

Effective Carbon Rates

2018



Effective Carbon Rates 2018 is the most detailed and most comprehensive account of how 42 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 taxes and tradeable permits that put a price on carbon emissions.

This brochure summarises the main results of the 2018 edition by:

- Showing the use of price mechanisms in the 42 countries as a group, and
- Showing which countries lead in using carbon prices to steer their economies on a low-carbon growth path.

Stimulating economies and keeping climate change in check through carbon pricing

Pricing carbon emissions helps countries to steer their economies towards and along a carbon-neutral growth path. Carbon prices increase resource efficiency, boost investment in clean energy and low-emission goods and services, and facilitate a gradual low-carbon transition.

Failing to price carbon emissions now increases the risk of average temperatures increasing by more than two degrees. Adaptation to such increases may be possible, but would likely be very costly. Decisive action to reduce the risk is by far the better option.

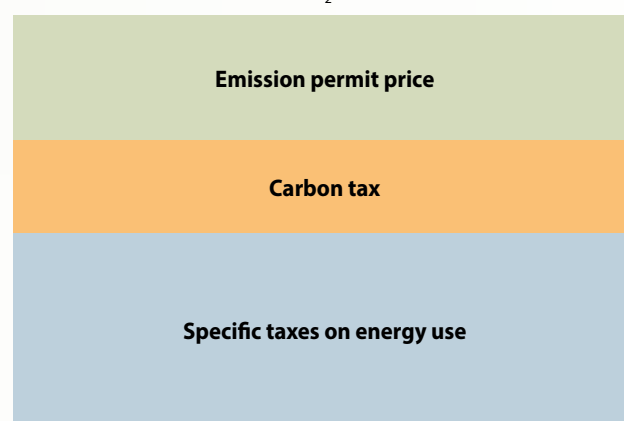
WHAT PROGRESS WITH USING CARBON PRICES?

Effective Carbon Rates 2018 shows how 42 OECD and G20 countries¹ price carbon emissions from energy use today, and how much progress they have made since 2012. The report measures carbon prices using the *effective carbon rate* (ECR), which is the sum of three components:

1. 35 OECD member countries (as of 2015) and 7 partner economies: Argentina, Brazil, China, India, Indonesia, Russia and South Africa

specific taxes on fossil fuels, carbon taxes and prices of tradable emission permits (Figure 1). All three increase the price of high-carbon relative to low- and zero-carbon fuels, encouraging energy users to go for low- or zero-carbon options.

Figure 1: Components of effective carbon rates
Effective Carbon Rate (EUR/tCO₂)



Source: OECD (2018), *Effective Carbon Rates 2018*

Box 1: Carbon pricing works

Carbon prices are effective for reducing emissions because they increase the price of carbon-based energy, so decreasing demand for it.^{2,3} Carbon prices encourage emitters to find and use economical ways of cutting emissions. Strong commitment to carbon prices also creates certainty for investors that it pays to invest in low-carbon technologies.

To illustrate effectiveness, consider the effect of the carbon price support in the United Kingdom. The policy increased carbon prices in the electricity sector from EUR 7/tCO₂ to

58% The introduction of the carbon price support in the United Kingdom's electricity sector was accompanied by a 58% decrease in carbon emissions.

more than EUR 30/tCO₂ between 2012 and 2016. Emissions from the electricity sector decreased by 58% in the same period. Overall UK emissions from energy use fell by 25%, of which 19 percentage points are due to cleaner electricity generation (Table 1).

Table 1: Emissions from electricity generation fall sharply with the introduction of a carbon price support

		2012	2016	Change (2012-2016)	Change in %
Electricity sector	CO ₂ emissions in Mt	158	66	-92	-58%
	Effective Carbon Rate in EUR per tonne of CO ₂	7.24	32.40	25.16	+347%
Entire economy	CO ₂ emissions in Mt	474	356	-118	-25%

Source: OECD (2018), *Effective Carbon Rates 2018*

2. Arlinghaus (2015), "Impact of Carbon Prices on Indicators of Competitiveness", *OECD Environment Working Papers* 87.

3. Martin et al. (2016), "The Impact of the EU ETS on Regulated Firms", *Review of Environmental and Resource Economics*, 10(1), 129-148.

The carbon pricing gap across 42 OECD and G20 countries is decreasing, but at a snail's pace

The carbon pricing gap measures how much OECD and G20 economies fall short of pricing carbon emissions in line with a benchmark value for carbon prices. It describes the state of carbon pricing, and can be tracked across time and compared across sectors.

THE CARBON PRICING GAP

The gap measures the difference between the benchmark value and the actual carbon price for every percentile of emissions, summing all positive differences – the grey area in Figure 2 – and expresses it as a percentage. If the carbon price on all emissions were at least as high as the benchmark, the gap would be zero, and if the price were zero throughout, the gap would be 100%. Two benchmark values are applied, EUR 30/tCO₂, a low-end estimate of the carbon costs today, and EUR 60/tCO₂, a midpoint estimate of the carbon costs in 2020 and a low-end estimate for 2030.

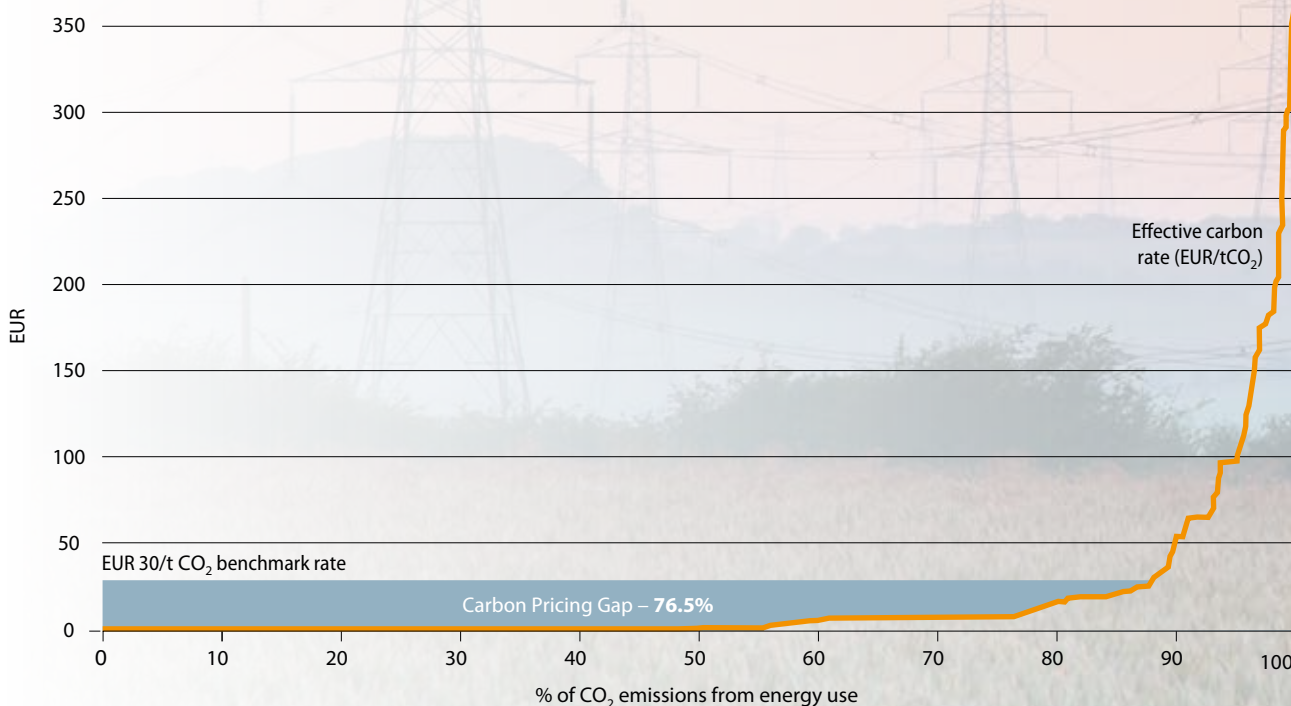
The current carbon pricing gap at EUR 30 is 76.5% across all 42 OECD and G20 countries, 3 percentage points

lower than in 2015. In 2012, the gap amounted to 83%. Hence, the gap is narrowing, but progress has been slow. If the decrease were to continue by 1 percentage point a year, the gap would close by 2095. Carbon prices need to increase considerably more quickly than they have done in recent years in order to ensure a cost-effective low-carbon transition.

THE CARBON PRICING GAP VARIES SUBSTANTIALLY ACROSS SECTORS

The gap is lowest for road transport (21% against the EUR 30 benchmark) and highest for industry (91%). The gap is over 80% in the electricity and the residential and commercial sectors. The vast majority of emissions in industry and in the residential and commercial sector remain entirely unpriced. While two-thirds of electricity emissions will be priced when the Chinese national ETS enters into force, permit prices well below EUR 30/tCO₂ imply that a large carbon pricing gap will remain.

Figure 2: The carbon pricing gap



Note: Estimate for 2018

Source: OECD (2018), *Effective Carbon Rates 2018*

Table 2: The carbon pricing gap by sector

Sector	Carbon Pricing Gap at EUR 30	Carbon Pricing Gap at EUR 60
Agriculture & fisheries	64%	78%
Electricity	84%	92%
Industry	91%	95%
Off-road transport	56%	75%
Residential and commercial	87%	93%
Road transport	21%	58%

Note: Estimate for 2018

Source: OECD (2018), *Effective Carbon Rates 2018*



At EUR 60/tCO₂, the carbon pricing gap is wide in all sectors. It is lowest in road transport at 58%, and 90% or more in the electricity, the industry and the residential and commercial sectors.

76.5%

Against a EUR30/tCO₂ benchmark, the carbon pricing gap is 76.5% in 2018, down from 79.5% in 2015 and 83% in 2012.



EXTERNAL COSTS IN ROAD TRANSPORT

Does the lower carbon pricing gap in the road sector mean that carbon prices need to increase less than in other sectors? Not necessarily.

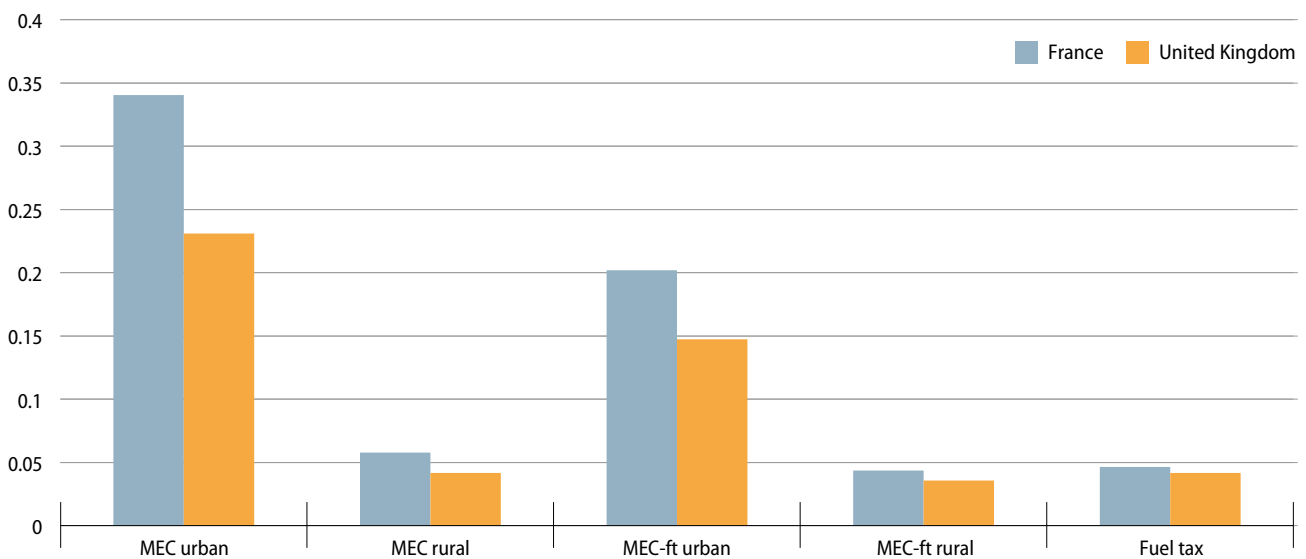
Road use gives rise to congestion, noise, accidents, and local air pollution, among other negative side-effects. These add to the damage caused by CO₂ emissions. Taxes on transport fuels, which account for 99% of the effective carbon rate in road transport, can help – even if imperfectly – to make road users pay for these damages. Ideally, prevailing taxes on transport energy therefore should be compared to the full range of external costs that they are intended to cover.

Based on estimates from the literature, Figure 3 shows the sum of marginal external costs associated with a litre of fuel use, for France and the United Kingdom, averaged across gasoline and diesel and distinguishing between

urban and rural driving. As can be seen, the external costs are much larger for urban driving. This is mainly because of higher congestion costs, and to a lesser extent because of greater exposure to air pollution. Fuel taxes appear adequately aligned with the marginal external costs of rural driving, but remain well below those of urban driving.

Are fuel taxes then on average too low? The main difference between urban and rural driving pertains to congestion costs. Since congestion costs in rural driving are very low, the answer depends on one's view on how to address congestion best. Fuel taxes are not very well suited for curbing congestion as they do not distinguish between congested and uncongested driving. If, however, sophisticated congestion pricing or other congestion management policies remain elusive, then higher fuel taxes can be justified. Furthermore, higher social costs of carbon also contribute to the case for higher automotive fuel taxes.

Figure 3: Estimates of marginal external costs and of fuel tax, France and United Kingdom, in EUR per litre of gasoline and diesel



Note: MEC = marginal external cost; urban = driving in urban environments; MEC-ft = MEC as relevant to the fuel tax, i.e. after correction for indirect impact of fuel costs on driving-related external costs; rural = driving in rural environments (to be understood as non-urban).

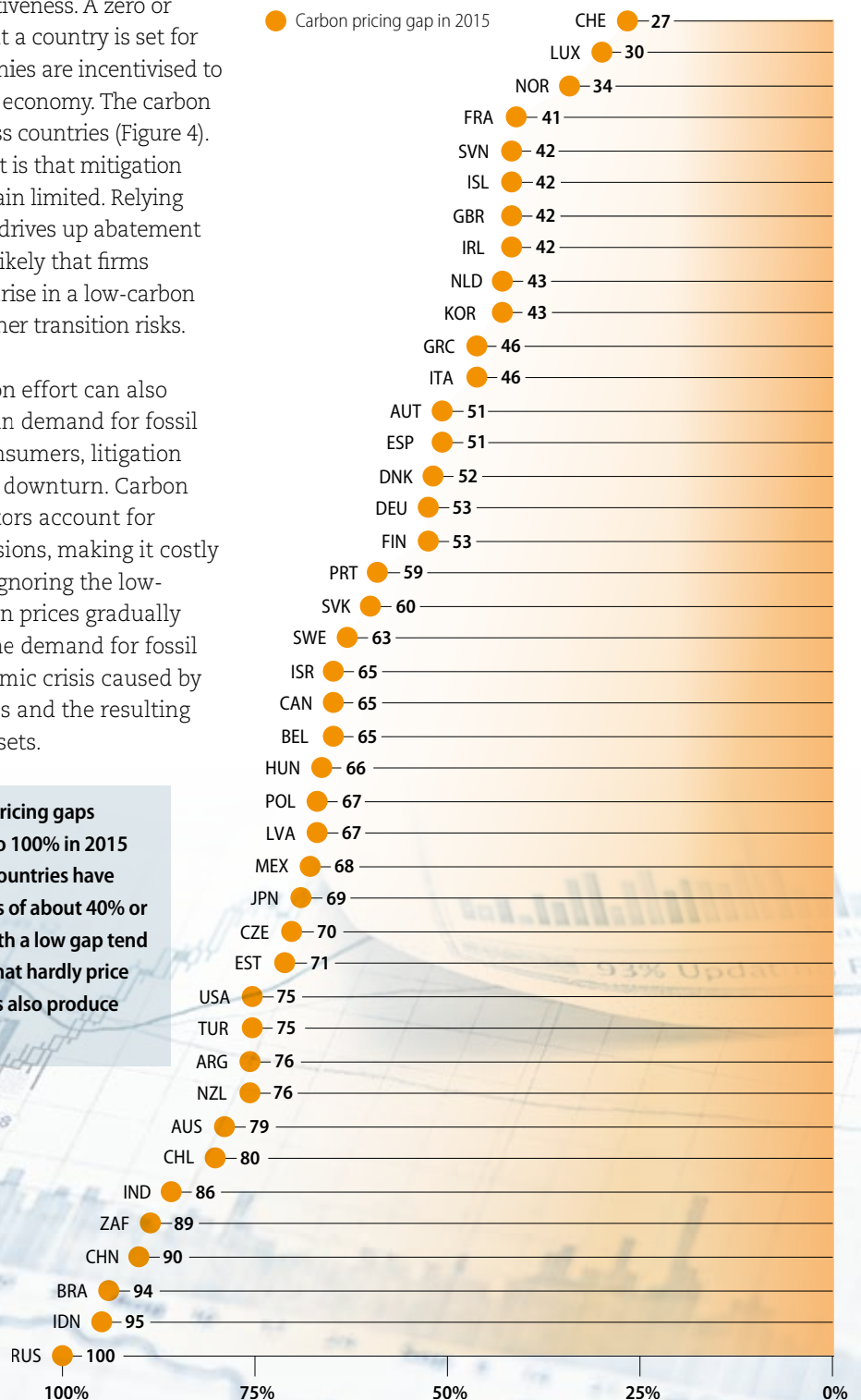
Source: OECD (2018), *Effective Carbon Rates 2018*

The carbon pricing gap at the country level: A measure of long-run competitiveness

At the country level, the carbon pricing gap can be seen as an indicator of long-run competitiveness. A zero or very low gap signals to investors that a country is set for decarbonisation and that its companies are incentivised to compete and thrive in a low-carbon economy. The carbon pricing gap varies considerably across countries (Figure 4). The higher the gap, the more likely it is that mitigation efforts are not cost-effective or remain limited. Relying on policies other than pricing likely drives up abatement costs. Limited effort makes it more likely that firms miss out on the opportunities that arise in a low-carbon economy and will be left to face higher transition risks.

Low or overly costly decarbonisation effort can also increase sovereign risk. A collapse in demand for fossil fuel, be it driven by technology, consumers, litigation or policy, could spark an economic downturn. Carbon prices ensure that all economic actors account for carbon costs in their business decisions, making it costly to sustain the behavioural bias of ignoring the low-carbon transition. Increasing carbon prices gradually allows for a smooth reduction in the demand for fossil fuels, lowering the risk of an economic crisis caused by a collapse in demand for fossil fuels and the resulting devaluation of carbon-intensive assets.

Figure 4: The carbon pricing gap varies widely across countries



40% Countries' carbon pricing gaps ranged from 27% to 100% in 2015 (Figure 4). Twelve countries have carbon pricing gaps of about 40% or lower. Countries with a low gap tend to emit fewer emissions than countries that hardly price any carbon emissions. Low-gap countries also produce fewer emissions per unit of GDP.

Source: OECD (2018), *Effective Carbon Rates 2018*

Several countries, including France, India, Korea, Mexico, and the United Kingdom, reduced their carbon pricing gaps between 2012 and 2015. Korea implemented a national emissions trading system in 2015. France and Mexico reformed their taxes on energy use. The United Kingdom implemented a price floor for electricity sector emissions covered by the European Union Emissions Trading System. India reduced its carbon pricing gap by increasing excise duties on transport fuels.

New carbon pricing initiatives have the potential to significantly reduce the carbon pricing gap. Nation-wide emissions trading in China could lead to a significant narrowing of the global carbon pricing gap, to 63% in the early 2020s. Canada could nearly close its national carbon pricing gap through new carbon pricing efforts in the same time frame.

COUNTRIES WITH A LOW CARBON PRICING GAP TEND TO BE LESS CARBON INTENSIVE

Countries with low-carbon pricing gaps also tend to have a less carbon-intensive GDP. Figure 5 illustrates this correlation. In the figure, the horizontal axis shows the energy intensity of GDP and the vertical axis the carbon intensity of energy. These two dimensions determine the carbon intensity of GDP. A country's GDP is less carbon intensive as it uses less carbon-intensive energy (i.e., it is positioned lower on the vertical axis) and as it uses less

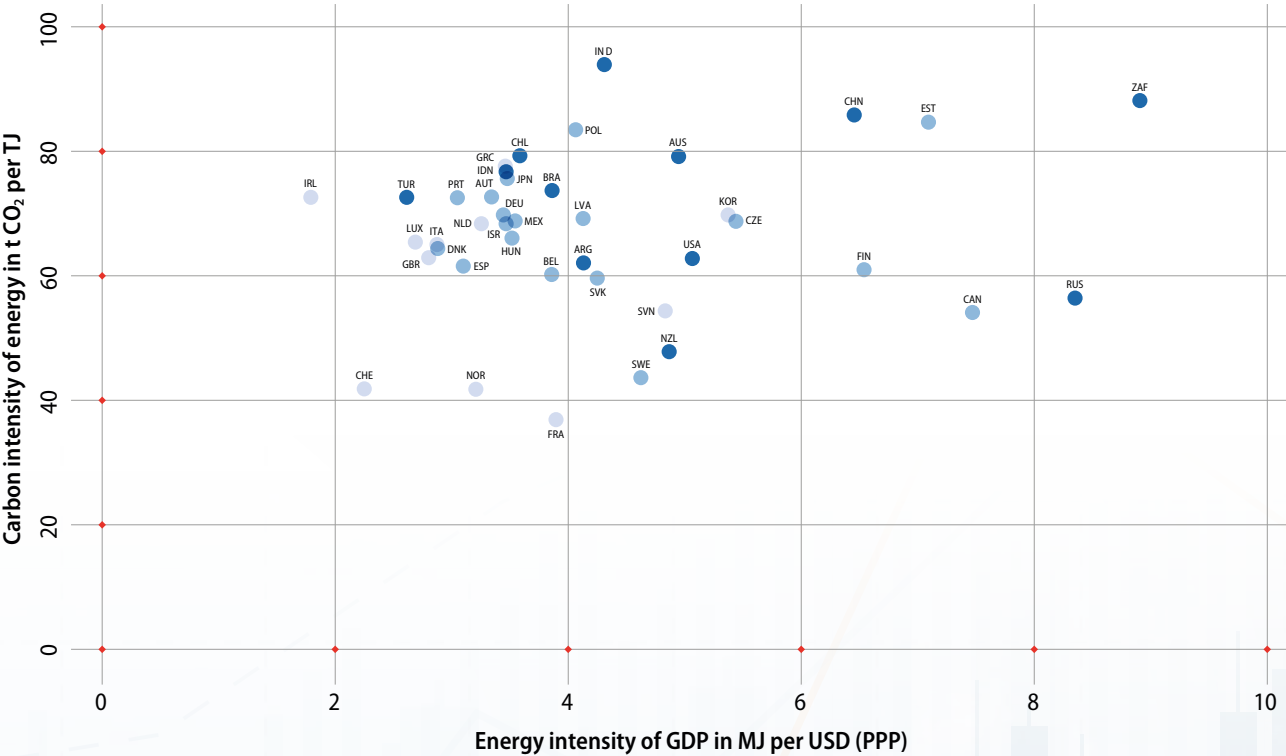
energy per unit of GDP (i.e., it is positioned more leftward on the horizontal axis), or a combination of both (i.e., a country is positioned closer to the origin in the figure).

Figure 5 uses a lighter shade of blue for countries with a lower carbon pricing gap. Country dots tend to be more lightly shaded the closer they are to the origin: GDP is generally less carbon intensive in countries with a low carbon pricing gap. For example (not shown in the figure), all countries emitting less than 0.15 kg CO₂ per USD of GDP – the level estimated to be required in 2030 for reaching the Paris Agreement (Peters et al., 2017) – have a carbon pricing gap of less than 50%. Many of the other countries with a gap below 50% show relatively low carbon intensities of GDP as well.




Carbon prices raise the price of carbon-intensive energy compared to low or zero-carbon energy sources, encouraging users to switch to lower carbon energy. Switching to more carbon-efficient energy sources implies that countries move towards the horizontal axis in the graph. As long as countries use non-zero carbon fuels, carbon prices will also increase the price of energy through increasing the price of their carbon content. This encourages energy users to use less energy, making countries move towards the vertical axis. This is why higher effective carbon rates contribute to the decarbonisation of GDP.



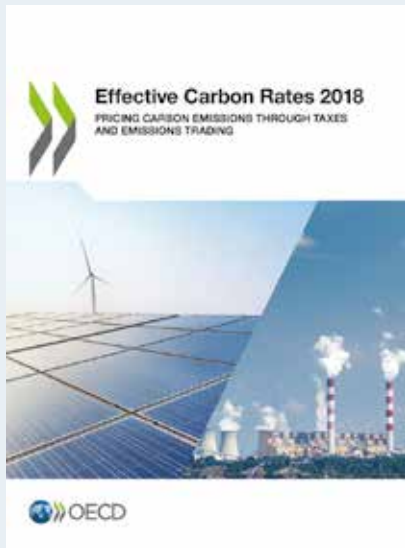
Figure 5: Countries with a low carbon pricing gap tend to be less carbon intensive



- carbon pricing gap <= 50%
- carbon pricing gap > 50% & <= 75%
- carbon pricing gap > 75%
- ◆ zero carbon emissions from energy combustion

Source: OECD (2018), Effective Carbon Rates 2018



EFFECTIVE CARBON RATES 2018: PRICING CARBON EMISSIONS THROUGH TAXES AND EMISSIONS TRADING

<http://oe.cd/ECR2018>



Further reading

Effective Carbon Rates 2018: Pricing carbon emissions through taxes and emissions trading, OECD Publishing, Paris, <https://doi.org/10.1787/9789264305304-en>.

Taxing Energy Use 2018: Companion to the Taxing Energy Use Database (2018), OECD Publishing, Paris, <https://doi.org/10.1787/9789264289635-en>.

Marten M. and K. Van Dender (forthcoming), “The use of revenues from carbon pricing”, *forthcoming*, *OECD Taxation Working Papers*, OECD Publishing, Paris.


Van Dender, K. (forthcoming), “Taxing vehicles, fuel, and road use: Opportunities for improving transport tax practice” *OECD Taxation Working Papers*, *forthcoming*, OECD Publishing, Paris.

Dressler, L., T. Hanappi and K. Van Dender (2018), “Unintended technology-bias in corporate income taxation: The case of electricity generation in the low-carbon transition”, *OECD Taxation Working Papers*, N° 37, OECD Publishing, Paris, <https://doi.org/10.1787/9f4a34ff-en>.

Flues, F. and K. Van Dender (2017), “Permit allocation rules and investment incentives in emissions trading systems”, *OECD Taxation Working Papers*, N° 33, OECD Publishing, Paris, <https://doi.org/10.1787/c3acf05e-en>.

Arlinghaus, J. and K. Van Dender (2017), “The environmental tax and subsidy reform in Mexico”, *OECD Taxation Working Papers*, N° 31, OECD Publishing, Paris, <https://doi.org/10.1787/a9204f40-en>.

Flues, F. and K. Van Dender (2017), “The impact of energy taxes on the affordability of domestic energy”, *OECD Taxation Working Papers*, N. 30, OECD Publishing, Paris, <https://doi.org/10.1787/08705547-en>.



This document, as well as any data and any map included herein, are without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries and to the name of any territory, city or area.

The statistical data for Israel are supplied by and under the responsibility of the relevant Israeli authorities. The use of such data by the OECD is without prejudice to the status of the Golan Heights, East Jerusalem and Israeli settlements in the West Bank under the terms of international law.

You can copy, download or print OECD content for your own use, and you can include excerpts from OECD publications, databases and multimedia products in your own documents, presentations, blogs, websites and teaching materials, provided that suitable acknowledgment of the source and copyright owner(s) is given. All requests for public or commercial use and translation rights should be submitted to rights@oecd.org. Requests for permission to photocopy portions of this material for public or commercial use shall be addressed directly to the Copyright Clearance Center (CCC) at info@copyright.com or the Centre français d'exploitation du droit de copie (CFC) at contact@cfcopies.com.

Images: © shutterstock.com



For more information:



ctp.contact@oecd.org



<http://oe.cd/ECR2018>



[@OECDtax](https://twitter.com/OECDtax)