 is a low-end benchmark of carbon costs in 2030 and mid-range 2020 benchmark. Three countries had reached two-thirds of this goal of pricing all energy related emissions at the EUR 60 benchmark in 2018, and ten countries were more than halfway towards this goal.

Countries with higher carbon pricing scores are more carbon efficient. In addition, by increasing their carbon pricing scores, countries can strongly reduce emissions and move towards a greener growth path. Recent policy innovations in some countries have resulted in marked improvements in their carbon pricing scores and suggest an increase in reform momentum with the rising uptake of carbon pricing as a core element of effective climate policy packages.

Further reading



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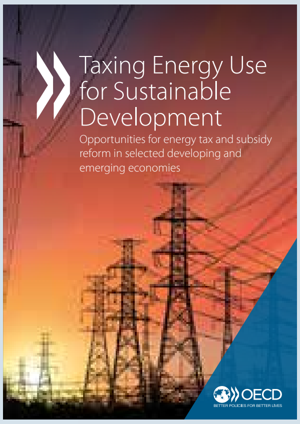

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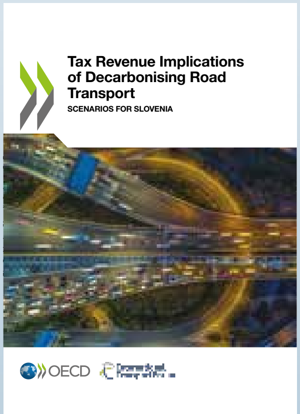
OECD (2019), **Taxing Energy Use 2019: Using Taxes for Climate Action**, OECD Publishing, Paris http://oe.cd/TEU2019



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Marten, M. and K. Van Dender (2019), **"The use of revenues from carbon pricing"**, OECD Taxation Working Papers, No. 43, OECD Publishing, Paris http://oe.cd/il/3yQ

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