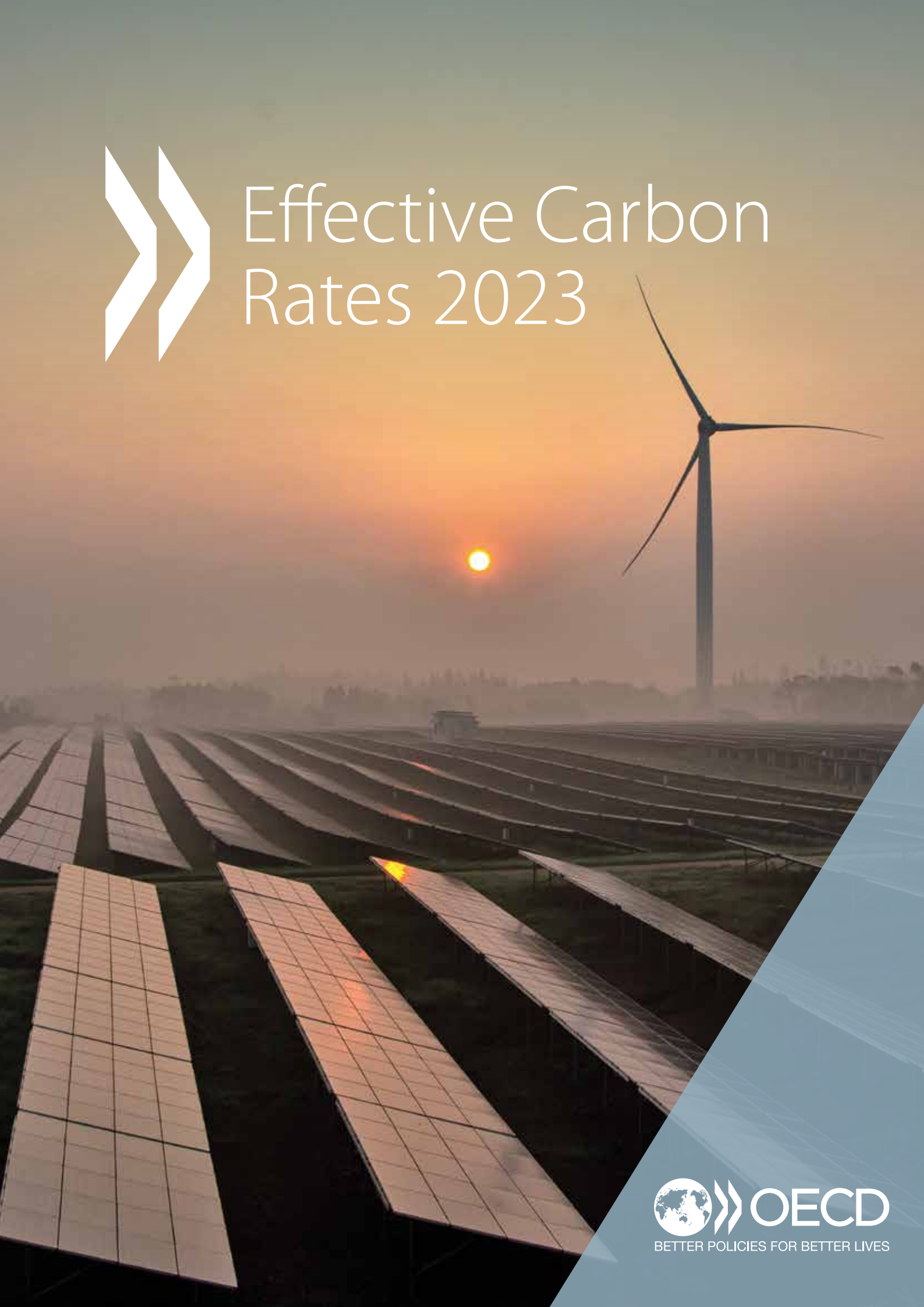
Effective Carbon Rates 2023



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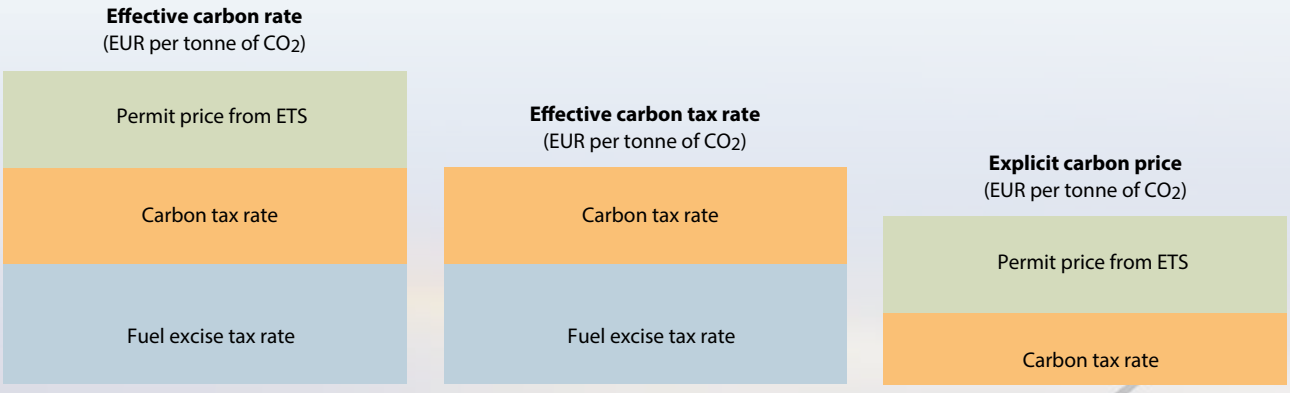
BETTER POLICIES FOR BETTER LIVES

Introduction

Effective Carbon Rates 2023 is the most detailed and most comprehensive account of how 72 countries, which collectively emit around 80% of global greenhouse gas (GHG) emissions, price GHG emissions. The *effective carbon rate* (ECR) is the sum of tradeable emission permits, carbon taxes and fuel excise taxes (Figure 1), all of which result in a price on GHG emissions. They directly increase the cost of emitting GHGs, thereby stimulating the uptake in production, consumption and investment choices of low- or zero-carbon alternatives. This brochure summarises the main results of the OECD report *Effective Carbon Rates 2023*.

This fourth edition of *Effective Carbon Rates* sheds light on the state of carbon pricing as of 2021, with updates reflecting developments up to 2023. It provides an in-depth analysis of emissions trading systems (ETSs) in 2021 as well as of two common features of this carbon pricing instrument: free allocation and price stability mechanisms. In addition, given the effect of the energy crisis and high inflation rates on the recent policy landscape, the report discusses the evolution of emissions trading systems, as well as fuel excise taxes and carbon taxes in the road transport sector in 2022 and 2023.

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



Source: *OECD (2023), Effective Carbon Rates 2023.*

The merits of carbon pricing

While many policy instruments can be deployed to reduce carbon emissions, the principal appeal of carbon pricing is that in contrast with other mitigation instruments it encourages cost-effective abatement and at the same time it can raise public revenue. By decentralising abatement decisions, it helps overcome the asymmetry of information between the government and polluters and encourages emissions cuts at the lowest cost. Moreover, carbon pricing creates ongoing mitigation incentives, and it reduces rebound effects. Finally, while direct support measures for innovation are essential, evidence also shows that carbon pricing spurs innovation and investment in low-carbon technologies, such as carbon capture and storage.

Based on the *Effective Carbon Rates* database, a recent study (D'Arcangelo et al., 2022) estimates carbon dioxide (CO_2) emissions responsiveness to carbon pricing within a unified framework for a large panel of countries (44 OECD and G20 countries), sectors and fuels. It shows that a 10 EUR/tCO_2 increase in effective carbon rates would decrease CO_2 emissions from fossil fuel use by 3.7%. This effect is stronger for coal emissions, where the same increase in carbon prices would decrease emissions by 12%. This allows to simulate the revenue impact of introducing carbon price floors of different levels. A carbon price floor of EUR 60 per tonne of CO_2, for instance, could generate revenues of 2% of countries' GDP on average. The revenue potential depends on countries' starting points – e.g. their initial carbon price level or the carbon-intensity of the economy.

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Carbon pricing: progress with disparities across sectors and countries

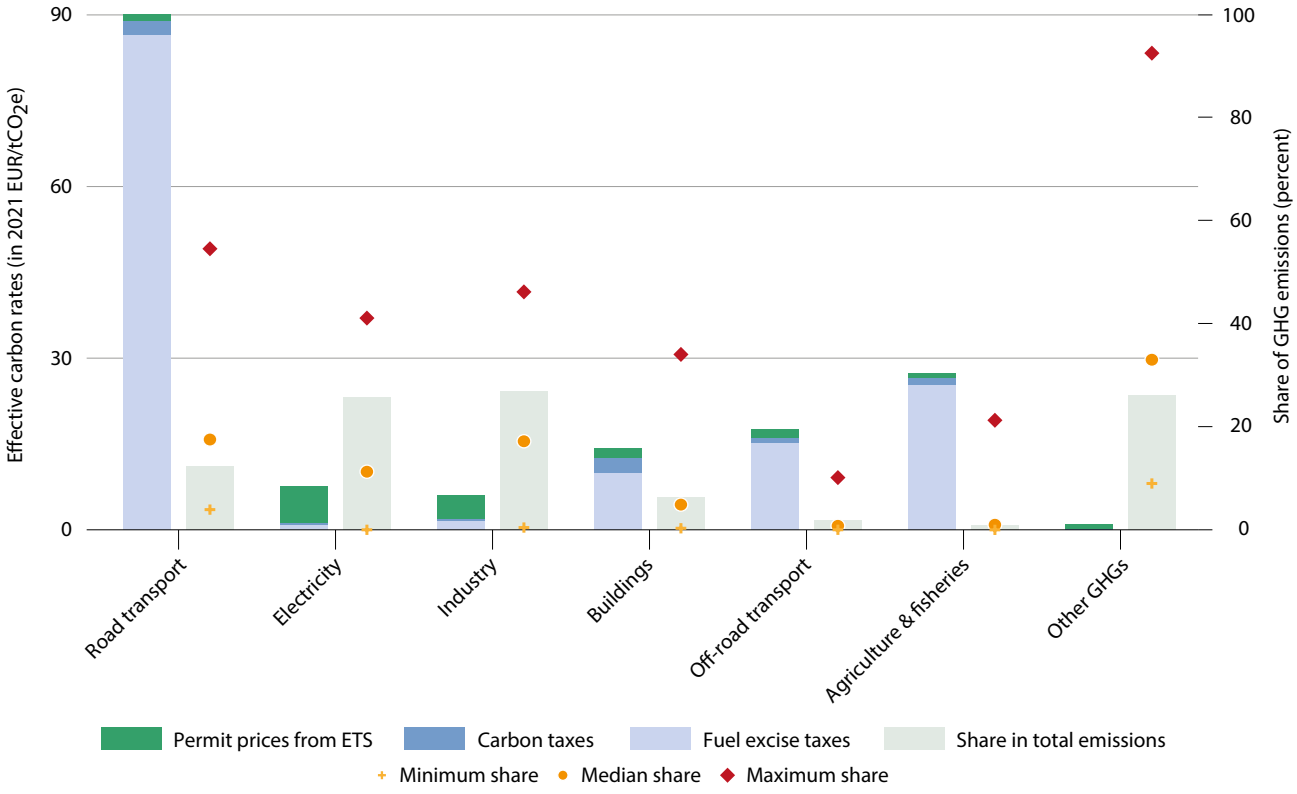
In 2021, 42% of the approximately 40 billion tonnes of GHG emissions were priced in the 72 countries covered in this report, with significant variation of coverage, prices and pricing instruments across sectors and countries.

Coverage: The share of GHG emissions covered by carbon pricing ranges from only about 4% of non-CO_2 emissions from energy use being priced to around 93% of emissions priced in the road transport sector.

Price levels: About 16% of GHG emissions were priced at EUR 30 per tonne of CO_2 or more, and only 7% of GHG emissions were priced above EUR 60 per tonne of CO_2.

Pricing instruments: Carbon price signals mainly arise from fuel excise taxes, which cover more emissions and have higher rates than the two explicit carbon pricing instruments – i.e. carbon taxes and emissions trading systems. However, there is heterogeneity across countries and sectors (Figure 2). In the road and off-road transport sectors, as well as in the agriculture and fisheries sector, fuel excise taxes account for over 80% of the effective carbon rates. Carbon taxes tend to be more significant as a share in the ECR for the buildings sector than in other sectors. Electricity and industry sector emissions are predominantly priced through emissions trading systems (ETSs). Countries with the highest ECRs are more likely to have at least partial coverage of their emissions by an ETS and have the highest carbon taxes.

Figure 2: **Carbon pricing instruments and share of GHG emissions by sector, 2021**



Note: The left-hand side bars of this graph show ECR components and levels by sector. Together, emissions from the road transport, electricity, industry, buildings, off-road transport and agriculture and fisheries sectors make up CO_2 emissions from energy use. Other GHG emissions cover CH_4, N_2O and F-gas emissions as well as CO_2 emissions from industrial process. The right-hand side axis presents shares of emissions from these sectors in total emissions, as well as their variation across countries. "Minimum share" (resp. "Maximum share") indicates the minimum share this sector may represent in a country's total GHG emissions. "Median share" is the median of such shares across countries. For instance, the median share in the road transport sector indicates that half of countries in the sample have a road transport sector that accounts for more than 17.5% of national GHG emissions.

Source: OECD (2023), *Effective Carbon Rates 2023*.

Expanding reach and intensifying impact: the prevalence of emissions trading systems over carbon taxes

In 2021, explicit carbon pricing mechanisms covered more GHG emissions worldwide than in 2018. In addition, there was a **greater increase in coverage and prices through emissions trading than via carbon taxes**: coverage by emissions trading systems more than doubled between 2018 and 2021 and permit prices increased by almost 40%. In contrast, coverage and average tax rates remained almost the same for carbon taxes (Table 1).

Table 1: **Evolution of coverage and rates of explicit carbon pricing instruments between 2018 and 2021**

	Coverage		Marginal explicit carbon rate (in constant 2021 EUR/tCO_2)	
Instrument	2018	2021	2018	2021
Carbon tax	6.7%	6.9%	11.6	12.4
ETS	13%	27%	11.2	15.5

Note: The marginal explicit carbon rates presented in this table are the emissions-weighted averages of marginal carbon rates on emissions priced by the instrument considered. Prices and tax rates were converted into (constant) 2021 EUR using the latest available OECD exchange rate and inflation data.

Source: OECD (2023), *Effective Carbon Rates 2023*.

Between 2018 and 2021, several ETSs were introduced and others entered new phases. In 2021, China and Germany implemented nation-wide sectoral ETSs, while several Canadian provinces adopted ETSs in response to the introduction of the federal carbon pollution pricing backstop system. In 2020, Mexico launched the pilot phase for a national ETS, with the operational phase to commence in 2023.



In 2021, ETS coverage of CO_2 emissions from energy use varied across countries, reaching about 99% in New Zealand.

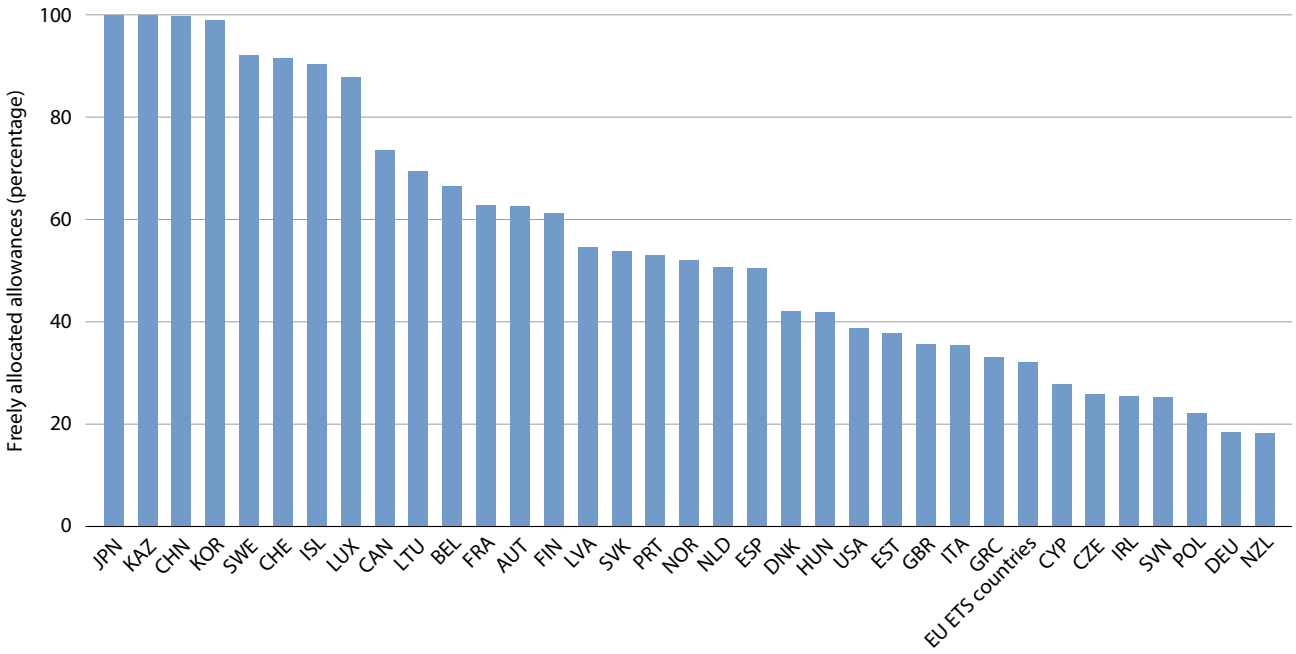
ETSs commonly mostly cover emissions generated by the electricity and industry sectors; however, an increasing number of new ETSs apply upstream (i.e. to fuel suppliers) and cover emissions from the buildings and transport sectors.

The free allocation of allowances undermines investment incentives in low-emissions technologies and limits the amount of revenue raised

Contrary to most carbon and fuel taxes, **marginal and average price signals often diverge in ETSs**. This disparity arises from the **free allocation of allowances**, which can have **implications for investment incentives and the revenue raised**.

The share of free allocation of allowances in verified emissions ranges from 19% to 100% across the countries covered in this report, with an average of 55% (Figure 3). The variation in shares can be attributed to countries' diverse industrial compositions, the maturity of their ETSs, political constraints, national preferences and other factors. In the EU ETS, industrial sectors deemed most at risk of carbon leakage receive the largest shares of free allocation. The Regional Greenhouse Gas and Massachusetts initiatives, which cover electricity sector emissions, provide minimal or no free permits.

Figure 3: **Share of free allocation of allowances in total verified emissions, by country, 2021**



Source: OECD (2023), *Effective Carbon Rates 2023*.

Free allocation weakens the average carbon price signal especially in the electricity and industry sectors, where carbon pricing mostly arises from ETSs. Even though permit prices in the electricity and industry sectors are respectively of EUR 11.5 per tonne of CO_2 and EUR 27.1 per tonne of CO_2 on average, these sectors are allocated respectively 88% and 84% of their allowances for free (Table 2), hence muting average carbon price signals in these sectors.

In most countries, the share of free allocation in the electricity sector is actually lower than that in the industry sector. In China, Japan, Kazakhstan and Korea, the share of free allocation in both sectors is equal or close to 100%. In all other countries, the share of free allocation ranges from 0% to about 59% in the electricity sector and from 42% to about 91% in the industry sector. However, given that China's electricity sector emissions covered by the national ETS represent around 80% of total electricity sector emissions covered by all ETSs, the *total* share of free allocation in the electricity sector ends up being higher than in the industry sector.

Permit prices can experience significant volatility
Contrary to taxes, permit prices can experience significant volatility even over the course of a single year. This volatility can hinder sustained investment in low and zero-carbon technologies.

Price stability mechanisms exist in many systems, either through direct approaches (e.g. through price floors or ceilings), **indirect approaches** (e.g. through market stability reserves), or a combination of both.

Table 2: **Total share of free allocation and average permit price in sectors across countries subject to ETSs, 2021**

Sector	Share of free allocation	Average permit price (in EUR/tCO_2)	Share of free allocation excl. China	Average permit price (in EUR/tCO_2) excluding China
Agriculture & fisheries	19%	23.40	19%	23.40
Buildings	39%	21.16	33%	22.72
Electricity	88%	11.54	34%	36.26
Industry	84%	27.14	78%	36.25
Off-road transport	77%	25.20	63%	36.75
Road transport	2%	20.90	2%	20.90

Source: Adapted from OECD (2023), *Effective Carbon Rates 2023*.

Permit prices have been more resilient than fuel excise and carbon taxes during the energy crisis

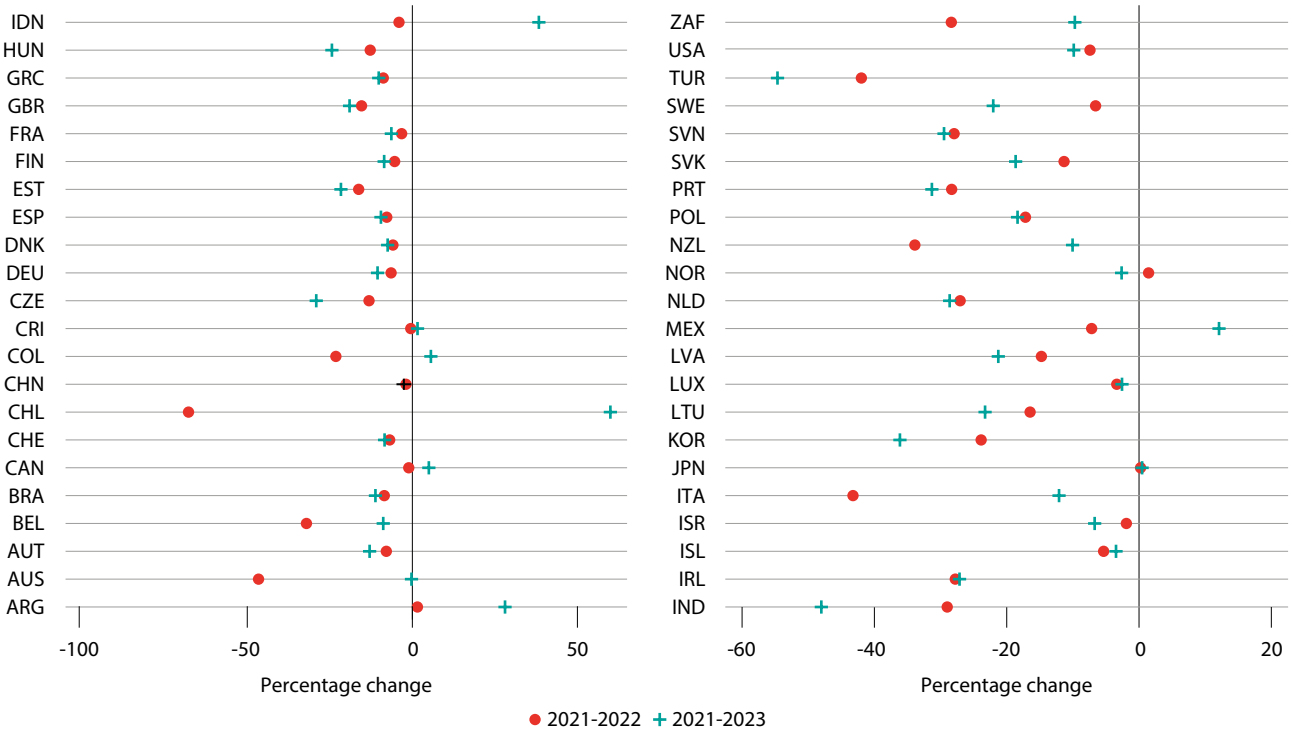
Since 2021, the energy crisis and Russia's war of aggression against Ukraine have led to policy responses, that have resulted in changes in the energy taxation and carbon pricing landscape in 2022 and 2023. Governments have sought to provide support to households and firms through reduced energy taxes, among other support measures.

Despite a high-energy price environment over the period, **new ETS initiatives** have emerged, mostly in Latin America (e.g. Mexico) and in Asia (e.g. Indonesia). Moreover, **ETS permit prices have increased for most systems** between 2021 and early 2023, with the increase mainly taking place between 2021 and 2022.

Tax rates in the road transport sector decreased in real terms, due to **rate cuts** in response to pre-tax price hikes but also due to a **lack of indexation to inflation**. Rates decreased more between 2021 and 2022 than between 2022 and 2023 (Figure 4).

Within OECD and G20 countries, the gap between the ECR faced by the road transport sector and that faced by the electricity and industry sectors has lessened between 2021 and 2023, due to a decrease in fuel excise taxes and an increase in permit prices.

Figure 4: **Evolution of effective carbon tax rates in the road transport sector since 2021**



Note: Percentage changes between 2021 and 2022 as well as between 2021 and 2023, in constant 2021 LCU.

Source: OECD (2023), *Effective Carbon Rates 2023*.

Non-CO_2 GHG emissions are the least covered by carbon pricing measures

Other GHG emissions (methane – CH_4, nitrous oxide – N_2O, fluorinated gases and CO_2 emissions from industrial process) **can represent a significant share of total emissions** in certain countries. This implies the need to incorporate these emissions in designing pathways to net-zero emissions. Yet, **they are the least covered by carbon pricing measures**.

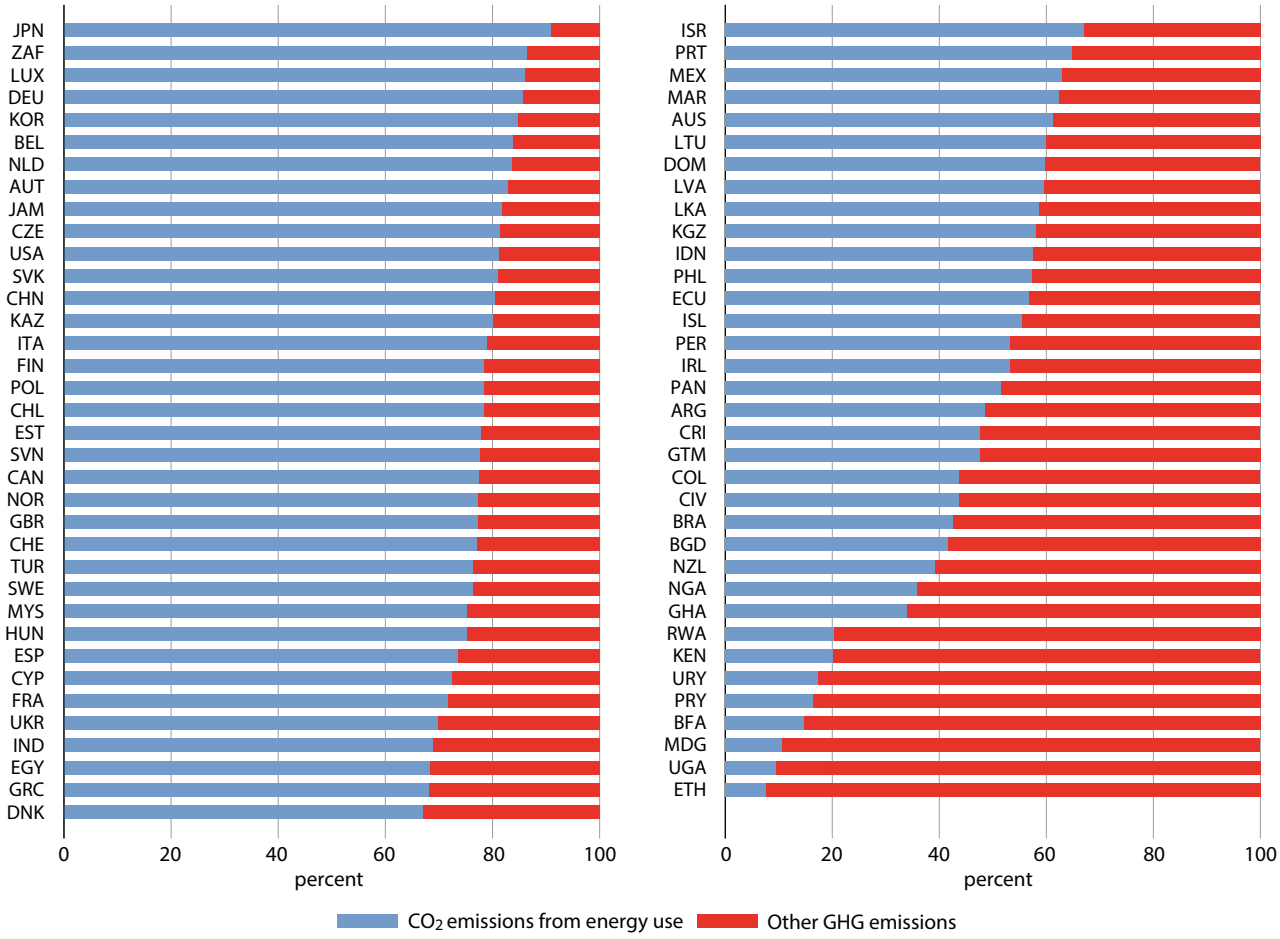
In the 72 countries analysed, **other GHGs make up between 8% and 92% of countries' total GHG emissions** (Figure 5).

Uncertainties in the measurement of these other GHGs makes establishing the tax base for these emissions considerably harder than for CO_2 emissions. Hence, effectively addressing these emissions through pricing mechanisms is likely to require the consideration of mitigation policies beyond carbon taxes, which are primarily designed to address CO_2 emissions from energy use.

Presently, carbon pricing instruments covering other GHG emissions generally only apply to emissions that are generated by industrial processes, which are partly covered by ETSs and some carbon taxes.

In most countries, **non-energy related agricultural emissions make up the highest share of other GHG emissions**. **Finding ways to address these emissions presents a challenge for the years to come.**

Figure 5: **Share of other GHG emissions in total emissions, by country**



Note: Other GHG emissions stand for emissions from CH_4, N_2O, F-gases and process CO_2 emissions.

Source: OECD (2023), *Effective Carbon Rates 2023*.

Conclusion and outlook

Carbon pricing is gaining momentum worldwide and explicit carbon pricing instruments are assuming an increasingly important role. ETSs are progressively expanding in countries where they are already established and being introduced in new countries. ETS permit prices have also demonstrated strong resilience to the energy crisis, sustaining an upward trend in most cases since 2021. Despite this momentum, there are considerable disparities in carbon pricing coverage and price levels across countries and sectors, with over half of global emissions unpriced.

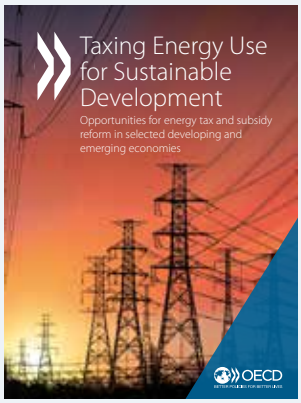
Additionally, the recent energy crisis resulted in a rise in energy prices, compelling countries to provide support through untargeted measures. These measures, along with a stagnation or cut in nominal fuel and carbon tax rates amidst high inflation have weakened carbon price signals. Building resilience to future shocks and maintaining carbon price signals may warrant a more targeted approach. At the same time, medium and long-term solutions to climate change and to future energy shocks include investments in energy efficiency and low-carbon energy sources and technology.

Furthermore, addressing emissions from methane, nitrous oxide, fluorinated gases and process-related CO_2 presents an additional challenge for the years to come.

Curbing emissions from energy use is urgent, but also addressing other emissions, such as methane, is a critical challenge. A comprehensive approach is key to tackle these diverse sources of greenhouse gas emissions.

Further reading

OECD (2023), **Effective Carbon Rates 2023: Pricing Greenhouse Gas Emissions through Taxes and Emissions Trading,** OECD Series on Carbon Pricing and Energy Taxation, OECD Publishing, Paris https://oe.cd/ECR2023



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OECD (2022), **Pricing Greenhouse Gas Emissions: Turning Climate Targets into Climate Action** OECD Series on Carbon Pricing and Energy Taxation, OECD Publishing, Paris https://oe.cd/il/5jw

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

OECD WORKING PAPERS

D'Arcangelo, F. M., Pisu, M., Raj, A. and Van Dender, K. (2022), **"Estimating the CO_2 emission and revenue effects of carbon pricing: New evidence from a large cross-country dataset",** *OECD Economics Department Working Papers, No. 1732,* OECD Publishing, Paris, https://doi.org/10.1787/39aa16d4-en.

Flues, F. and K. Van Dender (2020), **"Carbon pricing design: Effectiveness, efficiency and feasibility: An investment perspective"**, *OECD Taxation Working Papers, No. 48,* OECD Publishing, Paris, https://doi.org/10.1787/91ad6a1e-en.

Hemmerlé, Y., et al. (2023), **"Aiming better: Government support for households and firms during the energy crisis"**, *OECD Economic Policy Papers, No. 32,* OECD Publishing, Paris, https://doi.org/10.1787/839e3ae1-en.

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