EU REGULAR ECONOMIC REPORT 7

WORLD BANK REPORT
ON THE EUROPEAN UNION

# Green Fiscal Reforms

## Part Two of Strengthening Inclusion and Facilitating the Green Transition

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# Foreword

Europe has historically been at the forefront of the global shift to decarbonize economies. The European Union (EU) demonstrated its commitment to reducing greenhouse gas emissions with the launch of the EU Emissions Trading System (ETS) in 2005, the world's first and largest carbon market, currently accounting for over four-fifth of the global carbon market in value terms. The leaders of EU member states agreed to achieve carbon neutrality by 2050 and a 55 percent reduction in emissions by 2030, compared to 1990 levels. Achieving this ambitious target will require determined action.

More recently, the Russian invasion of Ukraine has added energy independence and security to the on-going dialogue on greening the energy sector in Europe. Starting in mid-2021, gas prices had increased substantially, and they skyrocketed with the start of the Russian invasion of Ukraine in February 2022. The war has had adverse spillover effects through higher inflation, disruptions to trade and financial flows and increased uncertainty. The deleterious effects of the war come on top of the fragile recoveries in many countries that are still grappling with the effects of the COVID-19 pandemic. In addition, the effects of the war are higher on the Europe and Central Asian countries because of the influx of forcibly displaced persons (FDPS) and via closer trade and financial linkages with Russia and Ukraine. More than a quarter of Ukraine's population is estimated to have fled their homes since February 24th, making this the fastest growing refugee crisis since World War II.

The immediate impact of the war on European Union (EU) countries is primarily through the supply and prices of commodities, particularly food and fuel, along with the inflow of FDPS. Higher fuel prices as a result of the crisis are likely to lead to an increase in the incidence and depth of poverty. The impact will be both, directly, through higher fuel costs, and indirectly, through second-round effects of higher fuel prices on goods and services. Although the poor are partially shielded from the price rises by the fiscal measures taken by governments, the higher proportion of expenditure on food products among poorer households is likely to increase in the depth of poverty. To mitigate the impact of high prices, targeted transfers to vulnerable and energy poor groups have been combined with retail price regulations and reductions in taxes on food and fuel for all households.

In addition to supporting the FDPS, EU governments are also discussing measures to reduce dependence on Russian fossil fuel imports. This could embolden the transition to net zero emissions, which will be a defining feature of the coming decade. It will require a diversification of natural gas supplies together with increased climate adaptation and mitigation efforts, particularly, towards renewables.

This report speaks to fiscal policy measures that countries can undertake to support the transition to climate neutrality by 2050. These measures will help provide the right price incentives to move away from fossil fuel-based energy and will also help correct for market failures. The fiscal measures proposed in the report will be critical for climate mitigation efforts and include the following: imposition of carbon taxes, elimination of fossil fuel subsidies and increase in green public investment.

Carbon prices are an interplay of carbon taxes and fossil fuel subsidies. It is important to get the price of carbon right because the public sector does not have the resources to undertake all the investment required to enable the transition to net zero emissions. The private sector will need to play a critical role and galvanizing the private players will require appropriate pricing. Getting the price right will require the imposition of carbon taxes and the elimination of fossil fuel subsidies. In addition to the appropriate level of prices, green public investment will also be needed to overcome market failures that hold back green innovation and infrastructure.

Overall, this report provides new insights on the impact of carbon tax scenarios, on the size and gaps in the assessment of fossil fuel subsidies, and on the challenges in measuring green public investment. Our hope is that the findings of this report will contribute to the debate on decarbonization with emphasis on the critical role of green fiscal policies in ensuring an inclusive transition to net zero emissions in the EU member states. Governments will need to weigh in on their options for the energy transition path that will vary for different countries. In addition, concerns on energy security make it clear that actions on the green transition are required sooner than later. Timing is of the essence to ensure that countries can reap the benefits from lower emissions along with increased energy security and independence.

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# Abbreviations

| | |
|---|---|
| **AROP** | At Risk of Poverty |
| **BGK** | Polish National Development Bank |
| **CBAM** | Carbon Border Adjustment Mechanism |
| **CGE** | Computable General Equilibrium |
| **COFOG** | Classification of the Functions of Government |
| **CPAT** | Carbon Pricing Assessment Tool |
| **CPRS** | Climate Policy Relevant Sectors |
| **CT** | Carbon Tax |
| **DALY** | Disability-Adjusted Life Years |
| **EAD** | Bulgarian Energy Holding |
| **EC** | European Commission |
| **EEA** | European Economic Area |
| **EIB** | European Investment Bank |
| **EPE** | Environmental Protection Expenditure |
| **ESD** | Effort Sharing Decision |
| **ETR** | Environmental Tax Reform |
| **ETS** | Emissions Trading System |
| **EU** | European Union |
| **EUR** | Euro |
| **FFS** | Fossil Fuel Subsidies |
| **GDP** | Gross Domestic Product |
| **GFC** | Global Financial Crisis |
| **GHG** | Greenhouse Gas |
| **GPI** | Green Public Investment |
| **GTAP** | Global Trade Analysis Project |
| **HBOR** | Croatian Bank for Reconstruction and Development |
| **IBS** | Institute for Structural Research (Poland) |
| **IDB** | Inter-American Development Bank |
| **ILO** | International Labor Organization |
| **IMF** | International Monetary Fund |
| **KUKE** | Poland's Export Credit Agency |
| **LPG** | Liquid Petroleum Gas |
| **MFF** | Multiannual Financial Framework |
| **MRIO** | Multi Regional Input Output |
| **MTB** | Means Tested Benefits |
| **ND** | New Deal |
| **NECP** | National Energy and Climate Plan |
| **NMVOC** | Non-Methane Volatile Organic Compound |
| **NTL** | National Tax List |
| **ODI** | Overseas Development Institute |
| **OECD** | Organization for Economic Co-operation and Development |
| **PIT** | Personal Income Tax |
| **PLN** | Polish Zloty |
| **POLES** | Prospective Outlook on Long-Term Energy Systems |
| **PPP** | Public Private Partnership |
| **PSP** | Podzemno Skladište Plina |
| **R&D** | Research and Development |
| **RRF** | Recovery and Resilience Facility |
| **RRP** | Recovery and Resilience Plan |
| **SCD** | Systematic Country Diagnostic |
| **SME** | Small and Medium Enterprises |
| **SOE** | State Owned Enterprises |
| **SSC** | Social Security Contributions |
| **UK** | United Kingdom |
| **UNFCC** | United Nations Framework Convention on Climate Change |
| **US** | United States |
| **VAT** | Value Added Tax |
| **WHO** | World Health Organization |
| **WTO** | World Trade Organization |

# Executive Summary

**In the post pandemic world, EU member states will need to embrace two simultaneous challenges.** These will include recovering from the COVID-19 pandemic and embracing the ambitions of the European Green Deal, which maps out broad policies aimed at achieving carbon neutrality by 2050 and reducing emissions by 55 percent by 2030. Compared to the emissions reduction achieved during 1990–2018 by the EU27 countries, the 2018–30 target is 50 percent more ambitious and is to be achieved in a third of the time. Meanwhile, the emissions reduction planned during 2030–50 will be even steeper. The transition in some EU countries will be particularly challenging, given their high energy intensity, significant dependence on fossil fuels for power generation and an increasing and environmentally unfriendly transport fleet. In addition, households will need to be supported in the transition, to avoid a substantial share of the population being adversely affected.

**Achieving the enhanced 2030 climate ambition and net zero emissions by 2050 will require prompt and decisive actions by both the public and private sectors.** Given reduced fiscal space in many EU countries due to the pandemic, the public sector in most countries will have even less resources to undertake the investment needed to achieve these goals. Thus, it is essential to provide the appropriate incentives for increasing green and reducing brown investment by the private sector. Investment has to shift away from the extraction and combustion of fossil fuels towards renewable energy, energy efficiency and the deployment of new low-carbon technologies. Since an eventual transition to a lower carbon economy is inevitable, delaying green investments (and thus continuing with more carbon-intensive investments) would increase the stock of capital that would eventually become obsolete and the size of the investments that would have to be made in the future. A green investment push could also boost demand and employment, helping economies recover from the COVID-19 crisis. Therefore, now is the time to invest in a green economy.

**This report speaks to the importance of three critical green fiscal instruments — carbon taxes, fossil fuel subsidies and green public investment — in supporting the green transition..** The report reviews experience from the EU and elsewhere, and applies lessons learnt to the specific challenges facing the four countries — Bulgaria, Croatia, Poland and Romania. The key questions considered in the report include: what is the most efficient path for ensuring that the price of carbon is consistent with achieving the emission reduction goals of the European Green Deal? What is the impact of raising the price of carbon on growth, employment, competitiveness and income distribution, and how can related concerns be addressed? What are the magnitudes and effects of fossil fuel subsidies, and what are the barriers to phasing them out? What are the challenges related to identifying and quantifying green public investment?

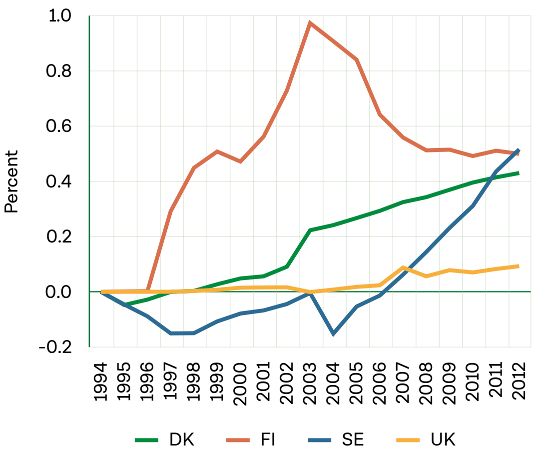
**Green fiscal reforms will be crucial to achieve climate mitigation targets while addressing distributional and competitiveness concerns.** The transition to net zero emissions will require a whole suite of policies to achieve economic, social and environmental objectives, but fiscal reforms play a central role. This report focuses on three fiscal policy levers to achieve the European Green Deal goals. The first two are increasing carbon taxes and phasing out of fossil fuel subsidies, to ensure that the price of carbon faced by firms and households encourages activities consistent with achieving net zero emissions. Such pricing can be implemented through emissions trading systems or carbon taxes. The EU Emissions Trading System (ETS) covers power and large industrial installations, while the remaining sectors (transport, residential sector and smaller businesses) are currently covered under the Effort Sharing Regulation with the imposition of taxes/levies determined at the national level. Raising carbon taxes in the non-ETS sectors and phasing out fossil fuel subsidies can be accompanied with a recalibration of other taxes along with targeted transfers to address concerns related to growth, employment, competitiveness and distributional aspects. The third fiscal lever is to increase the share and level of green public investment focused on overcoming market failures that hold back private investment in green innovation and infrastructure.

## Carbon taxes

**Experience with carbon taxes demonstrates that an appropriate design can reduce emissions and simultaneously yield economic and social benefits.** Carbon taxes, which change relative prices to incentivize lower carbon investment and innovation while raising revenues, are an efficient way to reduce emissions. This is because they are simple to administer, do not impose fiscal costs and are not technologically prescriptive (Branzini, 2018). The price signals, however, induce significant structural changes to the benefit of certain sectors like renewables and to the detriment of others like coal mining. While aggregate effects can vary, adverse impacts on certain groups of workers and businesses need to be carefully managed to protect those who are economically vulnerable and to make the reform sustainable. European countries' experience with carbon taxes demonstrates that they have successfully managed to introduce, and ramp up, carbon taxes while making the process growth oriented and just. Typically, governments with successful carbon tax schemes have addressed political economy issues through dialogue with key stakeholders to build consensus. Their experience demonstrates that imposition of carbon taxes can be economically neutral or beneficial, provided revenues are used to compensate for adverse effects.

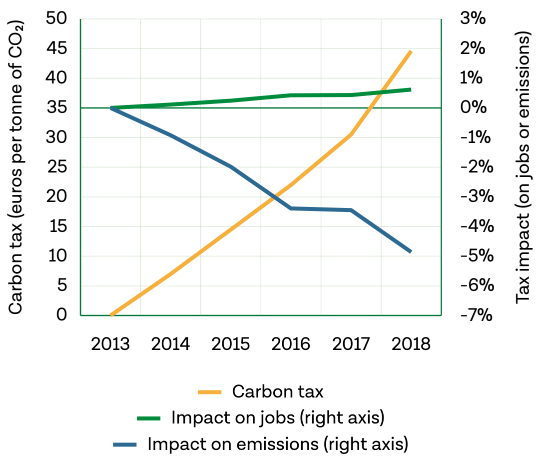
**An appropriate use of carbon tax revenues and targeted transfers can address concerns over competitiveness and income distribution frequently cited as reasons for the low uptake of carbon taxes.** Using carbon tax revenues to reduce other more distortive taxes (like labor and income taxes), together with providing targeted transfers to the vulnerable and those most affected by the transition, can ensure revenue neutrality and equity while achieving significant reductions in emissions. Revenue-neutral carbon taxation had a positive impact on GDP in Denmark, Finland, Sweden and the UK (Figure ES.1), and the imposition of carbon taxes was associated with an increase in manufacturing jobs in France (Figure ES.2). In addition, gradually aligning the tax burden across ETS (where they exist) and other sectors will help to ensure appropriate burden sharing.

**Figure ES.1** Change in GDP due to revenue-neutral carbon tax compared to business-as-usual




*Source:* Barker et al., 2009

**Figure ES.2** France — Impact of carbon tax on emissions and jobs in the manufacturing sector

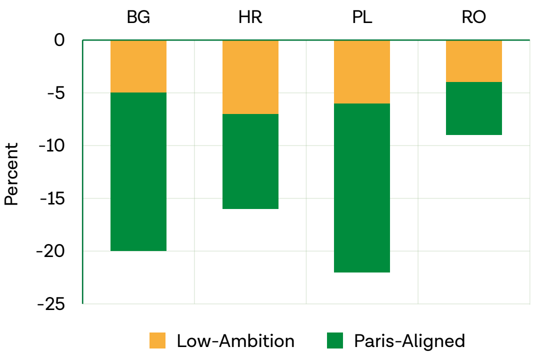



*Source:* Dussaux, 2020

**The initial level of carbon taxes to be adopted for the non-ETS sectors in the four EU countries in focus (Bulgaria, Croatia, Poland and Romania) should reflect the current level of energy taxation and appropriate burden sharing.** Taxation of emissions by the four countries is minimal; taxes on energy use, principally from motor fuel taxes, is above the EU average as a share of revenues and GDP, although the tax rates on motor fuels are close to the EU minimum. The United Nations Framework Convention on Climate Change principle of differentiated responsibilities calls for higher carbon taxes depending on income levels. These considerations suggest that current carbon pricing levels for the non-ETS sectors will need to increase gradually to reduce emissions sustainably. The revenues from carbon taxes could best be devoted to replacing social security contributions, since personal income taxes are relatively modest in the four countries examined. The lower social security contributions (SSCs) by employers could be offset by contributions from the government, such that the financial sustainability of the system is not compromised. In addition, countries can devise additional compensation mechanisms to protect vulnerable households and businesses.

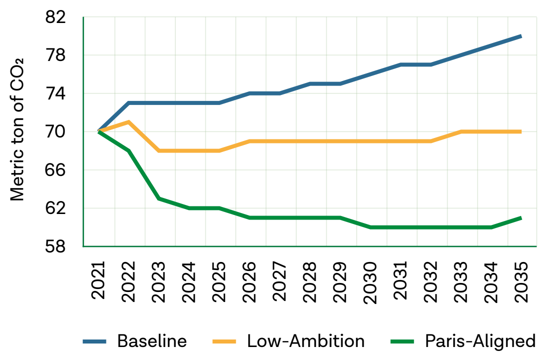
**A revenue-neutral increase in carbon prices could significantly reduce emissions in all four countries.** The Carbon Pricing Assessment Tool (CPAT) and the Multi Region Input Output (MRIO) model are used to illustrate the potential impact of higher carbon prices in the four EU countries examined. Two scenarios of carbon price increases are assessed, the low ambition and Paris-aligned/high ambition (where carbon prices are consistent with achieving countries' decarbonization commitments), while assuming revenue neutrality.[1] Modeling results indicate that the impact of policies on electricity prices is highly dependent on the energy mix (with Poland and Bulgaria seeing larger price increases due to their dependence on coal to generate electricity), while the impact on gasoline and diesel prices is similar across all four countries. Higher carbon prices result in a substitution away from fuel intensive to low carbon sources, and thus reduce emissions in all four countries (Figures ES.3 and ES.4).

**Figure ES.3** Emissions reductions induced by the carbon tax in the four countries




*Source:* Staff estimates

**Figure ES.4** Emissions trajectory with and without carbon tax — example of Romania




*Source:* Staff estimates

**The increase in carbon prices would have a broadly positive but uneven impact on employment and an adverse impact on the poor, requiring compensatory measures.** Carbon tax revenue collections range from a quarter to half a percent of GDP by 2030 in the low ambition scenario, while the Paris-aligned scenario yields between 0.9 – 1.5 percent of GDP. For Bulgaria, Croatia, and Romania, the employment effects of the two carbon price scenarios are net positive in aggregate but show variations between regions and sectors. Poland is likely to see declines in brown-dominated sectoral employment with large regional variations; but proactive policies can overcome this. Effects vary significantly across different sectors and occupations, and among countries given their specific economic structures. Carbon taxes raise prices for consumers, with lower income households disproportionately affected. However, in all four EU countries, the net impact on equity can become progressive if revenues are used to scale up social assistance and related policies, and to support workers through labor market transitions.

**Raising the price of carbon also would help to lower air pollution, and reduce traffic congestion and fatalities.** As carbon taxes incentivize a shift to cleaner technologies, they also deliver positive externalities by curtailing other harmful pollutants such as $SO_2$ and $NO_x$, while also improving air quality. The shift away from carbon-intensive fuels induced by carbon taxation would reduce ambient air pollution in the four countries in both rural and urban areas, contributing to better health outcomes. In addition, high dependence on automobiles for transport in EU countries creates negative externalities such as road accidents and congestion. Increasing motor fuel prices reduces vehicle kilometers driven and the purchase of vehicles, which will reduce the frequency of accidents and lower congestion. The analysis put forward in the report shows that both externalities are expected to improve with higher fuel prices in the four countries.

## Fossil Fuel Subsidies

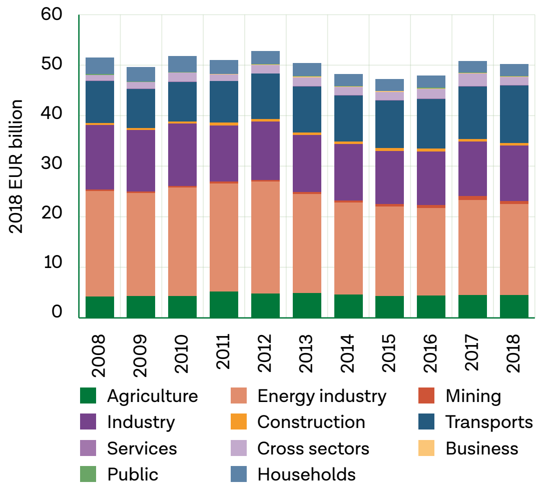
**The imposition of carbon taxes needs to be complemented by the elimination of fossil fuel subsidies to be effective in reducing carbon emissions.** Fossil fuel subsidies are costly for the public budget and undermine the green transition. They not only reduce scarce public resources, but also distort energy prices, generate economic inefficiencies, and hamper the transition to a low-emission economy. Limited progress in reducing fossil fuel subsidies across the EU is costly and leads to the misalignment of government spending with green transition goals. Therefore, phasing these subsidies out is an important environmental fiscal reform.

**While many countries have successfully introduced carbon taxes, progress in reducing fossil fuel subsidies has been limited.** A key part of the problem is that the fiscal impact of fossil fuel subsidies provided through State Owned Enterprises (SOEs) and public finance institutions is difficult to quantify, particularly in comparison to quantifying direct subsidies provided through the budget. Reduction of these subsidies is also a challenging task, given the associated political economy factors.

**Governments in the EU, including the four countries in focus, continue to subsidize the reliance on oil, gas and coal, thereby, supporting the "brown economy."** Despite political commitments to phase out fossil fuel subsidies in the EU, recent estimates show that they have remained at near EUR 50 billion since 2008, with more than one-third going to the energy sector (Figure ES.5). Using a bottom-up, inventory methodology, a broader measure of fossil fuel subsidies was estimated for Bulgaria, Croatia, Poland, and Romania. The estimates include subsidies provided through fiscal support, public finance, and investment by SOEs, highlighting the importance of less traditional (off-budget) support to fossil fuels. Total fiscal support to fossil fuels is estimated to range from 0.2 percent of GDP in Romania to 3.1 percent in Bulgaria (ODI, 2021), although methodological differences in estimating the cost of tax expenditures as well as data gaps mean that these cross-country comparisons may be imprecise (Figure ES.6).

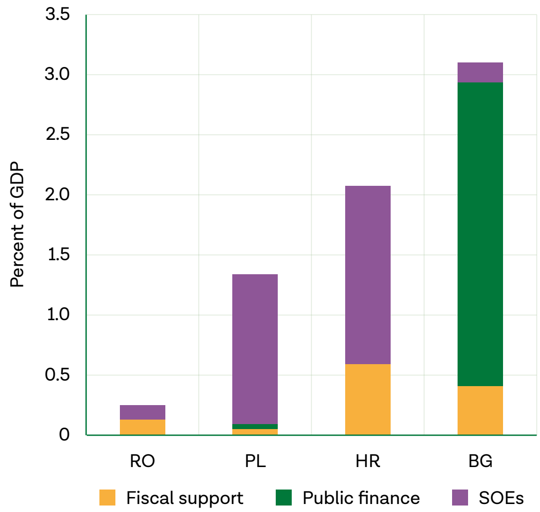
**Improving transparency is essential to address fossil fuel subsidies.** Financing for fossil fuels in the four countries is largely provided through SOEs rather than through the government budget. Poland and Croatia support fossil fuel production through one or more SOEs. In Bulgaria, the largest category of subsidy comes from public financing provided for transportation of gas. In addition, there are various examples of indirect subsidies that are difficult to quantify precisely (e.g., support to the road and railway infrastructure via diesel cars and trains using coal-fired electricity in Poland). Against this background and learning from the successful experience of fossil fuel subsidy reforms in Europe, there is an urgent need to start using the recognized definitions of fossil fuel subsidies and invest in transparent and comparable information to regularly monitor fossil fuel subsidies. As a second step, countries may consider building analytical tools that would inform policy choices and guide them on the size and nature of desirable compensatory policies, especially targeted support to affected families in associated sectors.

**Figure ES.5** Fossil fuel subsidies (stock) in EU27 by sector




*Source:* Study on energy costs, taxes and the impact of government interventions on investments https://ec.europa.eu/energy/studies_main/final_studies/study-energy-costs-taxes-and-impact-government-interventions-investments_en

**Figure ES.6** New estimates of fossil fuel subsidies for selected EU countries




*Notes:* Data is for 2018 or 2019. Methodological differences in estimating the cost of fossil fuel subsidies may exist across countries For details, please refer to Box 4.1

*Source:* ODI, 2021

## Green Public Investment

**Public investment is critical to support private investment in green infrastructure and innovation.** For carbon pricing to achieve net zero emissions, complementary policies that support green innovation, investment and more efficient use of energy and materials are needed. Without public investment in innovation, R&D and appropriate infrastructure, private sector green investment will fall short of required levels, while carbon policies will fail to shift economies and societies away from fossil fuels sufficiently and will face increasing opposition. In addition, without strong policies to support energy and materials efficiency by reducing their costs — particularly among poorer segments of society — it will be difficult to ensure support for carbon pricing (Grubb et al. 2014). Government policies and investment are thus critical to support the green transition and help to unlock private funds. Regulations also can be effective in steering investments into areas that are socially desirable.

**Green public investment also can aid in the recovery from the pandemic.** Empirical evidence suggests that green investment can have higher fiscal multipliers than traditional fiscal stimuli for both output and employment (Batini, 2021). Estimated fiscal multipliers for investments in renewables are twice as large as those for investments to extract and use fossil fuels. Therefore, such spending can be timely to support not only the green transition, but also economic recovery after the pandemic. Unfortunately, environmental protection spending (used as a proxy for green public investment) in the EU reached a mere 2 percent of GDP before the COVID-19 crisis and was driven by the private sector with limited public expenditures. The EU's €673bn Recovery and Resilience Facility (RRF) provides a unique opportunity for the public sector to play a large role in supporting both the European Green Deal and economic recovery.

**Difficulties in defining and identifying green public investment could potentially limit increases in this spending category.** Stepping up green public spending requires a uniform definition of specific investment outlays that can be classified as green. While the EU taxonomy — a classification system establishing a list of environmentally sustainable economic activities — provides appropriate definitions for economic activities that can be considered environmentally sustainable, its coverage of economic activities needs to be increased. Identifying and properly classifying green spending is challenging because of the multi-dimensional nature of climate objectives, difficulties in the binary classification of spending into green and brown, and limitations related to existing budget classification and reporting mechanisms that do not contain information on green outlays.

**In sum, the pandemic induced crisis presents an opportunity to invest in green activities to drive a low-carbon recovery.** Carbon taxation of the sectors outside ETS can support a green transition if implemented with appropriate changes to the overall tax structure, complementary social assistance interventions and elimination of fossil fuel subsidies. These improved price incentives together with the prioritization of green public spending will catalyze private sector green investment. All these policy areas would benefit from more transparency around data, ongoing assessments of impact, and communication with stakeholders. EU member states have the opportunity to tailor their national policies to provide better opportunities to citizens and also deliver on the European Green Deal and their national ambitions for a green economy.

# Notes

1 Revenues from carbon taxes are used to reduce income taxes and provide compensation to low income households. See Chapter 3 on Green Fiscal Reforms for detailed assumptions.

# THEMATIC FOCUS: **Green Fiscal Reforms**

**Green fiscal instruments are needed to support the green transition in the European Union (EU).** The shift to a green economy with net zero emissions will require a whole suite of policies in different sectors to address challenges related to mitigation, adaptation and transition. Carbon pricing, an interplay of carbon taxes and fossil fuel subsidies, is a key mitigation policy to address climate change and transition. Getting the price of carbon right is critical because the public sector does not have the resources to undertake all the investments that are needed to achieve net zero emissions. The private sector will need to play a crucial role in the transition process and galvanizing the private players will require appropriate pricing. This is all the more important in the post-pandemic world wherein many EU countries are facing higher levels of indebtedness and reduced fiscal space. In addition, the transition in some EU countries will be particularly challenging, given their high energy intensity, significant dependence on fossil fuels for power generation and an increasing and environmentally unfriendly transport fleet. While appropriate carbon prices are necessary to enable the green transition, they are not sufficient. They will need to be complemented with green public investment focused on overcoming market failures that hold back green innovation and infrastructure. As an example, emissions reduction will require increased spending on R&D and new infrastructure like transmission/transportation systems for fuels like green hydrogen and captured emissions. Therefore, governments can play a key role by providing appropriate incentives and reducing risks so as to galvanize increased private sector spending.

**This report analyzes carbon taxes (in non-ETS sectors), fossil fuel subsidies and green public investment, with a focus on four EU countries — Bulgaria, Croatia, Poland and Romania.** The report also discusses options to address the competitiveness and distributional concerns related to carbon taxes, the challenges associated with the comprehensive quantification of fossil fuel subsidies and the issues related to the identification of the green component of public investments. In addition, this report provides an illustrative example of the economic and other effects of the imposition of carbon taxes (combined with the recalibration of other taxes) and some policy suggestions to address the challenges associated with subsidies and green public investment. While these scenarios and challenges have been discussed in the report, the green fiscal policy mix adopted by different countries will ultimately vary depending on, *inter alia*, their exposure to specific climate change vulnerabilities, extent of dependence on fossil fuels, availability of alternative energy sources and other competitiveness, distributional and political economy considerations as well as current macroeconomic conditions.

**Carbon taxes and fossil fuel subsidy reforms strengthen price incentives for sustainable investment while public investment helps overcome market failures holding back green innovation and infrastructure.** A joint statement by 1700 European environmental economists suggests that *"a sufficiently robust price on carbon reduces the need for less efficient policies and provides the regulatory certainty companies need for long-term investment in clean-energy alternatives."*[1] The importance of carbon prices in the EU has been signaled in the initial policy directions of the European Green Deal which seeks to better align fuel prices with their carbon content (through an extension of the Emissions Trading System (ETS) and a reassessment of the Energy Taxation Directive). Without prices that reflect the social costs of fossil fuel usage, the private sector faces insufficient incentives to shift towards low-carbon investments. If the business-as-usual scenario continues, either countries will be left with stranded assets at a later date or a large share of the cost for the low-carbon transition will have to be borne by the government, something many of them can ill-afford, given elevated debt levels. Therefore, an adequate level of carbon pricing is necessary but may not be sufficient to address all the market failures inhibiting the low-carbon structural change. There is evidence of increased effectiveness and political acceptability when countries use a policy mix (e.g. combine carbon taxation of motor fuels with public investments in building public transport). Public investments can also speed up improvements in energy efficiency and support innovation and investment in infrastructure for low-carbon solutions.

**Green fiscal policies can support the transition to carbon neutrality by providing the right price incentives to the private sector and by correcting for market failures.** Price incentives will entail changes to the tax structure (increase in carbon taxes could be combined with a lowering of labor taxes) together with the elimination of fossil fuel subsidies. Overcoming market failures that hold back green innovation and infrastructure will require the government to step in with appropriate investments. Experience with these fiscal instruments points to the success of carbon taxes (together with the recalibration of other taxes) in reducing emisssions while simultaneously supporting an expansion in output and employment. Limited progress has however been achieved in exhaustively quantifying and reducing fossil fuel subsidies. A combination of increased transparency in the reporting of financial support to fossil fuels, analytical capacity to assess their costs and benefits, and the use of just transition schemes for workers are critical elements of successful fossil fuel subsidy reforms. And despite recent efforts, it remains challenging to identify the green component of public investment. The EU taxonomy provides a good starting point but considerable more work is needed. These investments need to be appropriately quantified (to avoid greenwashing) and stepped up to support the green transition while also enabling economic recovery.

**This report is structured in the following manner.** Chapter 1 discusses the EU 'green' context and related challenges. Chapter 2 presents the key lessons learned from countries that have introduced carbon taxes in the past and the implications for Bulgaria, Croatia, Poland and Romania. Chapter 3 provides an illustrative example on the impact of increasing carbon prices on emissions, GDP, employment and other parameters in the four countries. Chapter 4 discusses the extent of and options for reducing fossil fuel subsidies in the four countries. Chapter 5 provides a brief on the importance of green public investment and the difficulties in quantifying green spending based on the current EU taxonomy. Chapter 6 concludes.

# Note

1 European Association of Environmental and Resource Economists (2019). "Economists' Statement on Carbon Pricing", https://www.eaere.org/statement

Chapter 1

# Context and Challenges

# EU Context — 2050 target of Climate Neutrality

**The leaders of EU member states have agreed to achieve carbon neutrality by 2050 and to reduce emissions by 55 percent by 2030.** The European Green Deal outlines the policy elements and directions that will be articulated to support these commitments.[1] The European Climate Law approved by the European Parliament in June 2021 makes the 2050 commitment legally binding. In addition, the collective 2030 greenhouse gas (GHG) reduction target was raised from 40 percent to at least 55 percent, compared to the 1990 baseline.[2] Policy instruments to achieve the 2030 target are illustrated in Figure 1.1 (legislative proposals are awaited).

**Figure 1.1** EU Climate Target Plan 2030 — key contributors and policy tools.

**EU Emissions Trading System (ETS)**
- A strengthened cap on overall emissions under the EU ETS
- Aim to expand the use of emission trading to the maritime, buildings and road transport sectors
- Look into the integration of all emissions from fossil fuel combustion

**Energy Efficiency**
- Review the current EU energy efficiency target of 32.5% by 2030
- Launch a renovation wave to improve housing quality in the EU
- Strengthen the role of Eco-design standards to ensure EU consumers have access to efficient products

**Renewable Energy**
- Review the current target of 32% of renewables in the EU energy mix by 2030
- Review and revisit the biomass sustainability criteria
- New European terminology and certification system for all renewable and low-carbon fuels

**Road transport $CO_2$ emissions**
- Revisit and strengthen the $CO_2$ standards for cars and vans for 2030 and beyond
- Reflection on phase-out target date for internal combustion engines

**Agriculture, Land Use, Land Use Change and Forestry (LULUCF)**
- Integrated approach to reduce emissions from agriculture, provide bio-based materials for our economy, protect and enhance the natural carbon sink and improve the resilience of the EU's forests and agriculture to climate change

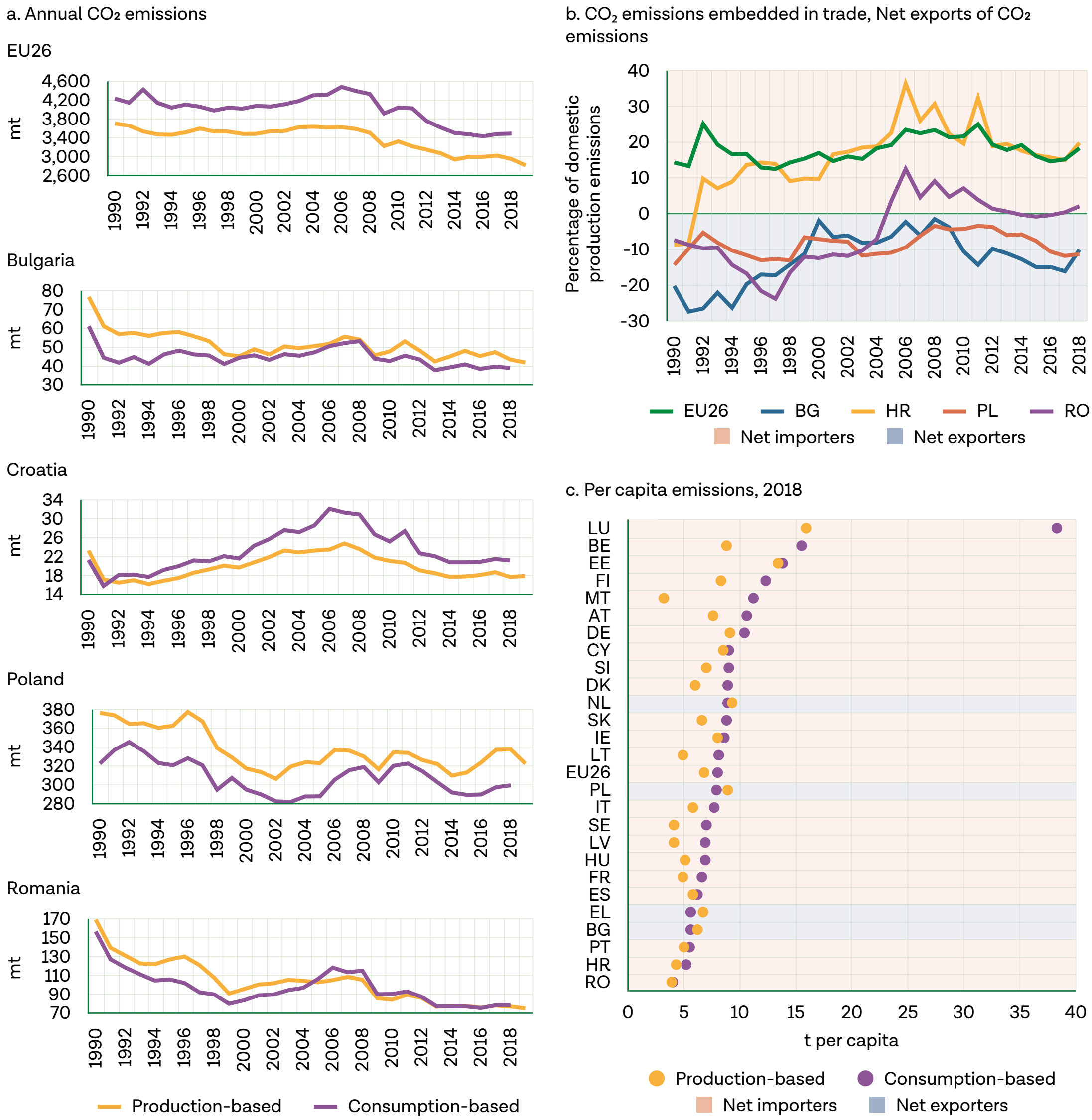
**Effort Sharing**
- Options range from reduced scope to potential future repeal if all emissions are covered by other policy instruments, while taking into account distributional concerns between Member State

*Source:* https://ec.europa.eu/commission/presscorner/detail/en/fs_20_1610

**During 1990–2018, the EU reduced emissions without offshoring emissions-intensive production to other countries.** In the EU, there has been a decoupling of emissions and production, between 1995 and 2018, as GDP per capita grew by 40 percent while GHG emissions from EU territories fell by 16 percent. In part, this has been the result of a rapid deployment of renewable technologies in some member states and the reduction in coal generation. In the EU[3], like in most advanced economies, consumption-based emissions, adjusted for the carbon content of imported and exported goods, are higher than production-based emissions. Thus, the EU is a net importer of $CO_2$[4] emissions — net imports of $CO_2$ are equivalent to 18 percent of domestic emissions in 2018 (hovering around 20 percent in recent years). Nevertheless, the trend in production- and consumption-based emissions have been broadly similar (and declining) at the EU level, suggesting that the EU is not structurally 'offshoring' emissions-intensive production to other countries (Figure 1.2).

**The EU, as a bloc, met its 2020 target on the reduction of GHG emissions but performance across member states was mixed.** The EU demonstrated its commitment to reducing greenhouse gas emissions with the launch of the ETS in 2005, the world's first and largest carbon market, currently accounting for over three-quarters of the global carbon market value.[5] As a whole, the EU met its 2020 target of a twenty percent reduction in GHG emissions, compared to 1990 levels, but performance varied across member

**Figure 1.2** Production vs consumption-based $CO_2$ emissions




*Note:* Consumption-based emissions are domestic emissions adjusted for trade.

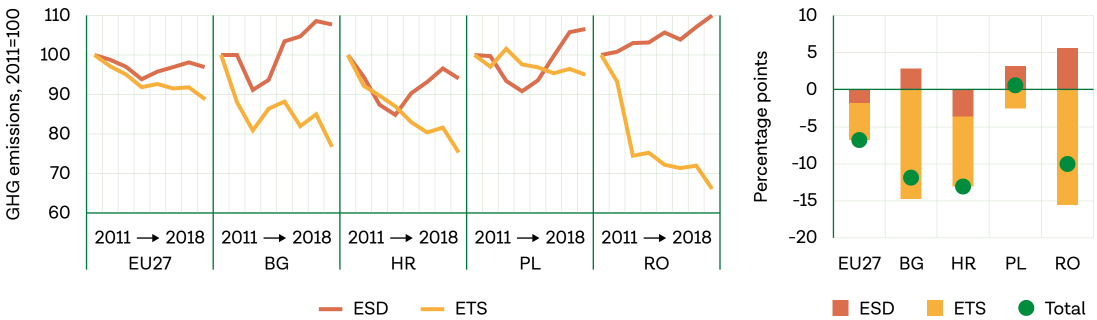
EU26 refers to EU27 excl. Czech Republic (no data for consumption-based $CO_2$ emissions).

Share of carbon dioxide ($CO_2$) emissions embedded in trade, measured as emissions exported or imported as the percentage of domestic production emissions. Positive values (light orange) represent net importers of $CO_2$ (i.e. "20%" would mean a country imported emissions equivalent to 20% of its domestic emissions). Negative values (light blue) represent net exporters of $CO_2$.

*Source:* Our World in Data based on Global Carbon Project. (2020). Supplemental data of Global Carbon Budget 2020 (Version 1.0) [Data set]. Global Carbon Project. https://doi.org/10.18160/gcp-2020.

states.[6] In some countries (like Hungary, Poland, Bulgaria, Portugal and Spain), the downward trend in emissions seen after the Global Financial Crisis (GFC) has been reversed. This was particularly visible in sectors covered by the Effort Sharing Regulation, i.e. sectors outside the ETS, where decarbonization policies are set at the national level (Figure 1.3). The share of renewable energy in the total energy basket has also increased somewhat more slowly (if at all) in the last few years while the economic recovery post-GFC had translated into growing energy consumption, undermining energy efficiency targets.

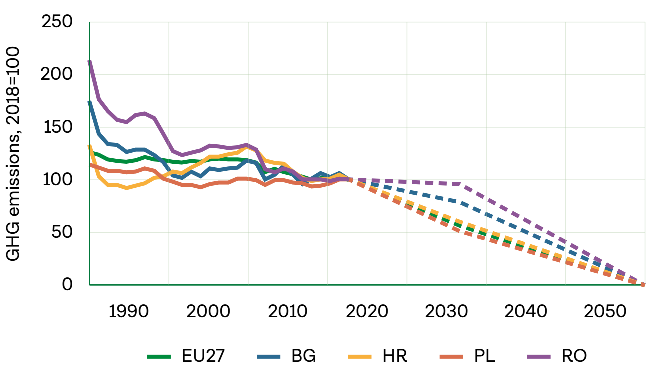
**Figure 1.3** GHG emissions under ETS and under non-ETS sectors (ESD, Effort Sharing Decision), EU27, Bulgaria, Croatia, Poland and Romania




*Source:* Eurostat, staff calculations.

**Looking ahead, meeting the 2030 and 2050 targets will involve significant efforts for the EU as a whole and particularly for some countries.** The pre-pandemic slowdown in GHG emissions reduction jeopardizes the EU's ability to meet its 2030 target. The EU27 will need to cut GHG emissions by 30 percent from present levels to meet the 2030 target. Compared to the reduction achieved during 1990–2018, the 2018–30 target is 50 percent more ambitious and is to be achieved in 1/3 of the time (Figure 1.4). Assuming that climate targets are binding at the country level, emissions reduction in Poland and Croatia will be substantial. The emissions reduction to be achieved during 2030–50 will be even steeper.[7]

**Figure 1.4** GHG emission reduction, actual (1990–2018) and required (until 2030 and 2050) to meet the European Green Deal commitments




b. Percentage change

| | Actual | To achieve target | |
|---|---|---|---|
| | 1990–2018 | 2018–2030 | 2030–2050 |
| EU27 | -20.7 | -43.2 | -56.8 |
| BG | -42.8 | -21.3 | -78.7 |
| HR | -24.8 | -40.2 | -59.8 |
| PL | -12.6 | -48.5 | -51.5 |
| RO | -53.2 | -3.9 | -96.1 |

*Source:* Eurostat, staff calculations.
*Note:* Hypothetical reduction required to meet the European Green Deal commitments.

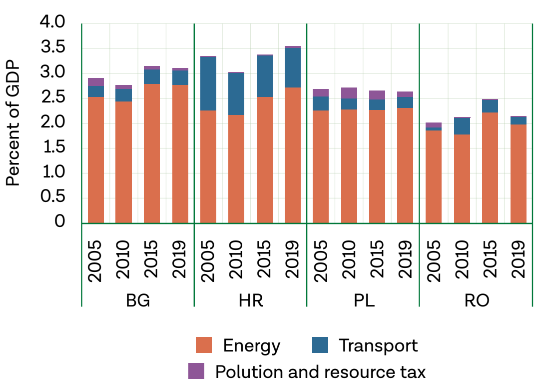
**The EU funds that will be made available over the next few years will support the green transition in member states.** The EU's recovery plan agreed upon in July 2020[8] is aimed at putting the member states on a more sustainable path. This includes repairing the damage from the COVID-19 crisis and also promoting and accelerating the green and digital transitions. Policies financed by the proposed multiannual financial framework and the Recovery and Resilience Facility[9] are expected to mainstream climate action. In the latter, member states are required to earmark a minimum of 37 percent of spending for climate investments and reforms.

# Challenges in becoming Climate Neutral

**Given the scale of work to be done in becoming climate neutral, appropriate actions are needed sooner than later, despite the increased indebtedness in many EU member states.** The COVID-19 pandemic has caused an economic crisis unique in its severity. The impact of the pandemic has been swift and severe with GDP contractions of varying magnitudes in different countries. Overall, the EU27 contracted by 5.9 percent in 2020 despite unprecedented fiscal, monetary and financial support provided to firms and households. These support measures have led to increased financing needs and indebtedness in several EU member states, reducing the fiscal space needed to undertake green public investment. Given the magnitude of the challenges facing EU member states in meeting their longer-term climate ambitions, countries will need to use the recovery from the crisis to recalibrate the growth trajectory. Indeed, there are several examples of green fiscal reforms conducted during times of crisis. In 1991, during one of Sweden's greatest economic crises, the country identified and reduced the taxes limiting growth and employment (like labor taxes) and introduced carbon taxation. Germany did the same in the 2001 recession,[10] and British Columbia in the 2008 recession. Research of the impacts of these reforms suggest that revenue-neutral reforms helped stimulate growth and employment, while supporting the environment (Ekins and Speck, 2011; Murray and Rivers 2015)[11]. Other EU countries can follow suit in the post pandemic period.

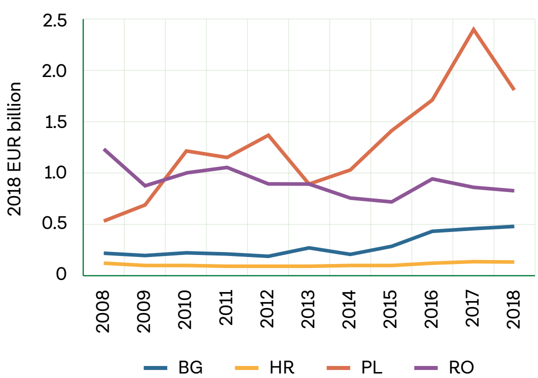
**With reduced fiscal space, it will be critical to galvanize green private investment through price signals that direct investors towards cleaner sectors and technologies.** These price signals are manifested through the ETS, carbon taxes and subsidies. The EU ETS covers 45 percent of EU's total GHG emissions and has only recently started delivering a meaningful price signal, following the introduction of the market stability reserve in January 2019. Till 2018, ETS prices remained muted because of interaction effects with other elements of EU mitigation strategies and supply–demand imbalances (Annex 1).[12] The remaining 55 percent of emissions in the EU are subject to national policies under the Effort Sharing Decision (ESD — Annex 2).[13] One of the key instruments under the ESD is environmental taxes, which have remained flat or have declined in some EU member states. In addition, even in sectors covered by the ETS, economic research suggests that efficiency benefits are possible by also pursuing tax policy (Böhringer et al 2017), as done in the UK through a carbon price floor.[14] Meanwhile, despite the political commitments to phase out fossil fuel subsidies, they have remained stagnant at around EUR 50bn since 2008, with more than 1/3 going to the energy sector.[15] Fossil fuel subsidies have more than doubled in Bulgaria and Poland since 2014, reaching 0.8 percent and 0.4 percent of GDP respectively (Figures 1.5, 1.6). As a result, price signals in the EU have been weak, uneven and contradictory.

**Figure 1.5** Environmental tax revenues




*Source:* Eurostat

**Figure 1.6** Fossil fuel subsidies in four EU countries

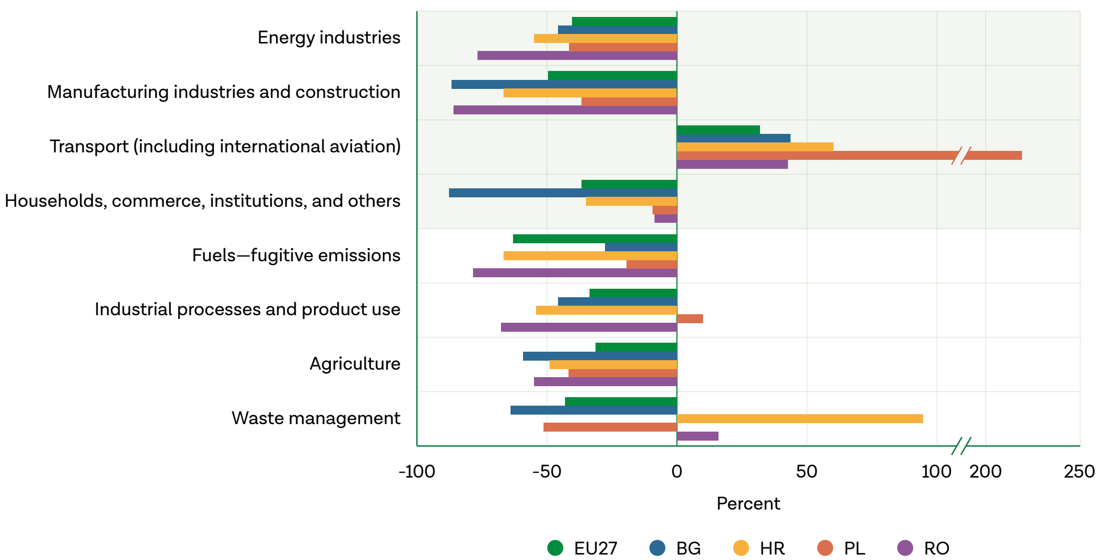



*Source:* EC (October 2020)

**Efforts will also be needed to make the shift to clean energy a just transition.** For regions that are heavily dependent on extractive and carbon-intensive industries, the green (energy) transition will pose challenges. With a firming up of ETS prices and falling costs of renewable energies, the transition process has begun and will accelerate in the future. In this transition process, it will be important to ensure that assistance reaches the affected families and communities. In addition, efforts will be needed to retrain/reskill the affected labor force. The EU has earmarked funds to make the transition process just. Given their higher dependence on coal, Poland and to some extent, Romania, are likely to be among the most affected countries and will be among the top 3 beneficiaries of the EUR 17.5 billion Just Transition Fund[16] (20 and 11 percent of total allocation, respectively). To access these funds, the countries are in the process of preparing Territorial Just Transition Plans.

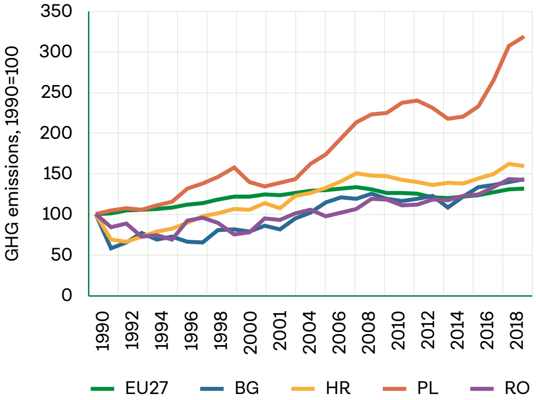
**The decarbonization agenda in the four EU countries confronts significant challenges arising from high carbon intensity and transition challenges related to the energy and transport sectors.** The four countries remain among the most energy- and carbon-intensive EU economies. Despite improvements, Poland's energy intensity is still twice that of Germany and Bulgaria is four times more energy intensive than Germany. High energy intensity combined with carbon dependent energy generation results in high carbon intensity. Power generation is responsible for the highest share of GHG emissions. In Poland and Bulgaria, the sector contributes to around 40 percent of total emissions and its share has remained fairly stable over the past few years. In Poland, 75 percent of primary energy production in 2019 was from fossil fuels while in Bulgaria, it was nearly 40 percent. Meanwhile, transport is the only sector with growing GHG emissions in the EU27. In Croatia, the sector generates as much as 29 percent of GHG emissions, nearly 50 percent higher than the 1990 level. The trend is even more challenging in Poland where GHG emissions from transport have more than tripled since 1990 (Figures 1.7, 1.8 and 1.9). With high energy intensity, significant dependence on fossil fuels for power generation and an increasing and environmentally unfriendly transport fleet, the green transition in the four EU countries, particularly Poland, will be even more challenging than in some other EU member states. It will bring to the fore issues of energy security, availability of transition fuels, energy intensity of production structures and the possibility of a larger share of the population being adversely impacted by the transition.

**Figure 1.7** Change in GHG emissions by source sector, 1990 – 2018




*Source:* Staff calculations based on EEA data (republished by Eurostat, online data code: env_air_gge).
*Note:* Fuel combustion as a source of GHG emissions is indicated by the shaded background
Air emissions inventories, submitted to UNFCCC

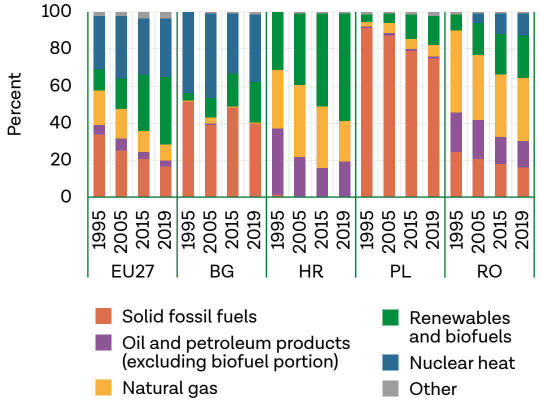
**Figure 1.8** GHG emissions in transport (including international aviation), 1990 – 2018




*Source:* Eurostat, staff calculations.

*Note:* 1990=100

**Figure 1.9** Primary energy production, selected years, 1995 – 2019, based on tons of oil equivalent




*Source:* Eurostat.

**Overall, the EU has increased its green ambitions and the four EU countries have a unique opportunity to decarbonize while lowering transition costs with the help of EU funds.** Net zero emissions by 2050 will require substantial structural changes in EU countries. The four countries in focus face unique challenges based on their energy mix, existing dependency on fossil fuels and costs of transition. While it will be important to avoid significant economic disruption, action will need to be taken sooner rather than later to minimize costs.

# Notes

1. A series of measures announced includes, among others, the review of the Energy Taxation Directive, the review of the ETS Directive; Effort Sharing Regulation; Land use, land use change and forestry Regulation; Energy Efficiency Directive; Renewable Energy Directive; $CO_2$ emissions performance standards for cars and vans; Alternative Fuels Infrastructure Directive.
2. The EU committed to a 40 percent cut in greenhouse gas (GHG) emissions by 2030 compared to 1990 levels. Of the 197 parties to the UNFCCC, 170 agreed to voluntarily reduce emissions, with the explicit goal of limiting global atmospheric warming to two degrees Celsius (UNFCCC, 2017). Ratifying parties have agreed to work collectively towards the Agreement's goals through a set of individual, country-defined mitigation targets, called Nationally Determined Contributions (NDCs). Interventions for achieving reduction targets vary by country. Examples include fuel switching, renewable energy portfolio standards, and adoption of sustainable agricultural practices that curtail carbon dioxide ($CO_2$) emissions from forest loss.
3. For consumption-based emissions this refers to EU26, i.e. EU27 excluding Czech Republic, where data for consumption-based $CO_2$ emissions are not available.
4. Available consumption-based statistics refer to $CO_2$ emissions, which account for 80 percent of EU27 GHG emissions in 2018.
5. Refinitiv (2020) Global Carbon Market Report 2020, January 2020 https://www.refinitiv.com/en/resources/special-report/global-carbon-market-report#form.
6. GHG emissions, estimated using production-based carbon accounting, decreased by 21 percent compared with 1990 levels in 2018, reflecting both policy action and economic shifts.

[7] The four EU countries differ in their decarbonization plans (as per the national energy and climate plans, NECP), which in many cases fall short of the Green Deal commitments. However, some of these plans were created before the increased 2030 target of 55 percent reduction was agreed upon.

[8] European Council conclusions, 17–21 July 2020 https://www.consilium.europa.eu/en/press/press-releases/2020/07/21/european-council-conclusions-17-21-july-2020/

[9] The Recovery and Resilience Facility (EUR 360 billion in loans and EUR 312.5 billion in grants) provides support for investment and reforms to mitigate the economic and social impact of the COVID-19 pandemic and make European economies and societies more sustainable, resilient, and better prepared for the challenges and opportunities of the green and digital transitions. The RRF is the centerpiece of NextGenerationEU, a EUR 750 billion temporary recovery instrument.

[10] Germany shifted the fiscal burden from labor to emissions by simultaneously raising electricity taxes and subsidies for renewables (which jointly mimics a carbon price) and using net revenues to finance a reduction in social security contributions.

[11] Murray, Brian, and Nicholas Rivers. 2015. "British Columbia's Revenue-Neutral Carbon Tax: A Review of the Latest 'Grand Experiment' in Environmental Policy." Energy Policy 86 (November): 674–83. https://doi.org/10.1016/J.ENPOL.2015.08.011; Ekins, Paul, and Stefan Speck, eds. 2011. Environmental Tax Reform (ETR): A Policy for Green Growth. Oxford Scholarship Online. https://doi.org/10.1093 /acprof:oso/9780199584505.001.0001.

[12] The ETS covers power and large industrial installations.

[13] It covers emissions from transport, agriculture, buildings, waste and smaller industries.

[14] Both the ETS and the ESD are under review to make them compatible with 'Fit for 55' ambitions.

[15] Direct fossil fuel subsidies as presented in the EC Fifth report on the state of the energy union (see Study on energy costs, taxes and the impact of government interventions on investments https://ec.europa.eu/energy/studies_main/final_studies/study-energy-costs-taxes-and-impact-government-interventions-investments_en). The value would be much larger if a wider set of tax expenditures are considered, which only France comprehensively does.

[16] EUR 10 bn under NextGenerationEU and EUR 7.5 bn under MFF 2021–27. The Just Transition Fund Regulation requires that the plans for just transition (Territorial Just Transition Plans) be coherent with the objectives and investment needs identified in NECPs. The approval of Territorial Just Transition Plans by the Commission will unlock dedicated financing not only from the Just Transition Fund but also from the dedicated just transition scheme under InvestEU and the EIB public sector loan facility (the two other pillars of the Just Transition Mechanism).

Chapter 2

# Carbon Taxes: Lessons and Implications for the four countries in focus: Bulgaria, Croatia, Poland and Romania

# Key lessons from experience with carbon taxes

**Carbon taxes support a green transition through changes in relative prices that provide the right price incentives for investment and a shift to cleaner technologies.** They help to raise the price of fossil fuels, electricity and goods and services that are produced using carbon intensive products compared with those which have a lower carbon content. This change in relative prices incentivizes the private sector to undertake green investment, enables a shift to cleaner technologies and incentivizes energy conservation. In addition, carbon taxes raise government revenues that could be recycled to offset the negative impacts of higher taxes on growth, income, and employment. Carbon taxes also entail co-benefits such as better health outcomes on account of lower air pollution as well as reduced traffic congestion.

**Carbon prices are the most efficient way of reducing emissions and are an indispensable part of any climate mitigation strategy.** Carbon taxes enable environmental improvements at least cost. After the last recession, the European Commission (EC) and the Organization for Economic Co-operation and Development (OECD) found that environmental taxes can raise additional revenue at lower cost than some of the more traditional broad-based taxes (European Commission 2013; OECD 2010, 2018). A recent seminal article confirms empirically that carbon taxes in Europe did not reduce output and employment and may have increased both (Metcalf and Stock, 2020). Other fiscal measures like feebates, subsidies to renewables and other green spending and green public investment, while helpful, do not necessarily discourage emissions. They are also less effective and efficient as they cover a narrower set of activities. In addition, carbon taxes can potentially promote innovation in clean technologies and energy efficiency. While imposing carbon taxes on emissions by each firm and household would be ideal (in terms of the tax base), it would be administratively complex and unaffordable. Therefore, carbon taxes are typically integrated as a surcharge on fuel excise duties and are based on the emission factors for fossil fuels. Carbon taxes apply to motor fuels, households, farmers and domestic business. Exemptions and special arrangements are frequently in place for energy-intensive industries. Carbon tax rates differ considerably by country, from EUR 9 per ton of $CO_2$ in Latvia to about EUR 108 in Sweden.

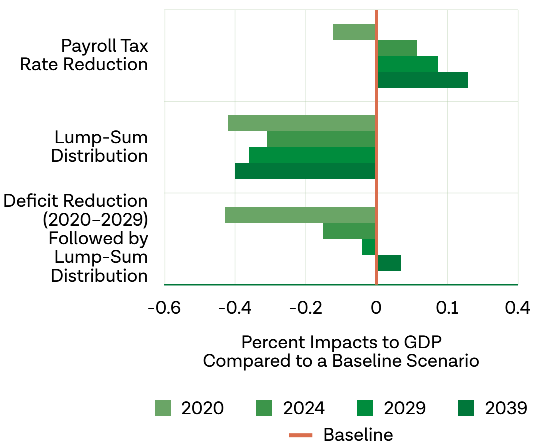
**As decarbonization proceeds, the tax base for carbon taxes will gradually be eroded.** Experience from Nordic countries shows, that in the longer run, a carbon tax, even if indexed to inflation, will not yield the same amount of revenues as taxes on income, from which revenues keep pace with GDP. The decarbonization of the economy will over time depress carbon tax revenues, subject to the magnitude of scheduled tax rate increases. This will require adjustments on the part of governments subject to specific country circumstances.

**Carbon taxes have been in place in European countries for several years.** A first generation of carbon taxes resulted from unilateral commitments under the 1988 Toronto declaration by Nordic countries (Finland, Sweden, Norway, Denmark). It coincided with domestic policies to lower payroll taxes with the aim to improve economic performance. Carbon taxes were part of wider tax reforms that maintained revenue neutrality, with adjustment of preexisting energy taxes (Larsen, 2002). A second generation of carbon taxes, enacted around 2000 in Slovenia, Estonia, and Latvia, reflected, besides the need to curb $CO_2$ emissions, a desire to prepare for membership of the European Union. In anticipation of the Commission's proposed carbon tax, carbon emissions were included in the preexisting schemes for taxation of air pollution, though with diminutive rates. A third generation of carbon taxes, enacted in countries with budgetary challenges (Ireland, Portugal, France) from around 2010, reflected climate policy ambitions as well as interest in broadening governments' tax bases beyond traditional revenue sources. The participation of green parties in government (Ireland) or competition over green voters (Portugal, France) partly conditioned these taxes, seen as more legitimate than other revenue sources.

## **LESSON 1:** Carbon taxes can be economically neutral and often beneficial provided revenues are recycled to reduce other more distortive taxes and/or to make compensatory transfers.

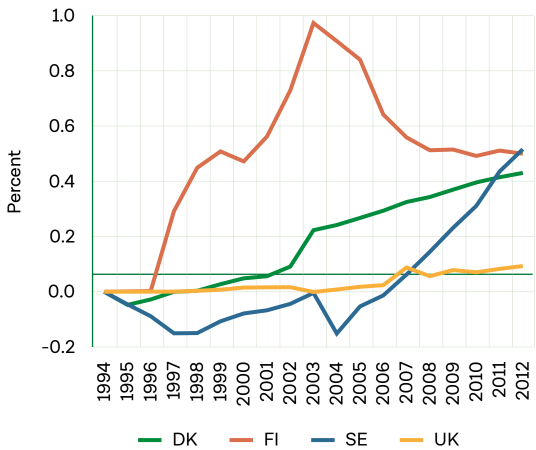
**The economic impact of carbon taxes depends on the magnitude and design of the tax and more importantly, on the use of carbon revenues.** Typically, revenue recycling measures that offset other taxes in the economy have yielded a net increase in GDP compared to the baseline. Figure 2.1 illustrates the impact on the US GDP with carbon tax revenues recycled into payroll tax reduction, lumpsum transfers and deficit reduction. Simulations[1] show that payroll tax reduction resulted in the most beneficial scenario in terms of the economic impact of carbon taxes. The experience of some European countries presents similar results, whereby the introduction of revenue neutral carbon taxes had a net positive impact on GDP (Figure 2.2). In Sweden, the effects took slightly longer to come through, as the increase in household electricity taxes depressed real incomes in the short run. Finland experienced a short-term boost to GDP because a reduction in the demand for imported fuel improved the country's trade balance (Barker et. al., 2009; Andersen, 2010). However, in the absence of revenue recycling, the impact of carbon taxes on GDP will likely be negative. Recycling carbon tax revenues, therefore, can be helpful to ensure political viability and reform sustainability. However, the choice of recycling options has varied and depends on country circumstances.

**Figure 2.1** Estimates of GDP impact in the US from a carbon tax (of $50/ton $CO_2$ in 2020 increasing by 2%) with different recycling options




*Source:* Prepared by CRS with data from John D. Diamond and George R. Zodrow, The Effects of Carbon Tax Policies on the U.S. Economy and the Welfare of Households, Columbia University, SIPA Center on Global Energy Policy, 2018

**Figure 2.2** Estimated change in GDP due to revenue-neutral carbon tax compared to business-as-usual

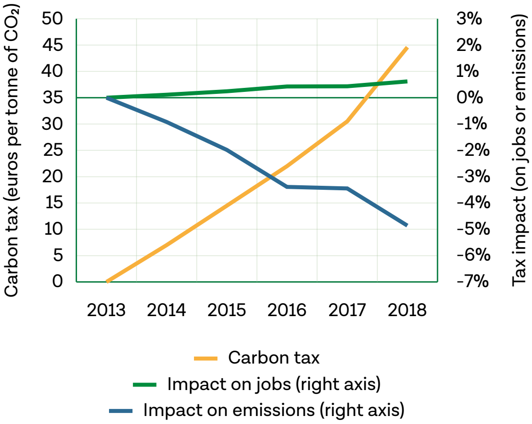



*Source:* Barker et al., 2009

## **LESSON 2:** Imposition of carbon taxes leads to a reduction in carbon emissions

**Multiple studies have estimated the emissions reduction that carbon taxes can achieve.** The size of this reduction is dependent both on the tax rates imposed (how they are applied to the various fuels and fuel user groups, how easy it is for fuel users to substitute between the various fuel types and non-fuel inputs) and the scale of the secondary effects from resulting changes in economic activity. A recent ex-post study of the carbon tax in France based on panel-data of 8,000 manufacturing firms comes to comparable findings (Figure 2.3). The carbon tax rate was gradually increased from EUR 7 to EUR 44 per ton of $CO_2$ between

**Figure 2.3** France — Estimated impact of carbon tax on emissions and jobs in the manufacturing sector




*Source:* Dussaux, 2020

2014 – 2018. It led to a reduction in $CO_2$-emissions of about 5 percent for the manufacturing sector as a whole, compared to a business as usual scenario (Dussaux, 2020). Results at a firm level suggest that the energy price increase due to the carbon tax resulted in a decline in energy use with an elasticity of 0.6 and a decline in carbon emissions with an elasticity of 0.9. The increase in total energy costs varied by industrial sector, but rarely exceed more than 5 percent. The carbon tax did not reduce overall employment, though a reallocation of jobs from energy-intensive to energy-efficient industries could be observed. Moreover, small firms did not reduce employment in response to the energy price increase. In France, electricity is mostly non-fossil (nuclear), offering a convenient route to substitution of conventional energy fuels.

## **LESSON 3:** Competitiveness concerns can be addressed by reinforcing revenue neutrality.

**Asymmetric climate policies among countries raises the issue of international price competitiveness which can be addressed by recycling revenues.** Countries facing carbon taxes experience cost increases and their transition towards a low-carbon production structure is potentially costly in the short run in terms of market shares (Gonne, 2016). However, these concerns can be mitigated by recalibrating the tax structure to combine carbon tax increases with a lowering of other taxes. The literature on taxation points to the importance of revenue neutrality, with carbon tax revenues recycled to reduce other more distortive taxes (Goulder 1996). The social contributions paid by employers have been identified as putting constraints on the use of labor and thus being a strong candidate for reduction when recycling revenues (Parry, 2003). Also, the part of carbon taxes paid by employees can be used to reduce their social contributions or income taxes. This mitigation approach was employed by the Nordic countries when introducing carbon taxes in the 1990s. In contrast, Ireland used carbon tax revenues to avoid an increase of income taxes (Convery et al., 2013). Also, Portugal's Green Tax Commission had recommended splitting revenues on reducing social contributions and income taxes, while providing investment tax credits to companies. The government in contrast used the proceeds entirely for lowering income taxes (in an election year), and then to direct them to the general budget — though still earmarking 30 percent for forest and environmental funds and support to fisheries and agriculture. Pereira (2016) shows that in Portugal, claiming revenues for the general budget negatively impacted employment and GDP, causing public debt to increase in the long run. A more recent study on Portugal finds that recycling revenues for reducing employers social contributions yields a weak double dividend and is preferable to a lump-sum compensation (Rodriguez, Robaina and Teotonio, 2019). These findings are in line with the modelling on the Irish carbon tax by Tol (2008).

**Where labor and payroll taxes are lowered with revenues from taxes on carbon and energy, incentives are provided to use more labor, while gradually decarbonizing.** Nobel prize recipient William Nordhaus had pointed out that 'full revenue recycling can make the tail of the dog (of climate policy) begin to wag'. Where carbon taxes are offset through a lowering of other taxes, notably payroll taxes, labor-intensive businesses benefit, which helps create employment and new job opportunities. As the four EU countries in focus have relatively high social contributions from both employers and employees (Eurostat, 2020), an approach targeting these contributions would have merit.

**Overall, using carbon tax revenues to reduce labor taxes is the focus of a widely agreed recommendation in most of the climate-fiscal literature.** There is momentum for shifting tax burdens from labor to emissions. The benefits of this particular policy mix have been found to hold across most countries (e.g., see analysis for 75 countries in Schoder 2021 or IMF Fiscal Monitor 2019).The focus on labor taxation is also justified by the importance of that tax type in the EU, its relevance for unemployment after COVID-19, and its potential for achieving a double dividend and just transition. Nevertheless, the recycling options ultimately adopted by countries will depend on their specific circumstances.

**However, it is challenging to introduce carbon taxes on energy and capital intensive industries.** These industries (like iron and steel, cement, and chemicals) are not labor intensive and do not benefit from the shift in labor taxes. Schemes that recycle some revenues for providing technical support and advice to energy intensive industries have proved successful, such as the Carbon Trust Fund in UK and Denmark's $CO_2$ industry compensation scheme (1996–2001). Some countries allow energy-intensive industries to benefit from the minimum rates of the Energy Taxation Directive, when the carbon tax burden exceeds a certain threshold of value added or output, which effectively provides an exemption to a small number of highly energy-intensive firms.[2] A complementary approach in Denmark (from 2008) has been to tax industrial $CO_2$-emissions only at the margin, exempting emissions below a certain threshold according to historical emissions. However, these approaches effectively shift the emissions reduction burden to other sectors in the economy.[3] To support the transition of energy intensive industries to a low carbon economy, a carbon tax rate reduction, that is gradually diminished over a period of up to ten years would be legally acceptable under EU state aid rules. In addition, the European Parliament has adopted a resolution backing the introduction of a Carbon Border Adjustment Mechanism (CBAM) no later than 2023 (See Box 2.1).

### Box 2.1 Carbon Border Adjustment Mechanism

The Carbon Border Adjustment Mechanism (CBAM) puts a price on the import of certain products into the EU to reduce the risk of carbon leakage — moving of carbon intensive production to countries outside the EU. This will support a global reduction in emissions while being compatible with World Trade Organization rules. The European Commission adopted the proposal for the CBAM on July 14, 2021.

The CBAM will work by requiring EU importers to buy carbon certificates corresponding to the carbon price that would have been paid if they had produced the goods domestically. The carbon certificate price will be calculated as a weekly average auction price of EU ETS allowances expressed in EUR/tonne of emitted $CO_2$. Alternatively, if a non-EU producer provides proof of payment of a carbon price corresponding to the carbon emitted in the production of the imported goods, the corresponding cost will be fully deductible for the EU importer. Thus, the CBAM acts as an incentive for non-EU countries to green their production processes.

The CBAM will be phased in gradually and will become fully operational in 2026. Initially, it will apply only to goods with a high risk of carbon leakage: cement, iron and steel, aluminum, fertilizers, and electricity. Starting from 2023, EU importers of these products will be required to report the emissions embedded in the products but no financial payments will be needed. When the system becomes fully operational in 2026, EU importers will need to declare embedded emissions in annual imports (of specified products) in the preceding year and provde the corresponding amount of CBAM certificates. As the system matures, the Commission will assess and decide if more products and services need to be included under the CBAM.

**European countries with successful schemes of carbon taxes have addressed political economy issues through dialogue.** Typically, these governments have coordinated and negotiated policies with peak level interest organizations (Andersen, 2019). In Nordic countries the main interests of employers and employees are organized with each having a single, united national umbrella organization that can speak to the government on their behalf. This set-up implies that once a government decides to opt for a policy (say a carbon tax), it will seek a dialogue with the main interest organizations, allowing them to voice their concerns. Through dialogue they find ways to implement the policy while minimizing disruptions and offering compensation to the most affected. Comparable patterns of decision-making were observed when Slovenia, Ireland and Portugal prepared their carbon taxes. In the four EU countries in focus, interest organizations are far more divided and are weaker in terms of resources. They also resort to either covert deals or ad-hoc protests, as there is limited precedent for governments to engage closely with interest organizations in a formalized way. Some form of a dialogue will certainly help build consensus on carbon taxes.

## LESSON 4: Distributional concerns regarding carbon taxes can be addressed through compensation measures.

**Distributional concerns of imposing carbon taxes are common and need to be addressed with proactive policy measures to minimize impacts on poorer households.** Overall, value-added-tax (VAT) is more regressive than environmentally-related taxes. Studies have found that taxes related to motor fuels and vehicles are in fact progressive, as high-salary earners tend to drive in relatively more expensive and fuel-consuming vehicles (Kosonen, 2012). However, taxes on heating fuels and end-use of electricity could potentially be regressive. Similarly, families dependent on coal mines will be disproportionately impacted in the decarbonization process. To ensure a just transition, it will be critical to compensate those who are disproportionately affected and those who are economically vulnerable. Proactively addressing distributional concerns is critical for ensuring the sustainability of the carbon tax reform.

**Lump sum transfers can be used to compensate those that are adversely affected by the carbon tax, but a challenge is to calibrate transfers to needs.** An OECD workshop of fiscal experts concluded in favor of providing lump-sum payments in terms of a green cheque ex-post, rather than to design reduced tax rates ex-ante (de Kam, 2002). The drawbacks of ex-ante mitigation (i.e. reduced tax rates for basic consumption) include higher administrative costs and compliance issues with benefits inadvertently also provided to high-income groups. A green cheque is a tax credit that is paid out by the tax authorities as a transfer, e.g. as in Denmark in connection with the annual income declaration, providing support to pensioners, unemployed and young people. A recent analysis considers a range of revenue recycling mechanisms for increasing Ireland's carbon tax to EUR 80 per ton by 2030 (de Bruin, Monaghan and Yakut, 2019). The study acknowledges that by recycling revenues to reduce income taxes, some low-income groups not on the labor market will be negatively affected. Moreover, as rural households have higher costs for transport than urban households, they will be disproportionally affected by the carbon tax increase on motor fuels. The challenge is to differentiate revenue recycling mechanisms for households accordingly. In British Columbia, Canada, where carbon taxation has been in place since 2008, with revenues being used to reduce other taxes, rural households have, following protests, been receiving a lump-sum compensation, corresponding to 6–7 percent of revenues, under the 'Northern and Rural Homeowner Benefit Program' to make up for their colder climate and longer distances.

### **LESSON 5:** It is beneficial for countries to align the tax burden in all sectors of the economy.

**It is useful to align the tax burden in ETS and non-ETS sectors.** With the power sector and large industrial installations covered by the EU's ETS for carbon allowances, the scope for carbon taxes concerns conventionally the non-ETS emissions from motor fuels, the residential sector (buildings) and smaller businesses. The non-ETS sectors are currently subject to various taxes on energy use, which traditionally have been much higher on motor fuels than on fuels used for business and heating purposes. With relatively low ETS prices (pre-pandemic) and varied fuel taxes at the national level, small and large industries were impacted differently by carbon prices, some in a more advantageous position than others. In addition, under the EU ETS, there are free allowances that have been granted to large industrial installations. Profits from over-allocation of free emission allowances are estimated at EUR 1.6 billion during 2008–19.[4] Therefore, it will be appropriate to align the tax burden in the ETS and non-ETS sectors. In addition, a minimum $CO_2$ tax should apply to emissions for which ETS allowances are grandfathered. The UK introduced a carbon price floor (£18/t$CO_2$), thus establishing a minimum price of ETS emissions, to provide certainty to investors in energy markets. Carbon price floors have been considered by governments in France and Germany, too.

**More recently, the price of ETS allowances has firmed up.** It increased to about EUR 90 per ton $CO_2$ (by mid-February 2022), which is significantly higher than the prices experienced pre-COVID-19 (ranged from EUR 10–25 per ton $CO_2$ during 2018–19). The tighter market for ETS allowances is due to the new market stability reserve introduced by the EU, whereby the large pool of excess allowances in the carbon market reduces. The significant ETS allowance price increase will have implications for the costs of electricity and, in turn, for the consumers, both households and businesses — especially so in energy systems with high shares of fossil fuels.

## Implications for countries of focus — Bulgaria, Croatia, Poland and Romania

**The countries of focus in this report do not have significant levies on $CO_2$ emissions in the non-ETS sectors.** Poland has a functioning levy on $CO_2$ emissions as part of its scheme of air pollution charges. However, with a rate of 9 eurocents per ton of $CO_2$, it is among the lowest in the world and covers only 4 percent of emissions (Boulard and Mariani, 2021). Bulgaria's fee for greenhouse gas emissions licenses is raising an annual revenue of less than EUR 10,000 (Eurostat NTL). Croatia is reported to have taxed $CO_2$-emissions from non-ETS installations at a rate of EUR 15 per ton, but it was discontinued. Effectively, the four countries, including Romania, do not tax $CO_2$ emissions at substantive rates.

**They do, however, tax energy use.** Energy taxes account for 7.8 percent of total tax revenues in Bulgaria, followed by Romania at 7.1 percent, Poland at 6.8 percent and Croatia at 6.9 percent.[5] Only four countries in the EU rival these shares — Latvia, Slovenia, Greece and Estonia. As a share of GDP, energy taxes in the four countries range from 1.8–2.3 percent, only slightly above the EU27 average of 1.8 percent. Most of the revenues stem from motor fuel taxes, but some business uses of energy are taxed too. With the exception of Croatia, motor fuel taxes are close to the EU minimum and, apart from Romania, they have not kept pace with inflation, with tax rates effectively losing power, especially in Poland.

**For carbon tax revenue recycling, social security contributions seem to be a prime candidate and this is doable without compromising the financial sustainability of the system.** Personal income taxes constitute only a modest share of GDP of about 3.3–3.6 percent (5.3 percent in Poland) and well below the EU average of 9.8 percent. Social contributions, while contributing significantly with 28–40 percent of total taxes, remain below the EU GDP-related average of 12.2 percent (Bulgaria at 8.4 percent, Romania at 8.5 percent, Croatia at 11.9 percent) except for Poland, where it stands at 13.2 percent. In Poland and Croatia a greater share of social contributions are paid by households, whereas in Bulgaria and Romania employers account for a higher share (58 percent in Bulgaria and about two thirds in Romania). These circumstances suggest that recycling carbon tax revenues for a lowering of social security contributions (SSC) would be appropriate in the four EU countries. Revenue recycling implies that carbon tax revenues will replace a part of SSC contributions, so that there is no financial loss to the purposes for which SSC is levied. As carbon tax revenues are not likely to keep pace with GDP, there has to be some adjustment over time. In practice it probably implies that the reductions in SSC will level off over time, as societies decarbonize.

**Taking into account the UNFCCC principle of differentiated responsibilities, a suitable *introductory* carbon tax rate for *non-ETS sectors* in the four countries in focus would be in the range of EUR 10–15 per ton of $CO_2$.**[6] For determining the possible rates of carbon taxes and their integration in preexisting energy taxes, the level of GDP per capita as well as the national purchasing power parities need to be considered. According to Eurostat, Croatia, Poland and Romania are at a similar level of GDP per capita at PPS (purchasing power standards) of ~EUR 20,000–22,000 followed by Bulgaria at EUR 16,000. Latvia with its PPS-adjusted GDP per capita of about EUR 22,000 currently has a carbon tax rate of EUR 9, with a planned increase to EUR 15 in 2022.

**Some considerations are in order in the four countries while introducing carbon taxes in the range of EUR 10–15 per ton of $CO_2$ in the non-ETS sectors.** These include the following:

- These introductory rates can be expected to drive early emission abatement efforts but would need to be *introduced and gradually ramped up* to reflect the level of ambition required to deliver a fair share in the EU's overall 55 percent reduction commitment by 2030. The national energy and climate plans (cf. Regulation on the governance of the energy union and climate action; EU/2018/1999), once revised to the new EU reduction target, can provide a basis for fine-tuning carbon tax rates and their future trajectories to national climate objectives.
- While *parity between the price of ETS allowances and carbon taxes* will be efficient, too sudden an alignment could cause considerable disruptions since current ETS prices are close to EUR 90 per ton of $CO_2$ (as of mid-February 2022). Therefore, an alignment should be targeted, but only in the medium to long term.
- On *sectoral coverage of carbon taxes*, it would be appropriate to target emissions of non-ETS sectors and those of ETS installations for which allowances have been grandfathered. For the latter, countries could start with a reduced tax rate (EUR 1–2 per ton or 10% of the nominal rate) and over a period of ten years phase in the full rate — unless, meanwhile, full auctioning of allowances has been introduced. No EU Member States are currently levying a carbon tax on emissions for which allowances are grandfathered, and it may thus prove politically challenging. Nevertheless, the unfairness and inefficiency of taxing small emitters, while effectively exempting the largest polluters would trigger objections from a wide range of stakeholders. Therefore, a trajectory for alignment in prices ought to be part of any policy considerations.
- On *integrating carbon taxes with pre-existing energy taxes*, it is advisable to follow the path of the Nordic countries that gradually aligned the effective tax rates per giga joule (GJ) to the same level for fuels used for heating and business purposes. With the rather large discrepancies in the four countries, incrementally adding the carbon tax onto pre-existing energy taxes will reinforce these discrepancies. However, it will be difficult in the four countries to align tax rates at once and it will need to be done gradually over time.

- One aspect of fuel price discrepancies is the *diesel differential* — that motor fuel diesel is taxed at lower rates than petrol, when considering its energy content (the same applies to LPG, which is a motor fuel for millions of passenger cars in Poland and Bulgaria). One option is to integrate the carbon tax into the motor fuel tax by converting part of the energy tax on petrol into a carbon tax, while for diesel and LPG to add the carbon tax on top of the energy tax. This would help to narrow the differential. This approach is recommended for Croatia (where motor fuel taxes are already high), Romania (where tax rates have kept pace with inflation), and Bulgaria (considering not only its relatively lower level of GDP per capita, but also its highly skewed income distribution (Gini-index of 40 in 2019[7])). In Poland, where the tax on petrol has lost about 20 percent of its real value since entering the EU, it might be reasonable to add the carbon tax on top of the energy tax for petrol.
- For all four EU countries in focus, once the carbon tax is in place *no further reductions in energy taxation* of motor fuels is advisable in tandem with future increases in the carbon tax rate.
- Recycling is imperative to protect low income, vulnerable and affected groups. *How revenues will be recycled* will need to be adjusted to the specific circumstances of each country, considering the modalities of the tax system and the specific concerns on vulnerable households and businesses. It will require a combination of reductions in other taxes and targeted transfers to poor/vulnerable households, while maintaining revenue neutrality. Nevertheless, for macro-economic modelling of carbon tax impacts, choosing a proper revenue recycling baseline is key, as without any recycling approaches the economic impacts will likely become negative.

**The table below shows illustrative carbon tax rates for Romania.** Similar tables for the other three countries are presented in Annex 3. The carbon tax rates are converted into nominal tax rates per unit of fuel, according to the methodology of Andersen (2015). Adjustments of preexisting energy taxes are included only where these do not respect the minimum rates of the EU's Energy Tax Directive (e.g. Bulgaria's electricity tax).

**Table 2.1 Illustrative carbon tax rates for non-ETS sectors for Romania**

| ROMANIA | **Energy tax existing** €/energy unit | **Energy tax existing** €/Gigajoule(GJ) | **Adjusted energy tax rate** €/GJ | **Adjusted carbon tax** €15/t$CO_2$ in €/GJ | **Adjusted carbon tax** €15/t$CO_2$ in €/energy unit | **Revised tax rate, total** €/energy unit |
|---|---|---|---|---|---|---|
| **MOTOR FUELS** | | | | | | |
| Petrol | €373/hl | €11.66 | €10.62 | €1.04 | €33/hl | €373/hl |
| Diesel | €342/hl | €9.50 | €9.50 | €1.11 | €40/hl | €382/hl |
| LPG | €137/t | €5.41 | €5.41 | €0.95 | €24/t | €161/t |
| Natural gas | €2.78/GJ | €2.78 | €2.78 | €0.84 | €0.84/GJ | €3.62/GJ |
| **INDUSTRY** | | | | | | |
| Diesel | €342/hl | €9.50 | €9.50 | €1.11 | €40/hl | €382/hl |
| Kerosene | €476/hl | €14.70 | €14.70 | €1.12 | €35/hl | €511/hl |
| LPG | €137/t | €5.41 | €5.41 | €0.95 | €24/t | €161/t |
| Natural gas | €2.78/GJ | €2.78 | €2.78 | €0.84 | €0.84/GJ | €3.62/GJ |
| **BUSINESS HEATING** | | | | | | |
| Diesel | €342/hl | €11.20 | €11.20 | €1.11 | €40/hl | €382/hl |
| Heavy fuel oil | €16/t | €0.40 | €0.40 | €1.58 | €37/t | €53/t |
| Kerosene | €401/hl | €12.39 | €12.39 | €1.12 | €35/hl | €436/hl |
| LPG | €121/t | €4.79 | €4.79 | €0.95 | €24/t | €145/t |
| Natural gas | €0.18/GJ | €0.18 | €0.18 | €0.84 | €0.84/GJ | €1.02/GJ |
| Coal | €0.16/GJ | €0.16 | €0.16 | €1.43 | €1.43/GJ | €1.59/GJ |
| **HOUSEHOLDS HEATING** | | | | | | |
| Diesel | €342/hl | €11.20 | €11.20 | €1.11 | €40/hl | €382/hl |
| Heavy fuel oil | €16/t | €0.40 | €0.40 | €1.58 | €37/t | €53/t |
| Kerosene | €401/hl | €12.39 | €12.39 | €1.12 | €35/hl | €436/hl |
| LPG | €121/t | €4.79 | €4.79 | €0.95 | €24/t | €145/t |
| Natural gas | €0.34/GJ | €0.34 | €0.18 | €0.84 | €0.84/GJ | €1.02/GJ |
| Coal | €0.32/GJ | €0.32 | €0.32 | €1.43 | €1.43/GJ | €1.75/GJ |
| **ELECTRICITY** | | | | | | |
| Business | €0.53/MWh | €0.15 | €0.15 | ETS | ETS | €0.53/MWh |
| Households | €1.07/MWh | €0.30 | €0.30 | ETS | ETS | €1.07/MWh |

**Overall, past experience with carbon taxes in various countries demonstrates its effectiveness in reducing emissions and supporting the economy and its citizens by recycling revenues.** Several European countries have introduced carbon taxes in the past three decades with no negative impacts to their economies and significant environmental benefits. The four countries in focus can start with low carbon taxes and then increase the price of carbon gradually so as to give their economies time to adjust. They can simultaneously recycle carbon tax revenues so as to boost growth and ensure that the transition to net zero emissions is just.

# Notes

1 The analysis simulates the effects of various carbon taxes using the Diamond-Zodrow dynamic overlapping generations computable general equilibrium model under a variety of assumptions regarding tax rates and with three revenue-neutral uses for carbon tax revenue including: (i) Payroll Tax Reduction wherein all the revenues from the carbon tax is used to reduce the employee portion of the payroll tax; (ii) Equal Per-Household Rebates wherein all the revenue from the carbon tax is used to finance equal per-household rebates; and (iii) Debt Reduction wherein all revenue from the carbon tax is used to reduce the national debt for a period of 10 years and then used to finance equal per-household rebates.

2 An energy-intensive company as defined in Article 17 of Directive 2003/96/EC is an enterprise whose energy purchases represent at least 3% of the value of production or whose annual energy taxes represent more than 0.5% of value added.

3 The costs to these industries should not be overestimated. The most affected sector (prior to ETS) was iron and steel, featuring costs corresponding to up to 3 per cent of gross value added after behavioral changes.

4 Additional Profits of Sectors and Firms from the EU ETS 2008–19, CE Delft, May 2021; The Phantom Leakage, Carbon Market Watch, June 2021

5 These include taxes on the use of fossil fuels by motor vehicles and industries and for heating and electricity.

6 It refers to the sectors not covered by the EU ETS in 2021.

7 Eurostat indicator ilc_di12, last accessed on September 29th, 2021.

Chapter 3

# Impact assessment for carbon tax reforms in the four countries of focus — an illustrative example

**This section presents the results of a modeling exercise using some of the insights from the previous section.** It assesses the impact of raising carbon prices in the countries of focus in this report — Bulgaria, Croatia, Poland and Romania. This section presents results using the Carbon Pricing Assessment Tool (CPAT) and the Multi Region Input Output (MRIO) model.[1] It illustrates the impact of raising carbon prices on a set of economic, social and environmental indicators like emissions, revenues, GDP, employment, air pollution, transport and consumption.

**These results are for illustrative purposes only.** They are not intended to substitute for more detailed and comprehensive economy-wide impact assessments using environmental CGE models (that capture the changes in factors of production, industry output, consumer demand, trade, private consumption, public consumption and other macroeconomic variables resulting from environmental policy changes). Instead, the model provides first-order estimates of carbon tax reforms based on reduced-form approximation of effects. It gives 'conversation-starter' estimates that are 'approximately' right, prior to potential deeper analysis using other, more complicated and calibrated models (e.g. CGE models, detailed micro-simulation models for distributional/sectoral analysis). The results below provide an initial assessment of the marginal effects of carbon tax reforms across a range of metrics of interest, prior to deeper analysis at the policy appraisal stage.

**At its core, the CPAT is a reduced form model based on price and income elasticities.**[2] It models the change in energy consumption based on energy prices (carbon taxes) and changes in real GDP. The altered energy consumption mix provides the change in GHG emissions. The net fiscal revenues are computed based on the carbon tax rate and base, overall GDP growth and revenue recycling measures that reduce other taxes. The model takes existing projections of GDP and adjusts growth forecasts endogenously through fiscal multipliers based on a combination of the impact of an increase in carbon taxes and the effect of revenue recycling measures (e.g., through a decline in personal income taxes (PIT)). On the consumption side, the CPAT estimates the impact of higher carbon prices, accounting for both direct (fuel) and indirect (other goods and services) effects, using a combination of household budget surveys and input output tables. The negative consumption effects and the positive compensation effects are expressed as a share of pre-reform disposable income. The CPAT also models the co-benefits arising from reduced GHG emissions like the impact of lower air pollution on mortality and disability adjusted life years (DALYS). This is done through reduced-form approximations that are used to estimate emissions, concentration of pollutants and health effects. The CPAT also illustrates the impact of fuel prices on externalities from driving (like traffic congestion) using price elasticities (Annex 4).

**Higher carbon taxes imply changes in the energy consumption pattern with a shift needed from higher priced polluting sources to lower priced greener sources.** The ability of countries to make this transition varies and includes both technical and political economy considerations. The technical considerations are accounted for in the CPAT through the power sector module which has two parts. The first part of this module uses marginal increases in fuel prices and price elasticities to determine the share of each generation type. It accounts for only the marginal changes. The second part models the capacity of different generation types, with capacity expanding to meet desired power demand. Investment is a function of levelized cost, with a system penalty for the cost of integrating high levels of renewable penetration, implying that the model can limit the share of renewables. Transmission losses are modeled as a fixed quantity of total generation. This part of the power sector module essentially allows for changing the stock of assets in the power sector (investment and retirement).

**The impact of higher carbon prices on employment is modeled using the price-dynamic MRIO augmented with employment statistics.** It is a partial equilibrium model that captures detailed short-run structural changes induced by the carbon tax such as sectoral interfuel substitution, efficiency gains, final demand adjustments and trade adjustments, accounting for sectoral and cross-border spill overs. The model is augmented with the latest available EU Labor Force Surveys to provide nationally and subnationally representative data for countries' workforce. The underlying model is a combination of the input-output price and quantity models based on the GTAP-MRIO database, combined with exogenously given price elasticities of production, trade, and final consumption. It estimates industry-specific employment effects derived from the first shock to the labor market, without considering any rigidities in the labor market.

# Assumptions

**Two scenarios of carbon price increases are assessed.**

- In Scenario 1 (Low-Ambition), ETS prices rise only marginally from their mid-2021 level of EUR 45 to EUR 50 in 2030, and countries introduce carbon taxes for the non-ETS sectors to gradually converge on the ETS price. The new carbon taxes start at EUR 15/$tCO_2$ (EUR 10/$tCO_2$ for Bulgaria) in 2022 rising to match the ETS price at EUR 50/$tCO_2$ in 2030.

- In Scenario 2 (Paris-Aligned), the carbon price path is consistent with achieving countries' decarbonization commitments (assuming that carbon prices are the only instrument to achieve the commitments). Here, an economy-wide carbon price of EUR 50/$tCO_2$ starts in 2022 and applies across the economy, implying a small rise in the ETS price from the mid-2021 level of EUR 45 but a substantial reform for non-ETS sectors to match the ETS price in 2022. For the subsequent years, the carbon price for the ETS and the carbon tax for non-ETS sectors rises to EUR 90/$tCO_2$ in 2030. In both scenarios, countries are assumed to completely phase out fossil fuel subsidies gradually over an eight-year transition period.

**The revenues from carbon taxation are recycled such that the reform is revenue neutral.** The classic design of environmental tax reforms seeks to shift the tax burden from 'goods' to 'bads'. Labor is a positive activity that should be encouraged, but European countries currently tax it highly, whereas emissions should be discouraged but are widely untaxed. Several European countries have thus undertaken fiscal shifts away from taxing labor towards taxing emissions, and the European Commission, the IMF, the World Bank and OECD recommend this reform design more generally. For assessing the impact on all parameters other than consumption-equity, net carbon tax revenues are assumed to be recycled to reduce personal income taxes (effects are modeled through multipliers and no distinction is made on PIT rates and/or standard deduction).[3] For assessing the consumption-equity impact, the model assumes that 100 percent of net revenues are recycled for social assistance. Transfers are provided to households through existing social assistance programs such that the top two deciles do not receive any benefits.

**In addition, assumptions or estimations on elasticities and multipliers are also used in the modeling exercise.** Income and price elasticities for fuel use, driving, consumption and others are obtained from literature review (country specific, where available). Fiscal multipliers (output and employment) used in the modelling exercise were estimated using data for the EU as a whole.

## Results

Based on the assumptions described above, the results of the modeling exercise are presented below.

### Prices

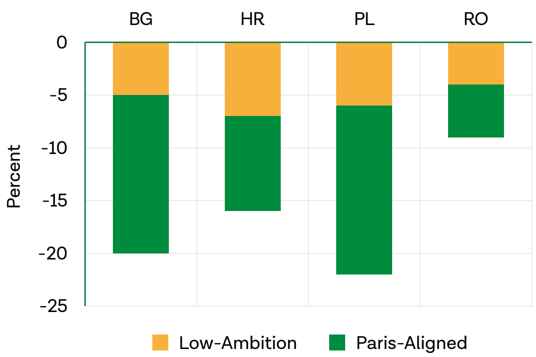
**Carbon pricing policies work by increasing the costs of fossil fuel-intensive sources of energy relative to low-carbon sources.** This increase is fueled by higher carbon taxes and lower fossil fuel subsidies. Some fuels, notably coal, are particularly carbon-intensive, and hence face higher charges relative to others like liquid fuels (gasoline, diesel, LPG and kerosene) or zero-carbon sources (electricity from solar and wind). As a result, the relative cost of coal increases substantially compared to other energy sources. However, the cost increase would be spaced out over time due to the gradual phase-in of the carbon price.

**The impact of policies on electricity prices is highly dependent on the energy mix, while the impact on gasoline and diesel prices is similar across countries.** For countries with a large share of coal in electricity generation (Poland, 73 percent and Bulgaria, 39 percent), the high carbon tax increases electricity prices. Except for Poland (which has relatively high diesel subsidies), the increase in gasoline and diesel prices across countries is close to 13–14 percent in the Low-Ambition scenario and 26–29 percent in the Paris-Aligned scenario by 2030.

### Emissions

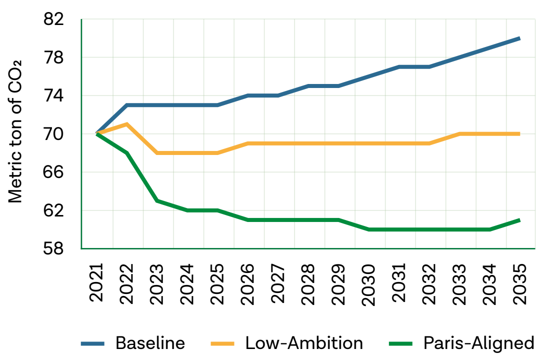
**Higher carbon prices result in a substitution away from fuel intensive to low carbon sources, resulting in reduced greenhouse gas (GHG) emissions.** Under the Low-Ambition scenario, a 5–7% reduction in emissions in 2025 is estimated relative to the baseline (Figure 3.1). Under the Paris-Aligned scenario, the emission reductions are more significant and more variable, with Bulgaria (-20%) and Poland (-22%) showing greater emissions reduction reflecting the larger share of coal in power generation in these countries compared to Romania (-9%) and Croatia (-16%).

**Figure 3.1** Emissions reductions induced by the carbon tax in the four countries




*Source:* Staff estimates

**Figure 3.2** Emissions trajectory with and without carbon tax — example of Romania



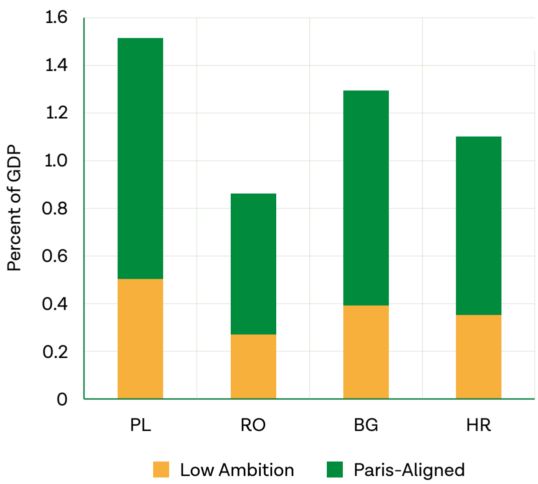

*Source:* Staff estimates

**Without a carbon tax in place, emissions would rise compared to today.** The baseline here assumes that, without new policy action, emissions in the four countries would be on an upward trajectory. The historic decline in emissions from the decay of heavy industries in the four countries has levelled off; emissions have started rising again. Forecasted economic growth, technology costs and pre-tax fuel costs drive emissions increases in the baseline. The baseline and policy predictions are also consistent with the European Commission's estimates for the four EU countries in focus, as expressed in the POLES model. The Low-Ambition carbon tax would achieve a stabilization of emissions at the current level — essentially allowing a decoupling of future growth this decade from the countries' carbon footprint (Figure 3.2). To reduce emissions in absolute terms, a higher carbon price level is needed.

## Revenues

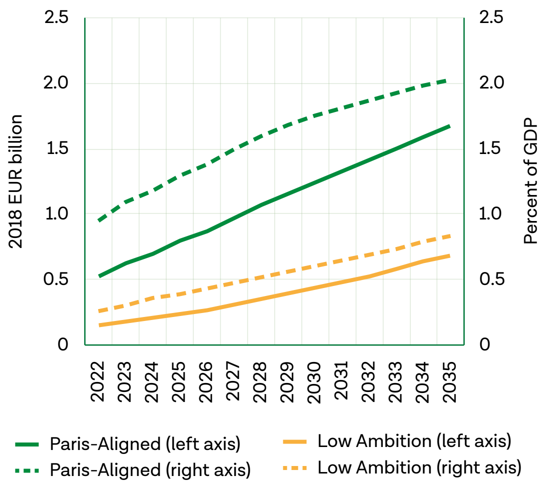
**The imposition of carbon taxes leads to additional revenue collections.** The Low-Ambition carbon tax would raise between a quarter to half a percent of GDP in revenues by 2030 while the Paris-Aligned scenario would yield more — between 0.9–1.5% of GDP. These quantifications are revenue gains after deducting ETS revenues. Finance ministries sometimes worry that a carbon tax may fail to provide a reliable revenue source since the objective of the tax is to reduce emissions and thus to erode its own tax base. However, in practice most countries have phased in carbon taxes gradually (like in the two scenarios modeled here) and then the rising rate compensates for a shrinking base. In the short- and medium-term, the rate effect typically dominates, meaning that for the normal planning horizon of fiscal policy, carbon taxes are a reliable revenue source. In the four countries analyzed here, these results hold, too. In addition, the fact that emissions in the four countries would be growing without policy change means that the revenue case for carbon taxation is particularly strong. In Bulgaria, for example, the revenues from the Paris-Aligned carbon tax would rise towards 2% of GDP in 2030 before gradually leveling off.

**Figure 3.3** Tax revenues from the carbon tax in non-ETS sectors and subsidy phase-out




*Source:* Staff estimates

**Figure 3.4** Time trajectory of the additional revenues — example of Bulgaria

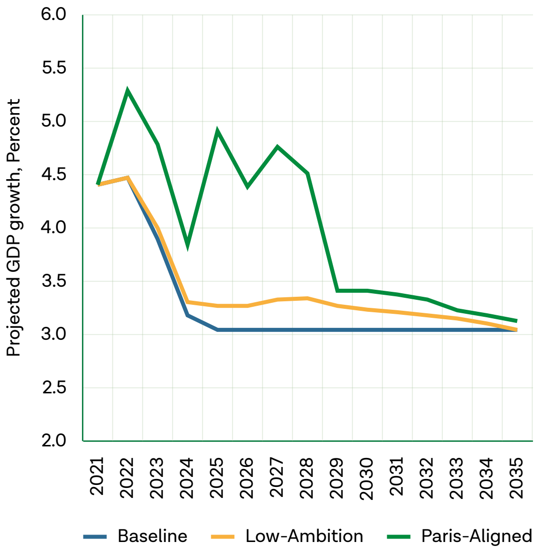



*Source:* Staff estimates

## Output

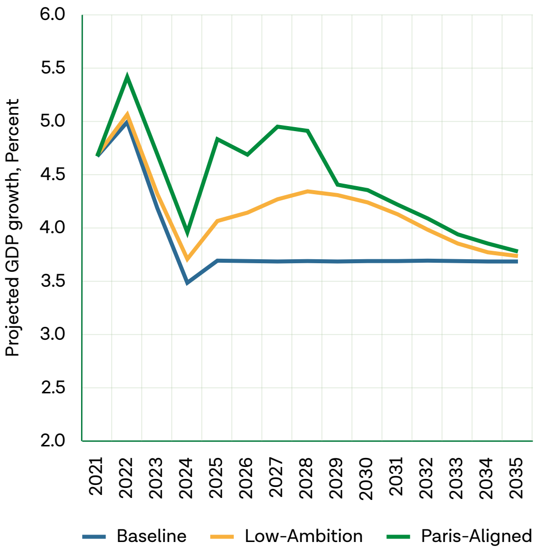
The economy wide effects depend on a multitude of factors including the magnitude and scope of the carbon tax, and most importantly, the use of the revenues. These effects are measured in terms of changes in GDP. The CPAT uses empirically estimated fiscal multipliers for EU27 countries (Box 3.1) to adjust baseline growth projections.[4] The trajectory of GDP growth shows an initial expansion followed by a leveling off in later years to the baseline scenario. The expansionary impact is primarily explained by the boost to aggregate demand as a result of lower personal income taxes in the first 7 – 8 years of reforms (Figures 3.5 and 3.6).

**Figure 3.5** GDP impact of carbon tax imposition and recycling of revenues to reduce PIT — Bulgaria




*Source:* Staff estimates

**Figure 3.6** GDP impact of carbon tax imposition and recycling of revenues to reduce PIT — Croatia

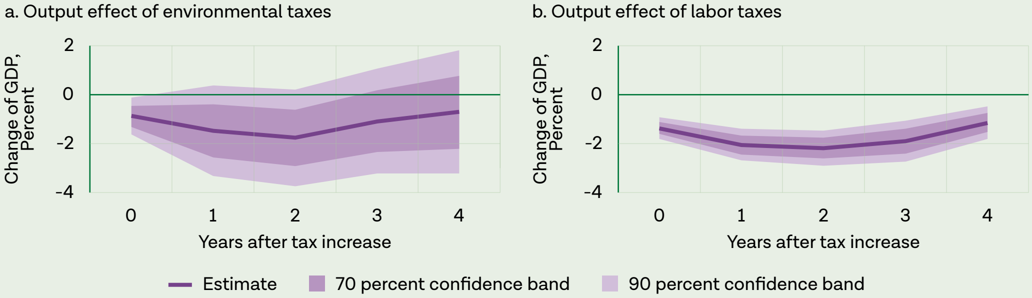



*Source:* Staff estimates

**Box 3.1** Estimation of output and employment multipliers for EU27 and a subset of 11 EU countries

**Environmental taxes have a lower fiscal multiplier than personal income taxes.** Raising 1% of GDP in additional tax revenues through environmental taxes in EU27 countries contracts output by 1% in the year of the reform, rising to 1.8% after two years, before the economy adjusts sufficiently for the effect to dissipate (based on data from 1993 – 2020). After four years, the fiscal multiplier for environmental taxes converges to almost zero. Furthermore, after the first year, the contractionary effect of environmental taxes on output is not statistically significant. By contrast, raising the same amount of revenue through additional PIT contracts output by 1.4% in the reform year, rising to 2.2% after two years (Figure B3.1.1). The results on both environmental and PIT are consistent with the literature (Metcalf & Stock 2020; Mertens & Ravn 2013, Dabla-Norris & Lima 2018). These results also hold true for Eastern European countries.

**Figure B3.1.1 Output effect from raising environmental and labor taxes by 1 percent of GDP in EU27 countries**

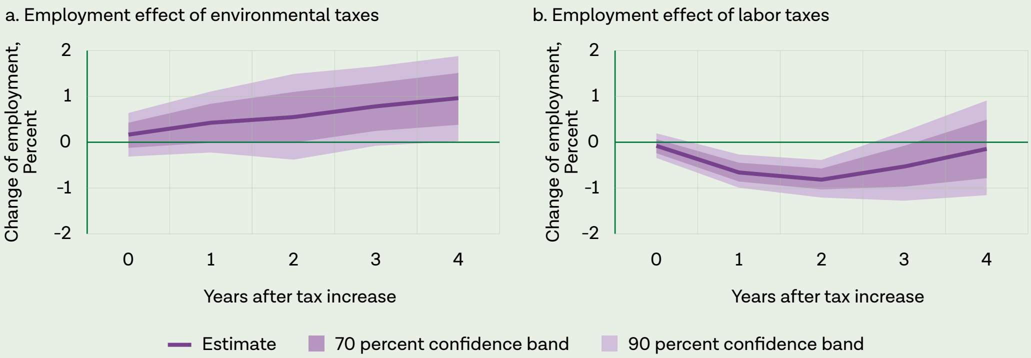



*Source:* Staff estimates

**Output effects of environmental taxes also depend on the business cycle.** As for any tax, it is also better to introduce environmental taxes in moments when the economy is expanding.

**Employment effects of environmental taxes are even more positive.** The economic literature suggests that low-carbon structural change and associated fiscal policies induce a slight shift towards more labor-intensive modes of production which increases overall employment per level of GDP (ILO, 2018; Hille and Möbius, 2019; ILO and IDB, 2020; Moszoro, 2021). In this context, a carbon tax has competing effects on economy-wide employment: to the limited extent that it contracts output, it can reduce employment, but the structural change it induces raises employment due to the change in labor intensity. The net effect can be seen in the fiscal multipliers by considering the employment effect of raising 1% of GDP in environmental taxes. For a smaller set of 11 EU countries (Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Lithuania, Latvia, Poland, Romania, Slovenia and Slovakia; Figure B3.1.2) and the EU overall, these effects are small but positive, even before considering how the revenues are recycled. If the revenues are then used to cut labor taxes, the positive impact on employment will be larger. While these results hold, on average, there will be heterogeneity among sub-regions, economic sectors and occupations.

**Figure B3.1.2 Employment effect from raising environmental and labor taxes by 1 percent of GDP in a subset of 11 EU countries**




*Source:* Staff estimates

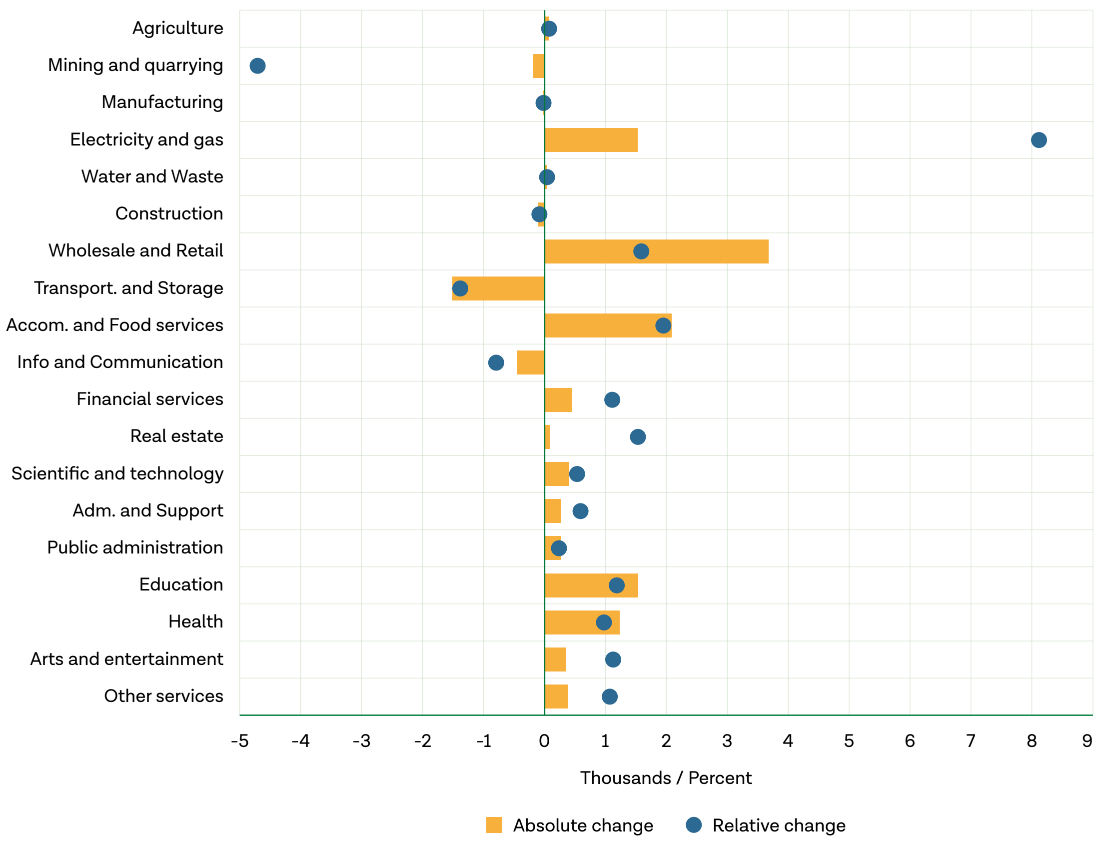
*Note:* The subset of 11 EU countries includes Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Lithuania, Latvia, Poland, Romania, Slovenia and Slovakia.

## Employment

**For three of the four countries modelled, the employment effects of the two carbon price scenarios have the potential to be net positive in aggregate but show large variations across regions and sectors.** Under both scenarios, Bulgaria, Croatia and Romania experience net job growth. Poland is an exception and is also likely to witness regional variations. Hosting the bulk of Poland's coal mining industry, Slaskie voivodeship could experience employment losses in the absence of support policies to enable the transition of workers and firms to greener industries.

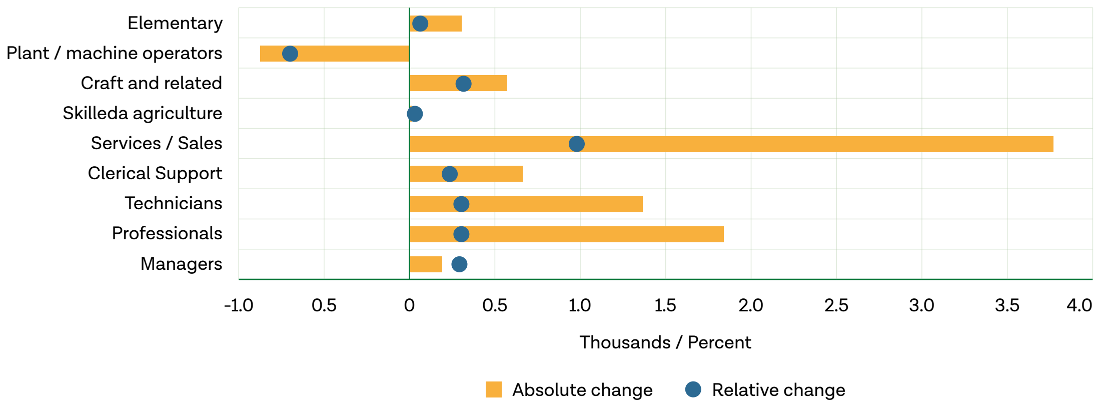
**Distribution impacts by sectors and occupation vary between countries given their specific economic structures.** Overall, sales and services occupations experience demand growth, followed by technicians and professionals, while plant and machine operators see a decline in demand. From a sectoral perspective, growth in labor demand is strongest in wholesale and retail, but also in manufacturing. The strongest losses of jobs are borne in Croatia in the transport sector, in Poland in the mining and electricity and gas sectors, in Bulgaria in the mining and transport sectors, and in Romania in the transport and construction sectors (Figure 3.7, 3.8). Most of these effects are explained by a combination of higher carbon prices and revenue recycling by lowering payroll taxes. The former induces a phasing out of coal mining activities while the latter gives a boost to aggregate demand with its concomitant effects.

**Figure 3.7** Change in labor demand by economic sector (Paris-Aligned scenario, Croatia)




*Source:* Bank staff

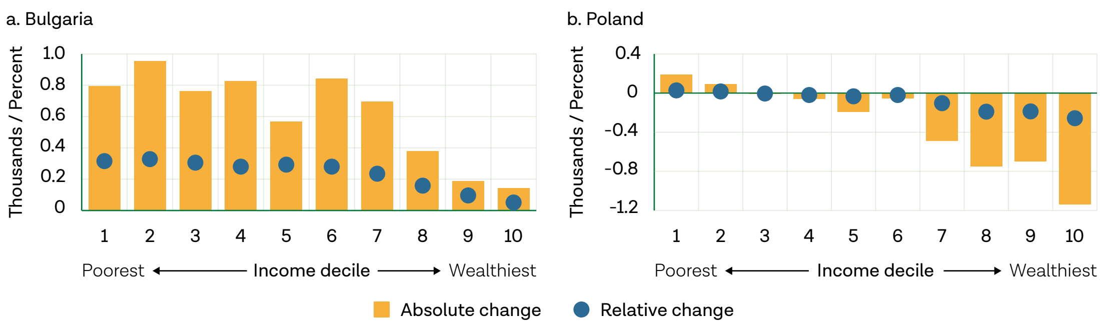
**Figure 3.8** Change in labor demand by profession (Paris-Aligned scenario, Croatia)




*Source:* Bank staff

**Lower-wage workers generally benefit more from the labor market shifts seen during the low-carbon transition.** The structural change from raising carbon taxation and reducing payroll taxes increases labor demand more in sectors that employ lower-wage workers (Figure 3.9). This finding has previously been shown for the United States (Goulder *et al.*, 2019) as well as all Latin American and Carribean countries (ILO and IDB, 2020). Similar effects are observed in the countries examined in this report. The distribution of jobs demand growth across the wage spectrum in Poland alludes to the fact that those sectors which are expected to experience job declines host relatively more higher-wage workers.

**Figure 3.9** Change in labor demand by wage group in the Low-Ambition scenario — examples of Bulgaria and Poland




*Source:* Bank staff

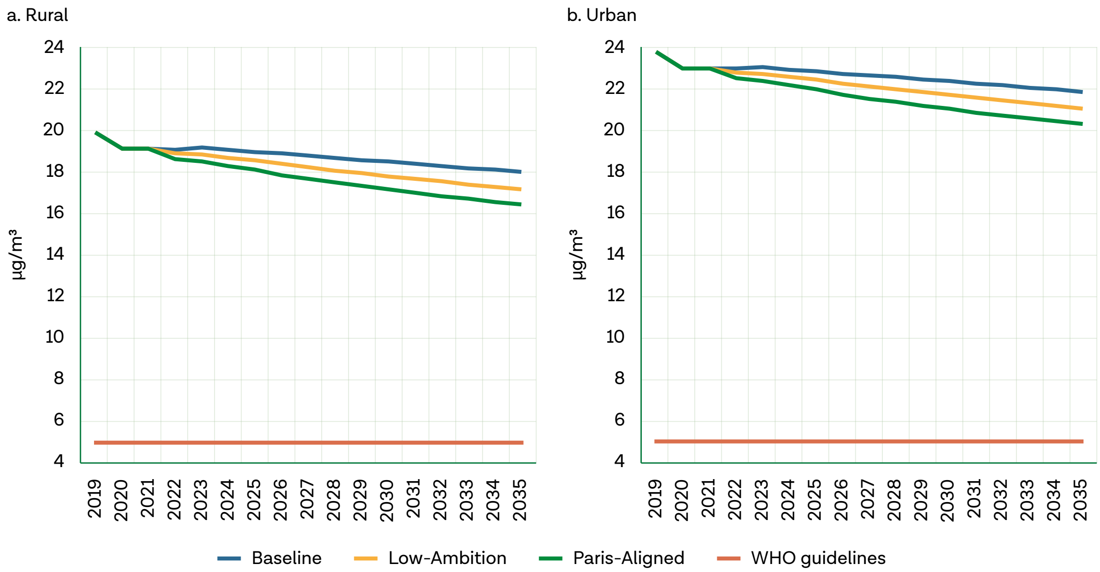
*Source:* Bank staff

## Air Pollution

**Since fuels such as coal emit not only carbon but also local air pollutants, carbon taxes contribute to cleaner air.** There is co-emission of GHGs and local pollutants when burning fossil fuels. Local pollutants, such as BC, OC, $NH_3$, $SO_2$ and NMVOC are responsible for the formation of fine particulate matter ($PM_{2.5}$) and ozone ($O_3$) pollution. The combustion of fuels is an important source of air pollution in all four EU countries. There is consensus in the academic literature that carbon taxation would reduce air pollution due to its aggregate impacts on fuel use (Markandya *et al.*, 2018; Vandyck *et al.*, 2018; Scovronick *et al.*, 2019; Weitzel, Saveyn and Vandyck, 2019; Rauner *et al.*, 2020).

**Increasing the price of carbon will reduce ambient air pollution in the four EU countries, contributing to better health outcomes.** In 2018, ambient $PM_{2.5}$ exposure contributed to 12,500 premature deaths in Bulgaria, 5,100 deaths in Croatia, 46,300 deaths in Poland and 25,000 deaths in Romania (EEA, 2018).[5] The concentration of fine particulate matter, which permeates the lungs and enters the bloodstream, is far above the WHO recommendation of 5 micrograms per cubic meter of surface air (µg $PM_{2.5}/m^3$) — the average Polish citizen is exposed to concentrations of 23 µg/$m^3$. The shift away from carbon-intensive fuels induced by carbon taxation would reduce this exposure, in both the rural and urban areas of the four countries. Yet, there remains a lot of air pollution and hence a need for additional policies and investments to combat air pollution in these countries (Figure 3.10).[6] The reduced air pollution would improve public health outcomes by reducing fatalities related to air pollution.

**Figure 3.10 Change in ambient air pollution — Poland**



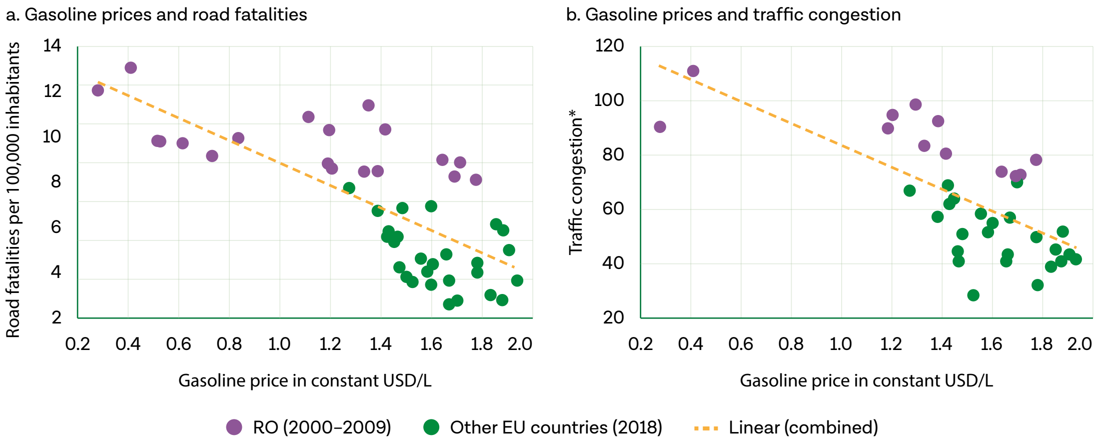

*Source:* Bank Staff

## Transport

**The transport sector in EU countries, which is highly dependent on cars, causes negative externalities such as road accidents and congestion.** Road accidents are among the key causes of premature deaths in the EU, particularly among young people. In 2019, 22,800 road traffic fatalities were recorded in the 27 EU member states (European Commission 2020). The rate of road traffic fatalities has plateaued, in some countries even declined due to stricter drunk drinking law, improved roads and greater use of seat belts. The urban traffic congestion problem has become ever more serious. A large majority of European citizens live in an urban environment, with over 60% living in urban areas of over 10,000 inhabitants. Congestion in the EU is often located in and around urban areas and costs nearly EUR 100 billion, or 1% of the EU's GDP, annually.[7] According to the 2020 traffic analysis report conducted by TomTom, many EU cities ranked among the most congested cities worldwide, such as Lodz (14th most congested city in the world), Bucharest (18th), Dublin (21st), Athens (36th), or Paris (42nd) (TomTom 2021).

**These problems have many causes, but one of the factors driving this is motor fuel prices, which don't reflect the broader negative implications of driving on society.** The relationships are visible already from raw-data plots, both across EU member countries and over time within countries (Figure 3.11).

**Figure 3.11 Raw-data relation between road fatalities and traffic congestion to motor fuel prices across space and time — example of EU27 in 2018 and Romania over last two decades**



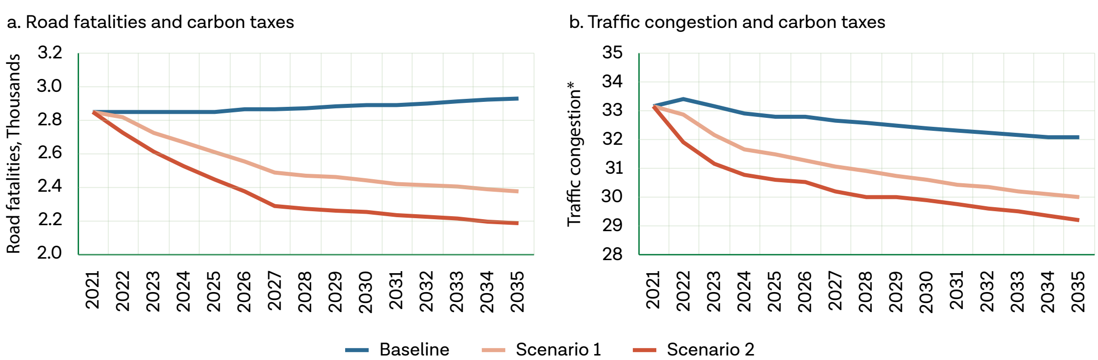

*Source:* World Bank Staff

*Note:* * Percent additional time duration of average car trip due to traffic congestion compared to duration under free-flowing traffic conditions.

**The relationships between motor fuel prices and road accidents becomes clearer after taking into account other determinants of traffic problems, including fixed effects, time tends and economic activity.** A series of empirical studies across and within countries finds that motor fuel prices have a measurable impact on vehicle kilometers driven, road congestion and road accidents.[8] Even though the social costs from traffic mostly call for sectoral policies, they are reduced by carbon charges, too. There is significant evidence that the price of motor fuels impacts the decisions of people to purchase vehicles (number, weight, etc.) and the frequency of using them. Driving styles also appear to become less aggressive as higher fuel prices raise the cost of accelerating vehicles abruptly. The relationships are especially visible when controlling for fixed factors, time trends, income, population size and other determinants of traffic problems.

**The carbon taxes would significantly contribute to wider efforts at reducing fatalities and slightly reduce congestion.** A 1 percent increase in gasoline prices in the EU, on average, leads to a 0.4 percent decrease in road fatalities and a 0.03 percent reduction in urban congestion.[9] Further analysis shows that road fatalities and congestion also fall with higher fuel prices in the countries analyzed and these results hold even when using alternative datasets or regression specifications (Figure 3.12).

**Figure 3.12 Change in road fatalities and traffic congestion due to carbon taxes — Poland**




*Source:* Bank Staff

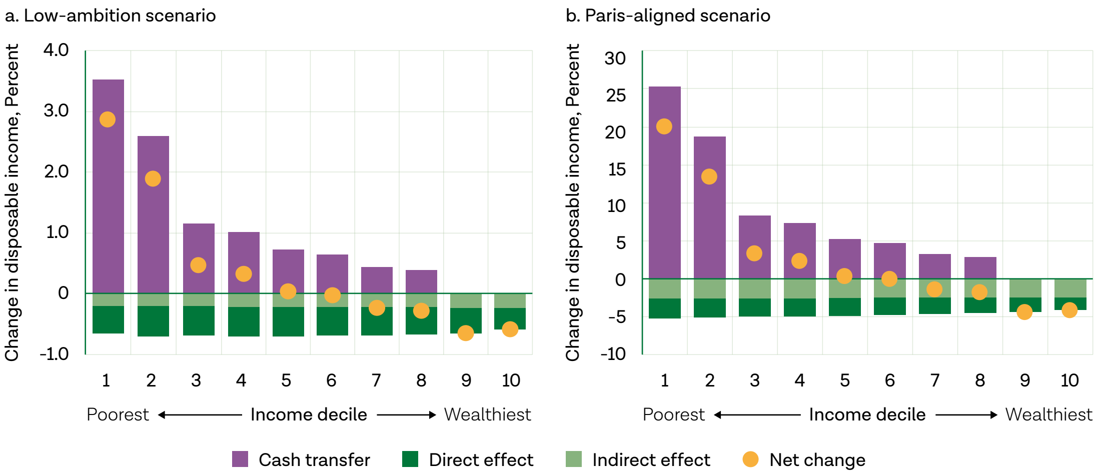
*Note:* *Percent additional time duration of average car trip due to traffic congestion compared to duration under free-flowing traffic conditions.

## Cost to Consumers

**Revenue recycling would help households cope with higher energy prices as a result of the carbon tax.** When the carbon tax is passed on to the consumers, considering only direct effects, lower income households are disproportionately impacted (Box 3.2). This is because a larger share of their income is used to pay for energy needs, such as electricity, gasoline, or home heating fuels. However, if both direct and indirect effects of an increase in carbon taxes are considered, the consumption effect is neutrally distributed across the population.[10] Using a combination of household consumption surveys and input-output tables, the impact of carbon price scenarios on consumption was assessed, with 100 percent of the net revenues recycled through the countries' social assistance systems among the bottom 80 percent of households.

**In all four countries, the net impact on equity becomes strongly progressive if revenues are recycled to scale up social assistance policies.** In the Low-Ambition scenario, the negative consumption effects are less than 1 percent while they go up to 5 percent in the Paris Aligned scenario (Figure 3.13). Overall, when revenues are recycled back to the bottom 80 percent of the income distribution, the bottom 40 percent of the population experience a net gain in disposable income while the income of the middle of the population remains unchanged. High-income groups experience a loss but it is a fraction of the gain accruing to the poorest.

**Figure 3.13** Distribution of consumption incidence from taxing carbon in the Low-Ambition and Paris-Aligned scenario and using revenues to scale up social security (2023, Poland)




*Source:* Bank Staff

### Box 3.2 Impact of carbon taxes on Polish households

**This box summarizes a background analysis that assesses which groups of households would be disproportionately affected by carbon taxes in Poland, and how carbon tax revenues can be used both to compensate households for the higher prices faced and to stimulate a labor supply response that can be growth enhancing.** The analysis is based on incorporating carbon taxation into a microsimulation framework that captures the distributional incidence of the fiscal system and the impacts of shifts in fiscal policy on labor market outcomes. Two policy scenarios were modelled: an upper-case scenario of EUR 45 per ton of carbon dioxide emissions in all sectors of the economy and a lower-case scenario of EUR 45 in ETS sectors and EUR 15 in non-ETS sectors. The results presented in this box focus on the upper-case scenario. Structural labor supply models were built to simulate labor supply responses to environmental tax reform, most notably personal income tax and social benefit changes, to offset the impact of the carbon tax on households. Further detail is included in Annex 5, which includes sensitivity checks to factors that are commonly found to influence the distributional impact of the reform.

**The carbon tax — without a broader fiscal policy shift — is strongly regressive in relative terms.** Figure B3.2.1a shows the impact of a EUR 45 carbon tax as a percent of disposable income, by income deciles, while Figure 3.2.1b shows the absolute impact on disposable income. Carbon tax (CT) as a share of income, declines monotonically across the income distribution — the carbon tax accounts for approximately 5 percent of the disposable incomes of households in the first decile of the income distribution compared to 2 percent for median households and 2 percent for the richest ten percent of households. While strongly regressive in relative terms, in absolute terms richer households are expected to face higher burdens due to higher spending. The share of the population at risk of poverty would be expected to increase by 10 percent or nearly 2 percentage points, from 19.9 to 21.8 percent (Table B.3.2.1).

### Figure B3.2.1 Upper-case scenario


*Notes:* CT — Carbon tax; CT+RF — Carbon tax and the 2022 tax reform;
CT + RF + MTB — Carbon tax, 2022 tax reform and the expansion of means tested benefits;
CT + RF + URR: Carbon tax, 2022 tax reform and a universal redistribution of revenues.

*Source:* Badiani-Magnusson, Goraus, Myck and Trzcinski (2022)

**Table B3.2.1 Share of the Population At Risk of Poverty**

| | EUR 4 Carbon Tax across ETS and non-ETS sectors | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Static effects | | | | Dynamic effects | | | |
| | CT | CT+RF | CT+RF+MTB | CT+RF+URR | CT | CT+RF | CT+RF+MTB | CT+RF+URR |
| **Baseline 19.9%** | 21.8% | 19.8% | 19.4% | 18% | 21.8% | 19.7% | 19.3% | 17.9% |

*Note:* AROP line set at 60 percent of equivalized household disposable income

**Incorporating broader fiscal reforms, through revenue recycling, can shift the distributional implications of the carbon tax reform from regressive to progressive.** However, labor tax reforms alone without targeting poorer households would be insufficient to offset carbon taxes for poorer households. The analysis used in this box is calibrated to labor tax reform elements considered under the 2022 tax reforms in Poland — a holistic labor tax reform that will expand the tax-free base for personal income taxes while raising labor taxes for richer households and shifting health insurance contribution exemptions. Carbon taxes together with a shift in personal income taxes along the lines of the 2022 tax reform (CT + RF in Figure B3.2.1), increases the relative progressivity of the system. Adding dynamic labor supply effects — wherein workers respond to the change in tax structure by moving into work — would raise disposable incomes further and has the greatest impact among bottom 40 percent of households that are more likely to include unemployed working age individuals. However, since labor market participation is limited among the poorest segments of society, reforming labor taxes alone may not be sufficient to reduce the poverty impacts of introducing the carbon tax.

**An increase in means-tested benefits shifts the needle for poorer households, but the population covered by means-tested benefits is more limited than those that are considered to be energy poor.** As such, a broader social assistance program or more targeted transfers could potentially be considered. The analysis models a 20 percent expansion of the means tested social assistance, family benefit and housing programs administered by social assistance centers — family allowances and supplements, temporary and permanent allowance, housing benefit, nursing allowance. Collectively, these programs cover 6 percent of the population compared to an estimated 16 percent of the population that live in energy poverty (IBS, 2018). While expanding means tested programs can reduce the poverty impacts of the carbon tax reform (scenarios CT + RF + MTB below), it cannot offset the carbon tax — poverty would remain 1.6 percentage points higher than the initial level. This is because gaps in the social assistance system imply that portions of poorer households would continue to see higher costs of living while not receiving offsetting gains in their incomes through transfers or reductions in labor taxes. Recycling the carbon tax revenues instead through more targeted transfers or a universal transfer (scenario CT + RF + UR) would reach more deeply into the pockets of poorer households and would bring poverty rates to below baseline levels.

**The nature of compensating reforms incorporated can substantially alter the distributional impacts.** This is particularly the case when one considers reforms that could elicit a higher elasticity of labor supply responses. In an aging society, such as Poland, a broad reform to personal income tax reforms may not generate compensating labor supply responses due to the demographic structure. Therefore, reforms that focus on employer social security contributions or allowances for workers may be more effective at stimulating growth enhancing labor supply responses.

**Overall, carbon taxation not only reduces emissions effectively, but can also create significant economic co-benefits.** The impact assessment of carbon taxes illustrates that countries can mitigate climate change while improving their economic development outcomes. It can help countries to reduce emissions while improving economic output, employment, and equity, if carbon taxes are supplemented by revenue recycling that addresses some of the key transition costs that will be faced by vulnerable groups. These reforms reduce not just global damages to the climate but also create local benefits such as reduced fatalities from air pollution and road accidents and less traffic congestion and pollution-related sickness. Many of these economic benefits are especially important in Eastern European countries.

# Notes

1 Methodological notes and detailed country-wise results are available upon request.

2 Elasticities based on a literature review.

3 PIT is used instead of SSCS because of the existing model set up.

4 Imported from World Economic Outlook, October 2020

5 https://www.eea.europa.eu/publications/air-quality-in-europe-2020-report

6 The projections include scheduled legislative changes for air pollution control technology and are based on IIASA GAINS emissions factors net of pollution control equipment. https://dare.iiasa.ac.at/87/

7 https://ec.europa.eu/transport/themes/urban/urban_mobility_en

8 Burke and Nishitateno 2015; Burke and Teame 2018; Ahangari et al. 2014; Chi et al. 2015; 2013; 2010; Sukhawathanakul et al. 2018; Burke and Teame 2018; Zhu et al. 2016; Hammoudeh, Yoon, and Kutan 2019; Naqvi, Quddus, and Enoch 2020; Safaei et al. 2021.

9 Measured by regressing road fatalities in the years 2008-2019 in 317 EU subregions and congestion measurements by TomTom in the years 2002-2020 for the largest 203 EU cities on local fuel prices and control variables.

10 A carbon tax directly raises households' costs of purchasing fuels and indirectly raises the costs of goods and services that use fuels as production inputs.

Chapter 4

# Fossil Fuel Subsidies

**Appropriate price incentives to encourage green investments by the private sector will require not only the imposition of carbon taxes but also the elimination of fossil fuel subsidies.** Fossil fuel subsidies are costly for the public budget and undermine the green transition. They not only reduce scarce public resources, but also distort energy prices, generate economic inefficiencies, and hamper the transition to a low-emission economy. Limited progress in reducing fossil fuel subsidies across the EU is costly and leads to the misalignment of government spending with green transition goals. Therefore, phasing them out is an important environmental fiscal reform that requires action under the Green Deal.

**While many countries have successfully introduced carbon taxes, the experience with reducing fossil fuel subsidies has been less encouraging.** A key part of the problem lies with the comprehensive quantification of fossil fuel subsidies. While direct subsidies provided through the budget are relatively easier to quantify, the quantification of fossil fuel subsidies provided through State Owned Enterprises (SOEs) and public finance institutions is trickier. There is limited transparency and information on the support provided to fossil fuels through the latter two channels. Beyond the identification, reduction of these subsidies is also a challenging task given the associated political economy factors. As a result, progress in this area has been limited. Nevertheless, galvanizing private sector investment will necessitate the exhaustive quantification and subsequent elimination of fossil fuel subsidies.

## Experience with the reduction of fossil fuel subsidies

**The most recent comprehensive study on fossil fuel subsidies in the EU prepared for the EC (Trinomics, 2020) concludes that little progress has been made in reducing these subsidies.** Despite political commitments to phase out fossil fuel subsidies, these estimates have remained at near EUR 50 billion since 2008, with more than one-third going to the energy sector. The subsidies are estimated to have more than doubled in Bulgaria and Poland since 2014. In the case of Poland, such subsidies seem to have supported ongoing investment of energy sector state-owned enterprises (engaged in fuel power generation, oil and gas production). Although the largest share of explicit and implicit subsidies has been estimated to go to the energy sector (36 percent of the 2018 total), transport, industry and agriculture are also receiving large fossil fuel subsidies. While European Green Deal commits EU member states to eliminating fossil fuel subsidies, plans for doing so in the four countries of focus must be based on a more complete assessment of the full range of subsidies.

**Several issues impede a comprehensive assessment of fossil fuel subsidies.** To begin with, there is no standard definition and methodology to measure subsidies and its estimation is complex and data intensive. As a result, there is lack of transparency on the overall size of subsidies in countries. In many countries, off-budget support to fossil fuels exceeds direct budget support. These off-budget sources include subsidies provided by SOEs and public finance institutions. Overall, until all subsidies are identified and measured, it will be difficult to eliminate them.

**Experience shows that increased transparency in the reporting of financial support to fossil fuels, analytical capacity to assess the costs and benefits of such subsidies, and the use of just transition schemes for affected workers and communities are critical elements of successful fossil fuel subsidy reforms.** Despite broad agreement that fossil fuel subsidies are inefficient and distortive, they have proved politically difficult to eliminate. The main problem that limits reform efforts is a lack of transparency on the total subsidization of fossil fuels. It complicates the policy discussion, decision-making and social support for the reform. Increased transparency through publicly disclosed annual reporting, which relies on a consistent methodology at the national and European level, could facilitate reforms. Countries in Europe that have made progress in reforming subsidies managed to increase transparency of reporting on investment and finance for fossil fuels by SOEs and government financial institutions, including through peer-reviews as part of the G20 process (Germany and Italy). The likelihood of reform is also increased by the availability and use of analytical tools to map out the objectives, cost-effectiveness, and long-term consequences of subsidy reforms. More advanced modeling tools also enable the assessment of policy interactions and complementarities. These tools could help with the prioritization and sequencing of government interventions and with proposing alternative policies with better economic, environmental, or distributional outcomes (OECD, 2020). Finally, moving away from fossil fuels has to be accompanied by targeted support to the poor and vulnerable families and workers employed in associated sectors. These could include cash transfers along with education and training, job-seeking support, business creation, and measures aimed at mitigating the impact of the transition on physical and mental health (ODI, 2017).

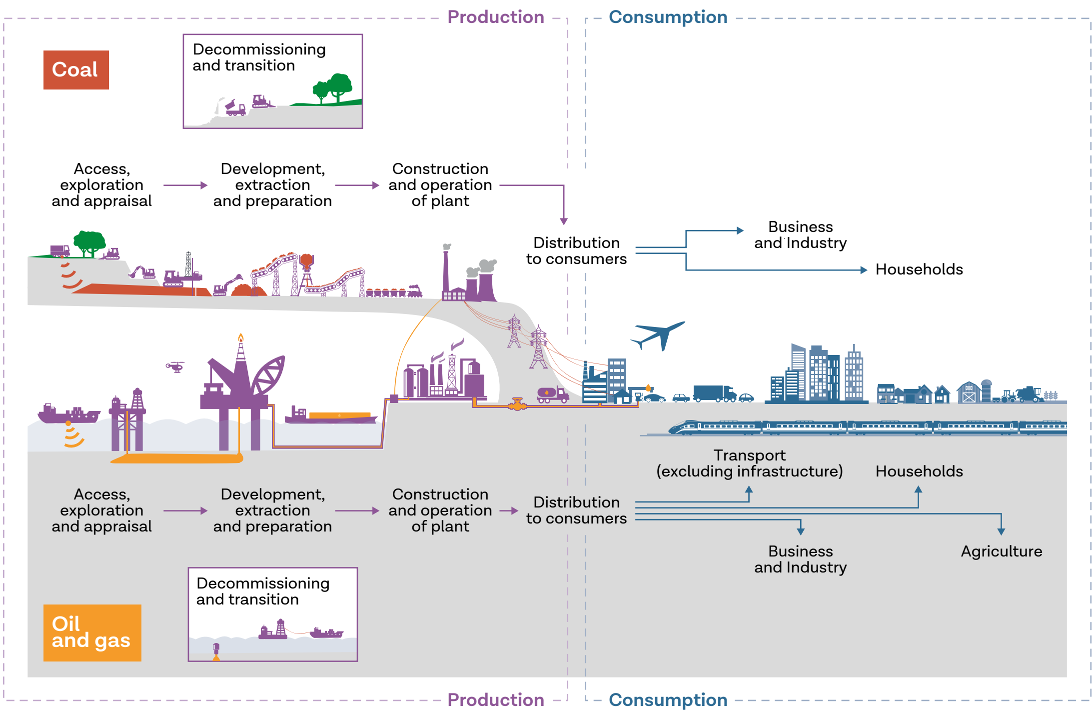
## Quantification of and options for the elimination of fossil fuel subsidies in the four EU countries in focus

**Estimating fossil fuel subsidies is a complex and data intensive process.** Governments must recognize that while some of the support and financing for fossil fuels comes through better-known channels such as subsidies in government budgets and tax exemptions or price support, subsidization also occurs through investments made by SOEs and by public finance institutions. In addition, if significant government support is provided to infrastructure that is mostly fossil fuel-based, in particular transport infrastructure, then that support is an indirect subsidy to fossil fuels. Moreover, the high levels of government support often provided to natural gas, whether for production (e.g., extraction and distribution) or for consumption (e.g., incentivizing households to move away from solid fuel heating) needs to be considered carefully since transition away from gas will be necessary in the longer term. While governments have been supporting the transition away from coal, they must make sure that the support provides benefits to workers and communities. They must also ensure that it does not prolong the lifetime of these assets, and that the distribution of the burden is equitable between private shareholders and other key parties.

**A full accounting of subsidization must consider each stage of production and consumption of coal, oil, and gas, as illustrated in Figure 4.1.** All these mechanisms that generate fossil fuel subsidies must be made much more transparent, scrutinized in line with climate targets and commitments, and eventually phased out. (See Box 4.1 for a description of the methodology applied.)

**The bottom-up, inventory methodology shows that fossil fuel subsidies, provided through fiscal support, public finance, and investment by SOEs in the four countries analyzed, ranges from 0.2 percent of GDP in Romania to 3.1 percent in Bulgaria (ODI, 2021).**[1] Although European governments have made commitments to eliminate fossil fuel subsidies, they have not set a standard definition and methodology to measure these subsidies. Meanwhile, individual countries and international organizations use different definitions and include different types of subsidies in their current estimates (ODI, 2017). A lack of transparency over the size of total subsidization to fossil fuels complicates the policy discussion, spurring the need for better estimates that can underpin future reforms. The lack of progress in reducing fossil fuel subsidies across the EU has contributed to the misalignment of government spending with green transition goals and to a need for the Green Deal to reinforce EU commitment to phasing them out.

**Figure 4.1** Stages of support to fossil fuels




*Source:* Gencsu, Ipek, et al. "Phase-out 2020: Monitoring Europe's Fossil Fuel Subsidies." ODI, Overseas Development Institute, Sept. 2017, odi.org/documents/5664/11762.pdf.

## Box 4.1 Methodology for estimation of fossil fuel subsidies in the four countries in focus

**A more thorough assessment of the current size and structure of fossil fuel subsidies in Bulgaria, Croatia, Romania, and Poland requires a broad definition.** The WTO defines subsidies as "any financial contribution by a government, or agent of a government, that is recipient-specific and confers a benefit on its recipients in comparison to other market participants" (WTO, 1994). Based on the WTO definition, subsidies to fossil fuels are divided into three categories:

- 'fiscal support', such as direct spending by government agencies, tax breaks, and income or price support. Fiscal support is provided by national and sub-national governments and through the EU's budget. It is divided into three categories in this report:
  - budget expenditure (e.g., direct spending on R&D for fossil fuel exploration).
  - tax exemptions (e.g., tax breaks for diesel use in transport).
  - price and income support (e.g., provision of electricity at a lower price for specific groups or sectors, such as households or industry).
- 'public finance', including support from domestic, bilateral, EU and multilateral international agencies through the provision of grants, loans, equity and guarantees. These financial institutions include bilateral development banks, export credit agencies and majority state-owned banks, which provide public finance in the form of grants, loans, equity, insurance and guarantees both domestically and internationally. Investments by public finance institutions are backed by the government, through direct investment using public funds and through creditworthiness. The resulting high credit ratings of these publicly owned financial institutions can reduce the risk to parallel private investors. This leverage effect is the fundamental rationale for public investment in several sectors (i.e., to act or invest in areas where the private sector is reluctant to do so).

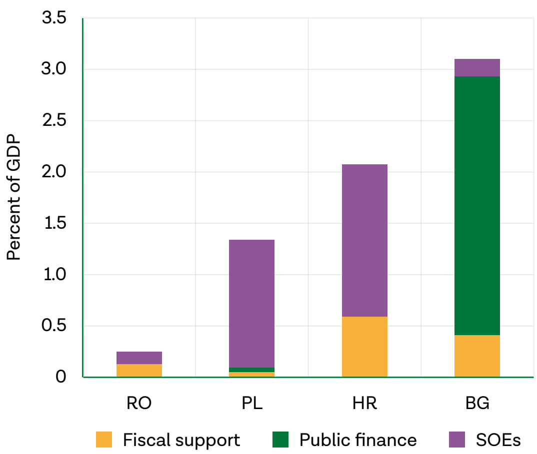
- 'investment by SOEs' if majority state-owned, both domestically and abroad. Majority government ownership of SOEs provides a degree of effective control and government involvement in decision-making and financing.

**The estimation of subsidies then required collection of all available data.** The limited transparency and the difficulty in accessing comparable information create significant barriers to estimating fossil fuel subsidies. All available data on all financial government support going to fossil fuels was collected for 2018 and 2019, using government budget documents, OECD databases, reports of public finance institutions and news reports, and SOE annual reports.

**The new estimates of fossil fuel subsidies in Bulgaria, Croatia, Poland, and Romania highlight the importance of less traditional (off-budget) support to fossil fuels.** Although these estimates provide a broader picture of subsidies in each of the countries, they remain incomplete because of missing information, most often in public financing and SOE investments. Nevertheless, the new estimates point to key issues. Bulgaria's fossil fuel subsidies are dominated by the public financing of a gas pipeline (2.5 percent of GDP), while Poland and Croatia use SOE investments to support fossil fuels. Poland devotes 1.3 percent of GDP via SOE investment in fossil fuels by various state utilities, while Croatia spends 1.5 percent of GDP via state-owned utilities in electricity, oil, and gas. Figure 4.2 compares fossil fuel subsidies across the four countries. All these mechanisms are sources of the government's finance flows. Therefore, they must be made much more transparent, scrutinized in line with climate targets and commitments, and eventually phased out.

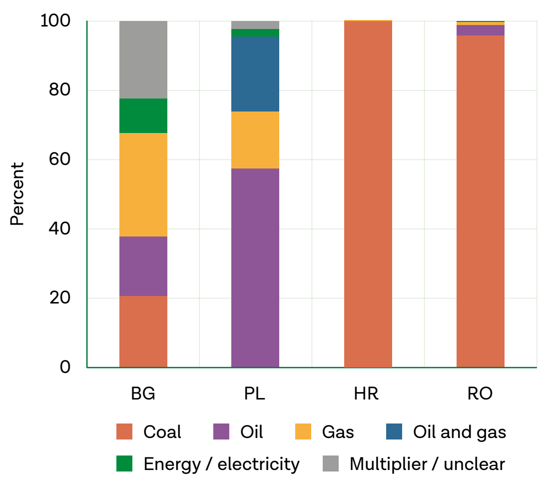
**Although in the four countries financing for fossil fuels comes much less through the more 'known' channels (i.e., subsidies through government budgets and in the form of tax exemptions/price support), data gaps in estimating the size of fiscal support point to a need for greater transparency.** Poland and Romania provide fiscal support (including tax exemptions and price, income support) almost entirely to coal. At the same time, Croatia targets oil (more than 50 percent of the fiscal support) predominantly. Bulgaria's fiscal support for fossil fuel is less concentrated and goes to coal, gas, and oil (Figure 4.3). Bulgaria uses budget support to lower the cost of consumption of fossil fuels by households, businesses, and agriculture, while Croatia uses tax exemptions (mostly for agriculture). Both countries give fiscal

**Figure 4.2** New estimates of fossil fuel subsidies for four EU countries




*Notes:* Data is for 2018 or 2019.
*Sources:* ODI, 2021

**Figure 4.3** New estimates of fossil fuel subsidies for the four countries, structure of fiscal support to FFS




*Notes:* Data is for 2018 or 2019.
*Sources:* ODI, 2021

support for the production of oil and gas and electricity. Energy tax breaks are provided for fossil fuel consumption by the industry, agriculture, and transport sectors and to households in Poland. However, estimates on the value of these subsidies were not available. In addition, a potentially larger area of indirect subsidy on the consumption side in Poland, though difficult to quantify precisely, is road and railway infrastructure (e.g. via diesel cars and trains using coal-fired electricity). Romania's more modest fossil fuel subsidies are mostly budget support to subsidize the acquisition of $CO_2$ certificates by coal plants and SOE investment in gas production. Besides, significant subsidies are provided for the consumption of fossil fuels, in particular, for district heating.

**Detailed results from the fossil fuel subsidy quantification exercise undertaken in the four countries are discussed below.**

## Bulgaria: Fossil fuel subsidy estimates and options for reduction

**In Bulgaria, at least EUR 250 million per year of fiscal support for fossil fuels has been identified, along with EUR 1,546 million in public finance support and EUR 105 million in SOE investment that supports fossil fuels.[2]** These amounts are equivalent to 0.41 percent of GDP, 2.52 percent of GDP, and 0.17 percent of GDP respectively. Two-thirds of fiscal support has been identified as subsidizing consumption of fossil fuels, spread across households, business and industry, and agriculture, while the remaining one-third of fiscal support is mostly for oil and gas production. Fiscal support in Bulgaria is three-quarters budget support (and one-quarter tax breaks). However, by far the largest category of subsidy for Bulgaria is the EUR 1.5 billion of public financing provided for transportation of gas. No financing of fossil fuel projects by the Bulgarian Export Insurance Agency has been identified. Lastly, support of about 0.2 percent of GDP is estimated to be provided through majority state-owned companies, including Martisa Iztok Mines, Bulgartransgas EAD and Bulgargaz. The estimates are summarized in Table 4.1 and Table 4.2.

**Table 4.1 Total government support to fossil fuels in Bulgaria (EUR, millions)**

| | Fiscal support | Public finance | SOE investment |
|---|---|---|---|
| Coal | 51.95 | | 53.24 |
| Oil | 42.84 | | |
| Gas | 74.32 | | 0.07 |
| Oil and gas | | 1,546.02 | |
| Energy / electricity | 24.99 | | 51.26 |
| Multiple / unclear | 56.02 | | |
| **Total** | **250.12** | **1,546.02** | **104.57** |

**Table 4.2 Fiscal support to production and consumption of fossil fuels in Bulgaria (EUR, millions)**

| | Production | | | | Consumption | | | |
|---|---|---|---|---|---|---|---|---|
| | Coal | Oil and gas (including infrastructure) | Energy / electricity (power plants) | Multiple / unclear | Transport | Business and industry | Agriculture | Households |
| Fiscal support | | 55.69 | 24.99 | | | 56.02 | 42.84 | 70.59 |
| SOE investment | 53.24 | 0.05 | 51.28 | | | | | |

**The key recommendation for Bulgaria is to strengthen reporting and monitoring of fossil fuel subsidies that will help to increase transparency for subsequent reforms.** The Bulgarian National Energy and Climate Plan (NECP) states that, "Bulgaria does not provide energy subsidies, including for fossil fuels," but the more comprehensive definition applied in this report finds substantial subsidization. In addition, this new estimate is incomplete since data availability on government financing and support for fossil fuels in Bulgaria is very limited. Thus, it will be helpful if Bulgaria could consider developing and implementing a methodology for reporting and monitoring the level of fossil fuel subsidies that will help underscore the economic and environmental rationale for reform. The new estimates of fossil fuel subsidies in Bulgaria indicate that: first, Bulgaria may want to gradually phase out subsidies to consumption of fossil fuels by households, businesses, and the agricultural sector. Second, the significant subsidies for gas (30 percent of fiscal support) could be re-evaluated in line with the role of gas in a climate-compatible future.

## Croatia: Fossil fuel subsidy estimates and options for reduction

**In Croatia, at least EUR 321 million of fiscal support per year for fossil fuels has been estimated, along with EUR 804 million in SOE investments supporting fossil fuels.**[3] These translate to about 0.59 percent of GDP and 1.48 percent of GDP, respectively. About 40 percent of fiscal support has been provided through tax exemptions, and 60 percent through budgetary contributions. Nearly 60 percent of subsidies flow to the oil sector, through both fiscal support and SOE investment. Of the 40 percent of fiscal support that is for consumption (through nine different tax exemption measures), more than half goes to agriculture. Twelve other tax exemption measures were identified but could not be quantified, likely providing significant additional subsidies to consumption, in particular by business and industry. Of the 1.48 percent of GDP support through investments made by majority state-owned enterprises, major beneficiaries included natural gas storage companies and transmission operators.[4] A missing piece in these estimates are possible subsidies likely provided through favorable financing by the Croatian State Development Bank, HBOR, which does not publish project level data and provides financing to projects unless they have adverse environmental impacts that are not largely mitigated or compensated. Croatia's estimates are summarized in Table 4.3 and Table 4.4.

**Table 4.3 Total government support to fossil fuels in Croatia (EUR, millions)**

| | Fiscal support | Public finance | SOE investment |
|---|---|---|---|
| Coal | | | |
| Oil | 184.81 | | 448.00 |
| Gas | 52.15 | | 185.63 |
| Oil and gas | 70.53 | | |
| Energy / electricity | 6.12 | | 35.40 |
| Multiple / unclear | 7.67 | | 134.96 |
| **Total** | **321.28** | **-** | **803.99** |

**Table 4.4 Fiscal support to production and consumption of fossil fuels in Croatia (EUR, millions)**

| | Production | | | | Consumption | | | |
|---|---|---|---|---|---|---|---|---|
| | Coal | Oil and gas (including infrastructure) | Energy / electricity (power plants) | Multiple / unclear | Transport | Business and industry | Agriculture | Households |
| Fiscal support | | 69.00 | 47.23 | 70.35 | 27.52 | 26.32 | 70.36 | 10.49 |

**The key recommendation for Croatia's government is to review fossil fuel subsidies comprehensively and align them with country and EU climate objectives.** As for the other countries analyzed, improved transparency in reporting of fossil fuel subsidies is needed. While the tax exemption measures that benefit fossil fuel consumption in Croatia have been identified, not all were quantified. The subsidies provided through these measures should be made transparent which would help to draft a plan and timeline to phase them out.[5] Using the available data, the new estimates indicate that the government should consider phasing out its fiscal support to oil, gas and subsidies to the state-ownership of oil production and distribution companies.

## Poland: Fossil fuel subsidy estimates and options for reduction

**In Poland, at least EUR 267 million per year of fiscal support for fossil fuels has been calculated, along with EUR 206 million in public finance support and EUR 6,654 million in SOE investment that supports fossil fuels.**[6] These are equivalent to 0.05 percent of GDP, 0.04 percent of GDP, and 1.25 percent of GDP. Virtually all of the fiscal support, consisting almost entirely of budget support, goes to subsidize coal, to enable restructuring of the sector. An additional 0.39 percent of GDP of fiscal support was identified for transport infrastructure (roads and railways) but with only an indirect link to fossil fuels.[7] About half of SOE investment supporting fossil fuels (totalling 1.25 percent of GDP) goes to electricity and the other half to the oil and gas sectors. Government support through state-owned enterprises goes to state utilities. Lastly, although it is known that energy tax breaks are provided for fossil fuel consumption by the industry, agriculture and transport sectors, estimates on the value of these subsidies are not available.[8] In addition, the Polish export credit agency KUKE and state bank BGK continue to finance fossil fuel projects; but limited information is available. Poland's estimates are summarized in Table 4.5 and Table 4.6.

**Table 4.5 Total government support to fossil fuels in Poland (EUR, millions)**

| | Fiscal support | Public finance | SOE investment |
|---|---|---|---|
| Coal | 266.87 | | 144.20 |
| Oil | | | 1,373.92 |
| Gas | 0.06 | | 397.35 |
| Oil and gas | | | 1,346.67 |
| Energy / electricity | | 206.15 | 3,391.57 |
| Multiple / unclear | | | |
| Total | **266.93** | **206.15** | **6,653.72** |

**Table 4.6 Fiscal support to production and consumption of fossil fuels in Poland (EUR, millions)**

| | Production | | | | Consumption | | | |
|---|---|---|---|---|---|---|---|---|
| | Coal | Oil and gas (including infrastructure) | Energy / electricity (power plants) | Multiple / unclear | Transport | Business and industry | Agriculture | Households |
| Fiscal support | 266.87 | 0.06 | | | 2058.35* | | | |
| SOE investment | 144.20 | 3117.95 | 3391.57 | | | | | |

*Notes:* *Subsidies to roads and railways but with only an indirect link to fossil fuels so excluded from totals.

**The key recommendation for Poland is to focus on reducing investments in coal, oil, gas and fossil fuel-based electricity production through SOEs.** As SOE investment accounts for the largest support measure and considering the key role that SOEs play in Poland's energy system, it will be helpful if the government could encourage an SOE transition away from fossil fuels. In addition, fiscal support to the coal sector must help facilitate an orderly and just transition, supporting workers and communities but not benefiting private interests or extending the lifetime of these assets. New estimates of subsidies presented in this report indicate a need for enhanced transparency. It would be essential to make the list of subsidy measures publicly accessible[9] and provide more information on the projects financed by KUKE and BGK. Tax exemptions for the consumption of fossil fuels by industry, business, households, transport and agriculture should also be quantified and phased out in line with EU and global climate commitments. Lastly, the large indirect support that is being provided to transport through fossil fuel-based infrastructure needs to be re-assessed.

## Romania: Fossil fuel subsidy estimates and options for reduction

**In Romania, at least EUR 286 million of fiscal support per year for fossil fuels has been estimated, along with EUR 258 in SOE investments.**[10] These amounts are equivalent to 0.13 percent of GDP and 0.12 percent of GDP respectively. Almost all of the fiscal support, delivered as budget support (rather than tax breaks), supports coal, and most of that amount was state aid for the acquisition of $CO_2$ certificates by coal plants. Although significant subsidies are provided for consumption of fossil fuels, including through lower prices for heat, natural gas and electricity and through tax exemptions for LPG use in households and diesel fuel use in agriculture, no data was available to quantify the impact.[11] The Romanian government also provides support to fossil fuels through 0.12 percent of GDP in SOE investment, with 85 percent going to support gas. The estimates are summarized in Table 4.7.

**Table 4.7 Total government support to fossil fuels in Romania (EUR, millions)**

| | Fiscal support | Public finance | SOE investment |
|---|---|---|---|
| Coal | 274.57 | | |
| Oil | 8.67 | | 21.46 |
| Gas | 2.27 | | 217.55 |
| Oil and gas | | | |
| Energy / electricity | 0.95 | | 19.06 |
| Multiple / unclear | | | |
| Total | **286.46** | **-** | **258.07** |

**The key recommendation for Romania is that transparency and data availability on fossil fuel subsidies should be expanded.** As for all the countries analyzed, more information needs to be publicly available on support provided to fossil fuels, and in the case of Romania, particularly that of public finance institutions, as a first step towards phasing out this financing. The new estimates presented here indicate that, first, the planned full liberalization of Romania's natural gas market in July 2020 means that gas subsidies should be on track to being phased out. Second, Romania's National Energy and Climate Plan (NECP) also commits to reform of heat subsidies to apply only to vulnerable households and to be gradually replaced with other support measures that do not favor fossil fuels. Third, subsidies to natural gas production, as well as the role of gas production and consumption, should be critically evaluated in line with EU and Romanian climate targets. Last, as in the three other analyzed EU countries, state aid for closure of mines as part of support for transition away from fossil fuels is important but needs to be evaluated carefully, ensuring the support benefits workers and communities and that an equitable share of the burden falls on shareholders.

**Overall, in all the four countries examined, it will be critical to increase transparency on all forms of support provided to fossil fuels to enable their accurate measurement and subsequent reduction.** Since support to fossil fuels comes through known and lesser-known channels, it is important to take stock of all forms support and then eventually phase them out in line with EU and country specific climate commitments.

# Notes

1 It captures the value of government programs and investments benefiting a sector, whether these benefits end up with consumers (as lower prices), producers (through higher revenues), or resource owners (through higher rents). However, data access and quality make the comparison even among the selected four countries very difficult.

2 BGN 489 million, 3,024 million, and 205 million equivalent.

3 HRK 2,381 million and 4,957 million equivalent.

4 The Republic of Croatia also holds 45 percent of shares in the multinational oil company Ina-Industrija nafte. The investments made by this company, of EUR 303 million per year, were not included as it is not majority state-owned.

5 The Croatian National Energy and Climate Plan (NECP) outlines some of the tax exemptions provided but fails to outline reform plans.It states: "A smaller part of energy subsidies is related to exemption from excise duties in transport and agriculture, the abolition of which is currently not planned." See Croatia NECP, 2020. https://ec.europa.eu/energy/sites/default/files/documents/hr_final_necp_main_en.pdf

6 PLN 9,964 million, 879 million, and 28, 487 million equivalent.

7 Information was insufficient to add this amount to the fiscal support total. However, since Poland's transport sector is powered by fossil fuels (via diesel cars and trains using coal-fired electricity), it is indirectly a subsidy to fossil fuels.

8 The OECD database has not had data updates since 2017 (even then, estimates for these measures were missing). 2017 data shows PLN 896 million of tax rebates for diesel used in farming and PLN 1,450 million of tax breaks for diesel used in agriculture.

9 The Poland NECP currently omits but should include a list of support measures in the energy sector, including subsidies.

10 RON 762 million and 1,090 million equivalent.

11 Independent studies estimated the price support at RON 1.1 billion in 2015. Tax exemptions for diesel used in agriculture amounted to RON 30 million in 2020 (EUR 6.2 million), but data was not available for 2018 or 2019. Tax exemptions for LPG used in households (the excise level is set at zero) also lack data regarding the volume. See Romania's NECP, 2020.

Chapter 5

# Green Public Investment

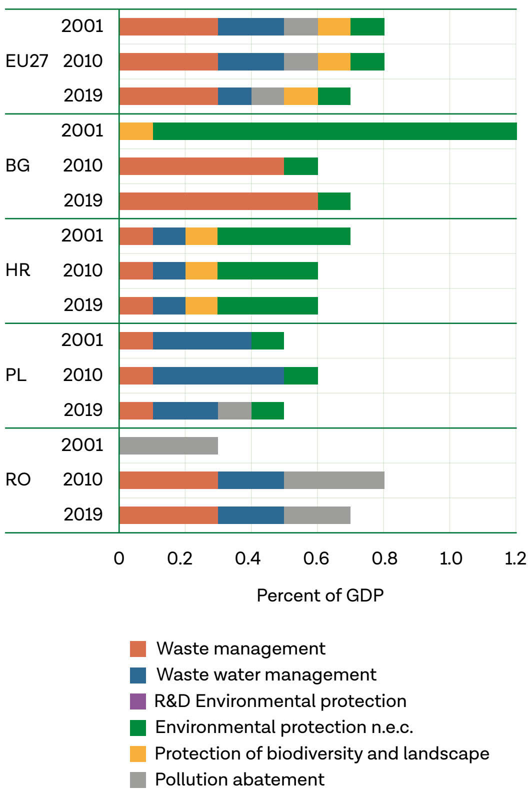
**Increased green public investment will help unlock private funds by correcting market failures and support the recovery from the COVID-19 pandemic.** Attracting private green investment[1] will not only require appropriate price signals but also government spending to overcome market failures that impede investment in green infrastructure and innovation. This is because green investment projects can potentially have higher upfront capital costs, higher risks (e.g., due to market and technology related uncertainties) and longer investment and payback timelines compared with fossil-fuel-based investment alternatives. In addition, green private investment can be impeded by market failures that do not account for the benefits of resource-efficient infrastructure and technologies, as well as the full costs associated with fossil-fuel use (OECD, 2013). Also, green public investment and co-funding for projects with large upfront investment costs could help crowd in the private sector by reducing risks and overcoming information asymmetries and misaligned incentives. In the context of the pandemic, green investments can support recovery as they have been found to have higher multipliers than traditional fiscal stimuli (Hepburn et al. 2020, IMF, 2021) while job multipliers are higher for investment in renewable energy generation than for investment in fossil fuels (Kammen, 2010). Such investment can potentially include spending on connectivity infrastructure, clean energy infrastructure, upgrade of energy transmission and distribution grids and R&D.

## Importance of and trends in green public investment in the EU

**Stepping up green public spending requires a uniform definition of investment outlays that can be classified as green.** The challenges associated with defining environmental-related expenditure mainly stems from three factors. First is the multi-dimensional nature of environmental objectives, which encompass various goals, including climate action, pollution reduction, and biodiversity protection. As a result, a measure favorable to a specific goal could be unfavorable to another goal. Second, it is difficult to classify spending measures in a binary way (green or brown) as they can contribute to the environment in various degrees (Carney, 2019). This also gives rise to the question of whether to include secondary and indirect impacts, as well as direct impacts, and, if so, how to appropriately weigh in or scale the allocated expenditure amount. The long-term dimension of environmental challenges implies that the impacts of some measures will only be properly understood in the long term, possibly following an impact-assessment analysis. On public investment, there are additional complications related to budget classification and reporting (documents do not contain information on investment outlays broken down by goals or anticipated effects, in particular, related to reducing the negative impact on the environment and climate) and attribution (estimating the contribution to climate goals by public sector investment at given points in time). Thus, for the time being, there is no standard approach to defining green public investments (GPI) consistent with climate change mitigation objectives. In 2020, the EU adopted the EU-wide taxonomy on sustainable investments[2] that helps to distinguish which investments contribute to the European environmental objectives, which is a good starting point to define GPI.

**Environmental protection spending (used as a proxy for GPI) in the EU accounted for a mere 2 percent of GDP before the COVID-19 crisis and was driven predominantly by the private sector (EEA, 2019).** The specialized producers (a combination of public and privately run environmental specialist services such as waste and wastewater companies) accounted for about 50 percent of total environmental protection expenditure (EPE), industry for 14 percent, and the public sector for the remaining 36 percent. In 2019, most expenditure was directed to waste management (above 40 percent of the total), followed by wastewater treatment, while air and climate constituted only 2 percent of total spending.[3] Government spending favoring the environment (including climate)[4] as a percent of GDP amounted to about 0.7 percent in the EU, with similar levels in Romania and Bulgaria; around 0.6 percent in Croatia and only 0.5 percent in Poland (Figure 5.1). Pollution abatement spending was even smaller and exceeded the EU average of 0.1 percent of GDP in only a handful of countries (like Romania). It is worth noting that Romania increased public spending on environmental protection since 2000, although from relatively low levels. At the same time, the EU average stayed unchanged while few countries noted a sizable reduction in spending.

**Figure 5.1** Government environmental protection expenditure (2001 – 2019)




*Source:* Eurostat, COFOG database.

**The EU's EUR 673bn Recovery and Resilience Facility (RRF) provides a unique opportunity for the public sector to play a larger role in supporting the green transition (the European Green Deal), while also recovering from the pandemic.** Several factors are relevant to the design of economic recovery packages: the long-run economic multiplier, contributions to the productive asset base and national wealth, speed of implementation, affordability, simplicity, impact on inequality, and various political considerations. The recovery packages could be 'brown,' reinforcing the existing links between economic growth and fossil fuels and risking future stranded assets (Pfeiffer *et al.*, 2018), or 'green,' decoupling emissions from economic activity and concomitantly addressing market failures that impede the transition. To make the packages green, the governments need to steer policies and investment towards a productive and balanced portfolio of sustainable capital assets (consistent with EU goals on climate change) and address existing distributional, competitiveness, and political economy concerns. To guide the design of the recovery packages, EU leaders agreed that recovery spending would need to effectively support the green transition, with 37 percent of member states' plans earmarked for green investments. In addition to public financing, large scale private sector financing will also need to be mobilized to achieve net zero emissions (Box 5.1).

### Box 5.1 Green Financing

**Mobilizing financing for sustainable and green investment, a large share of which is expected to come from the private sector, calls for re-shaping key aspects of the financial system.** To attract capital, green investments need to accrue sustainable economic returns. Governments around the world are taking steps to encourage the development of green finance with a view towards mobilizing the needed resources.

**The financial system can be instrumental in funding bankable green projects.** Green loans are defined as any type of loan instrument made available exclusively to finance or re-finance, in whole or in part, new and/or existing eligible green projects. Indicative categories of eligibility for green projects include production and transmission of renewable energy, pollution prevention and control, sustainable natural resources management, biodiversity conservation, climate change adaptation and green buildings. Green lending includes, but is not limited to, project financing, construction lending, renewable energy, energy efficiency and equipment leasing for enterprises along with personal housing mortgage loans and motor-vehicle loans.

**Integrating a green agenda into capital market development would help stimulate green financing.** Efforts can be made to channel institutional and retail investor funds into green assets. Some forms of interventions that can potentially be considered include co-investments and certain forms of profit/loss arrangements (for example for equity funds) or guarantees (for debt funds), with the latter two especially targeted towards SMEs. However, these arrangements have fiscal implications and need to be analyzed carefully since ill-conceived structures can potentially be distortionary. The end goal should be to align the risk-return appetite of investors that otherwise would not invest in these solutions.

**Green bonds are any type of bond instrument where the proceeds will be exclusively applied to finance or re-finance, in part or in full, new and/or existing eligible green projects.** The fundamental principal of a green bond is the mandate to utilize proceeds for green projects that address concerns related to climate change, natural resource depletion, loss of biodiversity, and air, water or soil pollution. The most common types of projects include those in renewable energy, energy and resource efficiency, clean transportation, and green buildings. All designated green projects should provide clear environmental benefits, that are assessed and, where feasible, quantified by the issuer. For issuers, green bonds have a favorable reputational effect while fund managers use green assets as a way to hedge carbon risks and to satisfy investors' mandates to invest in sustainable assets. While, evidence of a price premium, or 'greenium' (a term used for green bonds that are heavily oversubscribed and are priced higher than vanilla bonds) is not well established for green bonds, they provide other benefits to issuers. These include perceptions on national leadership on the green agenda, access to a new investor base and commitment towards the climate change agenda.

**Investment funds could also play an important role in supporting the green transition.** A green fund is a mutual fund or other investment vehicle that will only invest in companies that are deemed socially conscious in their business dealings or directly promote environmental responsibility on standardized green assets. The majority of European green funds are equity funds, but the market is gradually diversifying. Equity Funds (focusing on Private Equity/Venture Capital), while small, are a relatively well-established asset class. Fund investors buy equity/ quasi equity securities in companies that are not publicly traded, and in exchange for the capital, they take up an ownership stake in the company with the aim to increase the profitability of the company at the time of exit (in 3–7 years). This type of financing provides both funding and capacity building. Debt Funds are a new but growing asset class. These funds invest in a wide range of assets that provide investors with a stream of revenues typical of fixed income products (such as receivables, leases or even loans). Depending on the type of assets in which they invest, these funds could provide short and medium-term capital as well as longer-term debt financing for investments.

## Assessment of green public investment: illustration from Poland

**Assessing the green element in public investment is particularly challenging due to data and methodological issues. An illustrative attempt is presented here for Poland.** An assessment for Poland estimates Green Public Investment at PLN 36.1 billion, which is 1.6 percent of GDP or 33.5 percent of the total public investment in 2019.[5] Like many EU countries (EC, 2020), Poland does not use green budgeting practices, which would allow for tagging those components of the budget that explicitly contribute to climate and environmental objectives. It reflects difficulties in the binary classification of spending into green and brown and limitations related to existing budget classification as well as reporting mechanisms that do not contain information on green outlays. Applying the criteria defined in the EU Taxonomy and the Recovery and Resilience Facility approach, which were supplemented by Climate Policy Relevant Sectors (CPRS) methodology, about 33.5 percent of public investment in Poland was assessed as contributing to climate and environmental goals (see Box 5.2). If a quarter of the green spending in the Polish National Recovery and Resilience Plan (NRRP) is allocated to fund green public investment, the latter would increase from the estimated 1.6 percent today (Grabowski, Kotecki, 2021) to more than 2 percent of GDP by 2026, with an expected beneficial impact on growth and the green transition.

### Box 5.2 Methodology to estimate green public investment in Poland

**A comprehensive budget classification that could reflect climate-related spending is unavailable.** The state and local governments' budgets in Poland (plans and execution reports) do not contain direct information on expenditure related to investment outlays that have objectives related to environmental and climate protection. At the same time, the Multiannual Financial Framework for the EU 2021–2027 envisages that funds for climate-related goals will amount to at least 25% (see COM (2018) 375). Even more is expected from the implementation of the Next Generation EU instrument. The drafts of the National Recovery and Resilience Plans were required to assume at least 37 percent of expenditure for "green" goals to accelerate and support the green, ecological transformation. Lack of data/details to apply the available EU methodologies (such as a taxonomy for sustainable activities) to assess the greenness of public investment requires a non-standard (mixed) approach of combining different sources of data and classification principles to the estimation of the green share of public investment.

**The proposed methodology in the case of Poland uses a database on fixed assets in the national economy in 2019 as the main source of information.** This database provides information on investment outlays in the national economy by sectors, sections, and divisions in 2019. Such classification (Polish Classification of Activities or PKD) is consistent with the EU-wide NACE statistical classification of economic activities. Additionally, a breakdown of the outlays between private and public sector investment is available, where the public sector includes state, self-government institutions and public corporations. The information and database on economic aspects of environmental protection in 2019 and some specific information (e.g., information on public investment programs), detailed data on particular sectors or sections were used as supplementary information. Given limited data sources, some justified assumptions were made.

**The Poland example attempts to combine three methodologies to determine whether public investment contributes to green objectives.** It used the guiding principles of the EU Taxonomy approach and the Recovery and Resilience Facility approach (coefficients for the calculation of support to climate change and environmental objectives), which were supplemented by a research of approaches used in similar exercises (e.g., Climate Policy Relevant Sectors (CPRS) methodology). The resulting methodology classified the following as green investment: all investment outlays in environmental protection and a part of the outlays on water management, climate mitigation and climate adaptation. The main challenge was the estimation of green investment in the transportation and storage section (section H in Polish classification of the economic activities (PKD)). In addition, available data on investment in buildings and structures (which constitute an important share of public sector investment) did not contain information on energy standards and norms met. Therefore, certain assumptions were made to estimate the green part of outlays on transportation and buildings.

*Source:* Grabowski, Kotecki (2021)

**The COVID-19 crisis presents an opportunity to invest in green activities to drive a systemic change.** Carbon taxation will more effectively support green recovery and transition when it is accompanied by the phasing out of fossil fuel subsidies and prioritization of green public investment. Such investment is characterized by high economic multipliers and is of key importance for recovery and for overcoming market failures in the path towards net zero emissions. The NRRPs allow increasing green investment without endangering fiscal sustainability. Thus, EU governments should focus on shifting investments from fossil fuels to low carbon development and avoid supporting fossil fuels in their recovery spending. Quantifying the potential impact of public investment on both growth and climate/environment becomes a priority to guide decisions on the type and size of the stimulus. To do so, more granular investment data and adequate impact-assessment analyses are needed. For example, available data on investment in buildings and structures (which constitute an important share of public sector investment) need to be supplemented with information on energy standards and norms. The EU taxonomy for sustainable activities is a useful starting point to guide data collection and identify green expenditure items. Nevertheless, until it is fully developed, policy choices will be guided by a non-standard (mixed) approach for estimation of green public investment.

# Notes

[1] Green investment is a broad term, which can include investment in green infrastructure sectors such as renewable energy, energy efficiency, water sanitation and distribution systems, waste management, sustainable transport and housing as well as sustainable natural resources management and other relevant activities within the environmental goods and services sector.

[2] The EU taxonomy is a classification system, establishing a list of environmentally sustainable economic activities. It provides companies, investors and policymakers with appropriate definitions for which economic activities can be considered environmentally sustainable. https://ec.europa.eu/info/business-economy-euro/banking-and-finance/sustainable-finance/eu-taxonomy-sustainable-activities_en

[3] EPE only partly captures climate-related expenditure

[4] Note that environmental protection expenditure according to the COFOG classification does not cover climate transition expenditure on energy, transport and housing.

[5] Estimated by the World Bank

Chapter 6

# Conclusions

**The EU, a global leader on climate action, has raised its climate ambition by committing to achieve carbon neutrality by 2050 and reduce emissions by 55 percent by 2030 as part of the European Green Deal.** Meeting its targets will involve significant efforts for the EU as a whole and its member states. The EU27 will need to cut GHG emissions by a further 30 percent from present levels to meet the 2030 target, a speed of emissions reduction that is 50 percent more ambitious, to be achieved in one-third of the time, compared to past performance. The reduction is likely to be particularly ambitious for carbon-intensive coutnries that need to reduce emissions by 40–50 percent between 2018 and 2030. To support and enable the green transition, EU funds will be made available over the next few years, some of which will be in the form of grants.

**This report explores key issues related to green fiscal reforms focusing on four EU countries: Bulgaria, Croatia, Poland and Romania.** These reforms primarily envisage an alignment between taxation and spending with environmental and climate goals. Green fiscal reform can improve price incentives and provide a tax system that is less distortionary, while simultaneously ensuring that those who lose out are compensated and supported in the transition. Better price incentives and enhanced public investment will spur green private investment to propel the economy towards a low carbon future. Thus, environmental fiscal reforms promise to bring both short-term positive economic impacts, enabling the post-COVID recovery, and long-term structural change by decoupling greenhouse gas emissions from economic growth.

**Decisive policy action is needed to steer the post-pandemic economic transition towards long-term sustainability and to provide incentives for green private sector investment.** The pandemic induced recession has accelerated the ongoing economic transformation towards a more digitized economy. Green fiscal policies are necessary in order to ensure that the transformation is simultaneously green and "builds back better". Accelerating the transition to zero net emissions, as laid out in the European Green Deal, requires a strong incentive framework of prices and taxes to galvanize green private sector investments and inhibit brown investments. Crowding in of green private investment is crucial as fiscal space has been eroded by the large fiscal stimulus and the resultant increased indebtedness. Nevertheless, public investment will also be needed in building new low-carbon industries and consumer alternatives for structural change.

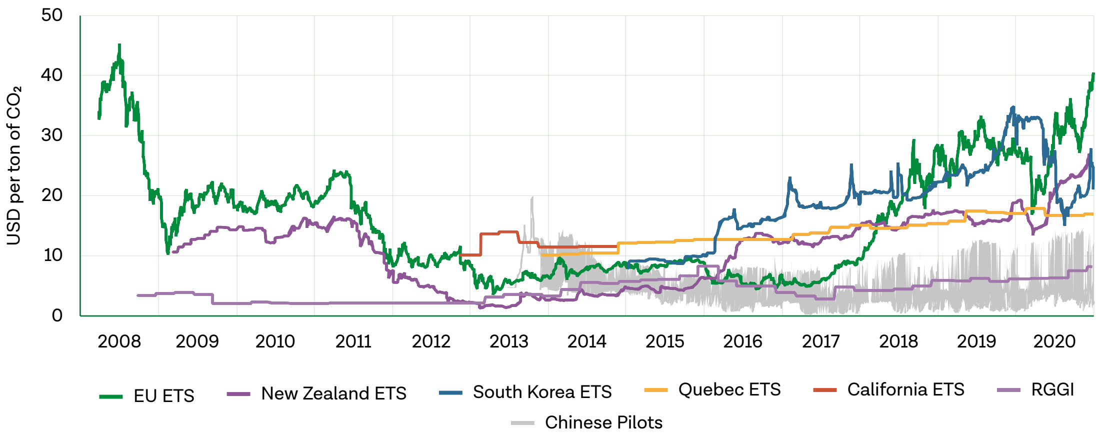
**This report provides some new insights on the impact of carbon tax scenarios, on the size and content (and gaps in knowledge) of fossil fuel subsidies, and on the challenges in measuring green public investment.** Country experience on carbon taxation provides consistent evidence of these taxes' effectiveness, options on how to deal with competitiveness and distributional concerns, and strong evidence that carbon taxes can be inclusive and growth enhancing if revenues are recycled. Modeling using the CPAT and MRIO models provides quantitative estimates for Bulgaria, Croatia, Poland and Romania on how carbon taxes are likely to affect prices, energy use and emissions, tax revenues, and output and employment. The modeling shows how carbon taxes can be made progressive through recycling of revenues and can provide local co-benefits in lower air pollution, less traffic congestion, and fewer traffic accidents. New estimates of fossil fuel subsidies in the four countries illustrate the importance of off-budget support to fossil fuels and, most importantly, the need for greater data transparency to improve decision making. Last, an exploration of green public investment found that quantification of green public spending is limited by a lack of consensus on defining and identifying green expenditure items. An exercise for Poland illustrated the specific complexity of assessing green public investment.

**While the new analytics presented here should be of value to policymakers, more can be done to feed into the implementation of well-informed policy decisions.** There is a long and growing list of analytical tools relevant for environmental fiscal reform in support of a green transition and an expanding set of country experiences with various low-carbon policy instruments. Perhaps most of all, there is a rising demand for more data and information to enable better decision-making. By providing some new analysis of environmental fiscal reform (carbon taxes, fossil fuel subsidies and green investment) in Bulgaria, Croatia, Poland and Romania, this report intends to feed into the policy dialogue on decarbonization with emphasis on the role of fiscal responses for a green and inclusive economic recovery from the COVID-19 pandemic and for moving ahead on the path towards zero carbon emissions.

# Annex 1
# EU ETS

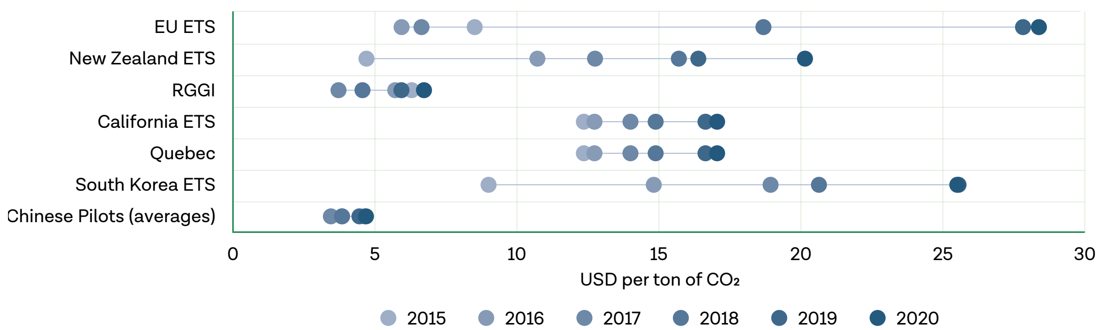
**The EU Emissions Trading System, a central policy instrument, covers 45 percent of EU GHG emissions.** The system applies a market-based price to the largest 11,000 power and industrial installations for all the $CO_2$ they produce. This leaves 55 percent of emission-related activity (including transport, agriculture, buildings, waste and smaller industries) exempt from the ETS levy (Figure A1.1 and A1.2). The Market Stability Reserve, operational from January 2019, helped to address the supply–demand imbalance prevailing in the EU ETS in the last decade. As a result, carbon prices increased. With a brief pandemic-related correction, the EU carbon price reached a record high of above 40 USD/t$CO_2$ by the end of 2020 and above 45 USD/t$CO_2$ in early 2021.[1] This is despite the estimated decline in actual emissions in the power and industry sectors by 14 percent in 2020. It reflects the tightening of emission caps due to more ambitious climate goals in the coming years.[2]

**Figure A1.1** Allowance prices in various ETSs




*Source:* ICAP, https://icapcarbonaction.com/en/ets-prices

**Figure A1.2** Annual average price

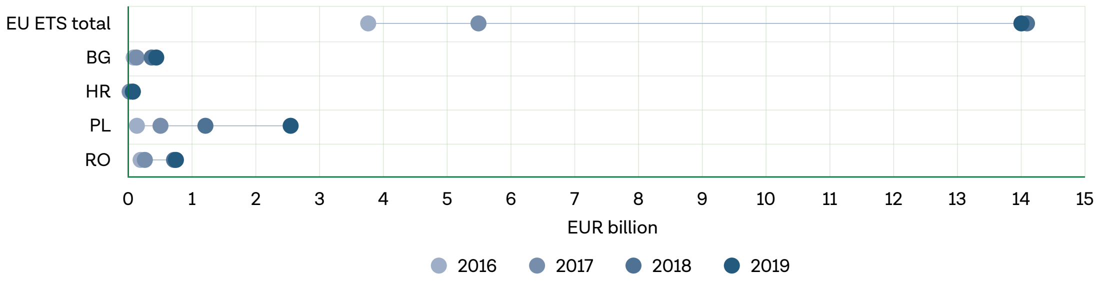



*Source:* ICAP, https://icapcarbonaction.com/en/ets-prices, staff calculations.

**Auctioning ETS emission allowances is a source of revenue for EU member states, of which at least 50 percent has to be used for climate and energy-related purposes.** EU ETS emission allowances (complying with the cap put on EU-wide GHG emissions to meet the emission reduction target) are in principle allocated through auctions[3] with auction revenues accruing to member states. By the end of 2019, nearly

EUR50 billion in auction revenues was raised from the EU ETS, mostly in the later years with collections only at about EUR12 billion during 2012–16 (Figure A1.3). In 2019 alone, over EUR14 billion was collected, and EUR7.5 billion in the first half of 2020 (EC, 2020). Member states are obliged to report annually to the EC on the amounts and use of the revenues generated. Around 80 percent of revenues in 2013–2018 were used for climate- and energy-related purposes (EC, 2020).

**Figure A1.3 Revenues from the auctioning of emission allowances 2016–2018**




*Source:* EC (2020). REPORT FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT AND THE COUNCIL Report on the functioning of the European carbon market COM(2020) 740 final, 18.11.2020.

# Notes

1 By mid-February 2022, EU ETS prices reached EUR 90 per ton of $CO_2$.

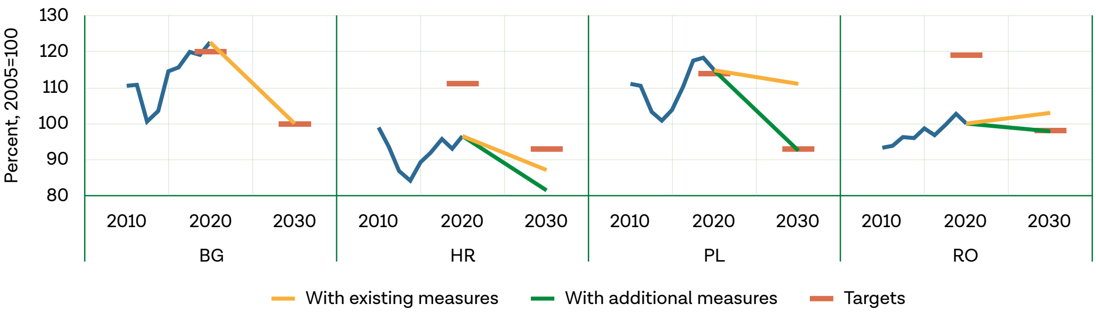
2 Refinitiv (2021). Carbon Market Year in Review 2020. Blooming Carbon Markets on Raised Climate Ambition, January 2021. https://www.refinitiv.com/content/dam/marketing/en_us/documents/reports/carbon-market-year-in-review-2020.pdf

3 Over the trading period 2013–2020 57% of the total amount of allowances was auctioned (default allocation method), but still significant number of allowances was available for free allocation. In sectors other than power generation, the transition to auctioning is taking place progressively. Some allowances continue to be allocated for free until 2020 and beyond. See EC (2020). REPORT FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT AND THE COUNCIL Report on the functioning of the European carbon market COM(2020) 740 final, 18.11.2020.

# Annex 2
# Effort Sharing Decision (ESD)

**Emission reduction in the non-ETS sectors are regulated at the country level and account for the remaining 55 percent of GHG emissions.** In the four countries in focus, these emissions have been rising in the past few years, primarily driven by the transport sector. Member States have signed up to the Effort Sharing Regulation for 2021–2030 to cut emissions in non-ETS sectors by 30 percent — as a contribution to the overall GHG reduction target (Effort Sharing Decision, ESD). EU countries were to set individual commitments and outline policies to help achieve decarbonization goals in their 10-year (2021–2030) integrated National Energy and Climate Actions Plans (NCEPS).[1] Overall, by 2030 the EU would reduce emissions by 32 percent in non-ETS sectors, according to an aggregation of the projected emission impacts of the national measures currently planned in the NECPS (Figure A2.1 and A2.2).[2]

**Figure A2.1** GHG emissions in ESD sectors, 2010–2019, and 2030 projections

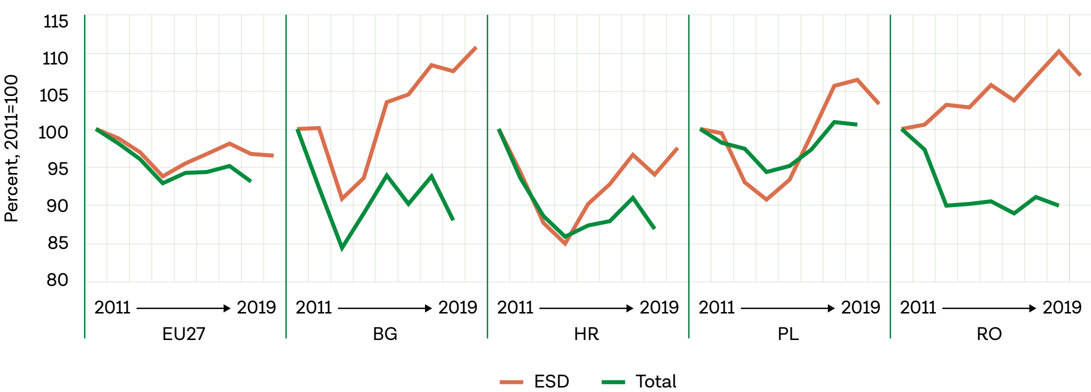



*Note:* The estimate for Bulgaria depends on the 2005 emission values used for the calculations. When using the 2005 base year value of the Effort Sharing Decision, Bulgaria's 'with additional measures' projections do not meet its 2030 target.

Similarly for Romania, estimate is dependent on the 2005 emission value used. Romania uses a value of 81 Mt, while the 2005 base year emissions for Romania under the Effort Sharing Decision are 75.5 Mt. Using the latter value leads to a gap of 12 percentage points (compared to 5 percentage points using the former value).

*Source:* NECPs and EC staff assessment of NCEPs.

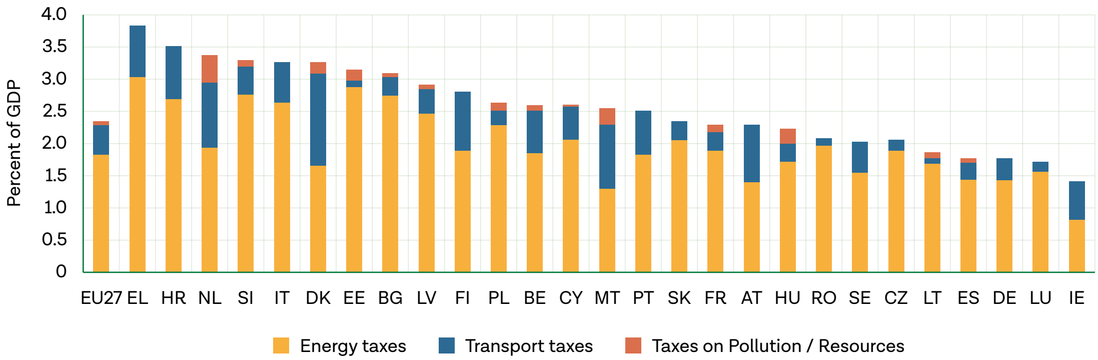
**Figure A2.2** GHG emissions, 2011=100




*Source:* Eurostat.

**One of the key instruments to reduce emissions in the ESD sectors is environmental taxes which have remained low and flat over the past few years.** Environmental taxes are imposed on activities or resources that have a proven, specific, negative impact on the environment. At around 2.5 percent of GDP in EU27 in 2019 they are not a significant source of revenue (below 6 percent of total), compared for example to taxes on labor that exceed 14 percent of GDP. Environmental taxes are strongly skewed towards energy (Figure A2.3, Table A2.1) compared with taxes on transport and on pollution and resource use. They have remained broadly unchanged in recent years (Figure A2.4), hovering around 3 percent in GDP in the four countries in focus. In particular, taxes on pollution and resources in the four countries are particularly low and have not grown in line with GDP, in comparison with some other EU member states (Figure A2.5).

**Figure A2.3** Environmental tax revenues, 2019

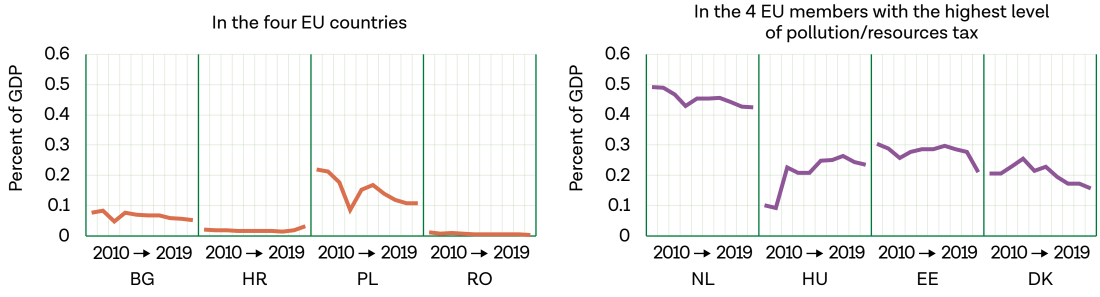



*Source:* Eurostat.

**Figure A2.4** Environmental tax revenues


*Source:* Eurostat.

**Figure A2.5** Taxes on pollution and resources




*Source:* Eurostat.

**Table A2.1 Structure of environmental tax revenues, percent of total, 2019**

**Bulgaria**

| | | | |
|---|---|---|---|
| **Energy** | | | **88.9** |
| | Excise duties and consumption taxes | Fuel | 65.1 |
| | Taxes on pollution | The revenue of emission trading permits | 22.7 |
| **Transport** | | | **9.5** |
| | Taxes on the use of fixed assets | Motor vehicles tax paid by producers | 4.2 |
| | Other current taxes n.e.c. | Vehicles tax paid by households | 5.1 |
| **Pollution and resource tax** | | | **1.7** |
| | Taxes on pollution | Water Act fees | 1.3 |

**Croatia**

| | | | |
|---|---|---|---|
| **Energy** | | | **76.8** |
| | Excise duties and consumption taxes | Excise taxes on mineral oils | 60.9 |
| | Excise duties and consumption taxes | Renewable Energy Sources and Cogeneration | 11.2 |
| | Taxes on pollution | Emission permits | 4.1 |
| **Transport** | | | **22.3** |
| | Excise duties and consumption taxes | Excise taxes on motor vehicles—from 01.07.2013 | 8.4 |
| | Taxes on the use of fixed assets | Registration | 1.9 |
| | Taxes on insurance premiums | Taxes on liability road vehicles insurance premium | 2.2 |
| | Taxes on pollution | Levy on the environment on motor vehicles | 1.4 |
| | Payments by households for licenses | Car registration taxes | 5.8 |
| **Pollution and resource tax** | | | **0.9** |
| | Taxes in land, buildings or other structures | Contributions for forests | 0.9 |

**Poland**

| | | | |
|---|---|---|---|
| **Energy** | | | **87.5** |
| | Excise duties and consumption taxes | Excise duty on petrol and other motor fuels | 55.0 |
| | Excise duties and consumption taxes | Fuel fee | 14.5 |
| | Taxes on pollution | Emission allowances | 8.5 |
| **Transport** | | | **8.4** |
| | Excise duties | Excise duty on cars | 4.9 |
| | Car registration taxes | Transportation levy | 1.5 |
| | Taxes on the use of fixed assets | Tax on means of transport | 1.9 |
| **Pollution and resource tax** | | | **4.1** |
| | Taxes on pollution | Levies on environmental exploitation | 2.3 |
| | Other taxes on production n.e.c. | The National Fund for Environmental Protection and Water Management—other legal payments | 1.6 |

**Table A2.1 Structure of environmental tax revenues, percent of total, 2019 (continued)**

**Romania**

| | | | |
|---|---|---|---|
| **Energy** | | | **93.2** |
| | Excise duties and consumption taxes | Excises from energetical products sales | 73.9 |
| | Taxes on pollution | Revenues from the sale of emission permits | 14.9 |
| **Transport** | | | **6.6** |
| | Taxes on the use of fixed assets | Motor vehicle tax (legal persons) | 2.3 |
| | Payments by households for licenses | Motor vehicle taxes owned by individuals | 4.3 |
| **Pollution and resource tax** | | | **0.2** |
| | Taxes on pollution | Environmental fees | 0.1 |
| | Other taxes on production n.e.c. | Tax on mineral extraction activities | 0.1 |

**In line with increased EU climate ambitions, the Energy Taxation Directive is currently being revised.**[3,4] The revisions will primarily focus on the following issues:

- Persistence of fossil fuel subsidies with highly divergent national rates combined with a wide range of tax exemptions and reductions (not in line with the objectives of the European Green Deal). Some sectors (aviation and maritime transport) are currently fully exempt from energy taxation, while an important part of the burden falls on others (land transport), increasing the fragmentation of the internal market and distorting the level playing field across the economy.
- Aligning the ETD with other EU policy objectives (including the EU ETS, the Renewables Directive and the Energy Efficiency Directive) to more adequately promote GHG emission reductions, energy efficiency, or alternative fuels (hydrogen, synthetic fuels, e-fuels, advanced biofuels, electricity, etc.).
- The ETD does not anymore achieve its primary objective in relation to the proper functioning of the internal market, as the minimum tax rates have lost significance. In the absence of an indexation mechanism, their real value has eroded over time and they no longer have a converging effect on national rates as the vast majority of Member States tax most energy products and, in some cases electricity, considerably above the ETD minimum.

# Notes

1 The national plans outline policies and measures covering energy efficiency, renewables, greenhouse gas emissions reductions, interconnections as well as research and innovation.

2 Communication from The Commission to The European Parliament, The Council, The European Economic and Social Committee and The Committee of The Regions. An EU-wide assessment of National Energy and Climate Plans Driving forward the green transition and promoting economic recovery through integrated energy and climate planning COM/2020/564 final 17.09.2020

3 A series of measures announced in the European Green Deal also includes, among others, the review of the Emissions Trading System Directive; Effort Sharing Regulation; Land use, land use change and forestry Regulation; Energy Efficiency Directive; Renewable Energy Directive; $CO_2$ emissions performance standards for cars and vans; Alternative Fuels Infrastructure Directive.

4 https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12227-Revision-of-the-Energy-Tax-Directive-

# Annex 3
# Illustrative carbon tax rates for non-ETS sectors

**POLAND**

| | Energy tax existing €/ energy unit | Energy tax existing €/ Gigajoule (GJ) | Adjusted energy tax rate (€/GJ) | Adjusted carbon tax €15/t$CO_2$ in €/GJ | Adjusted carbon tax €15/t$CO_2$ in €/energy unit | Revised tax rate, total €/energy unit |
|---|---|---|---|---|---|---|
| **Motor Fuels** | | | | | | |
| Petrol | €383/hl | €11.96 | €11.96 | €1.04 | €33/hl | €416/hl |
| Diesel | €337/hl | €9.36 | €9.36 | €1.11 | €40/hl | €377/hl |
| LPG | €191/t | €7.56 | €7.56 | €0.95 | €24/t | €215/t |
| Natural gas | - | €0/GJ | €0/GJ | €0.84 | €0.84/GJ | €0.84/GJ |
| **Industry** | | | | | | |
| Diesel | €337/hl | €9.36 | €9.36 | €1.11 | €40/hl | €377/hl |
| Kerosene | €447/hl | €13.78 | €13.78 | €1.12 | €35/hl | €482/hl |
| LPG | €191/t | €7.56 | €7.56 | €0.95 | €24/t | €215/t |
| Natural gas | - | - | - | €0.84 | €0.84/GJ | €0.84/GJ |
| **Business Heating** | | | | | | |
| Diesel | €53/hl | €1.47 | €1.47 | €1.11 | €40/hl | €93/hl |
| Heavy fuel oil | €15/t | €0.37 | €0.37 | €1.58 | €37/t | €52/t |
| Kerosene | €447/hl | €13.78 | €13.78 | €1.12 | €35/hl | €482/hl |
| LPG | €13/t | €0.53 | €0.53 | €0.95 | €24/t | €37/t |
| Natural gas | €0.29/GJ | €0.29 | €0.29 | €0.84 | €0.84/GJ | €1.13/GJ |
| Coal | €0.15/GJ | €0.15 | €0.15 | €1.43 | €1.43/GJ | €1.58/GJ |
| **Households Heating** | | | | | | |
| Diesel | €53/hl | €1.47 | €1.47 | €1.11 | €40/hl | €93/hl |
| Heavy fuel oil | €15/t | €0.37 | €0.37 | €1.58 | €37/t | €52/t |
| Kerosene | €447/hl | €13.78 | €13.78 | €1.12 | €35/hl | €482/hl |
| LPG | €13/t | €0.53 | €0.53 | €0.95 | €24/t | €37/t |
| Natural gas | €0.29/GJ | €0.29 | €0.30 | €0.84 | €0.84/GJ | €1.14/GJ |
| Coal | €0.15/GJ | €0.15 | €0.15 | €1.43 | €1.43/GJ | €1.58/GJ |
| **Electricity** | | | | | | |
| Business | €1.14/MWh | €0.32 | €0.32 | ETS | ETS | €1.14/MWh |
| Households | €1.14/MWh | €0.32 | €0.32 | ETS | ETS | €1.14/MWh |

**CROATIA**

| | Energy tax existing €/ energy unit | Energy tax existing €/ Gigajoule (GJ) | Adjusted energy tax rate (€/GJ) | Adjusted carbon tax €15/t$CO_2$ in €/GJ | Adjusted carbon tax €15/t$CO_2$ in €/energy unit | Revised tax rate, total €/energy unit |
|---|---|---|---|---|---|---|
| **Motor Fuels** | | | | | | |
| Petrol | €521/hl | €16.28 | €15.24 | €1.04 | €33/hl | €521/hl |
| Diesel | €413/hl | €11.47 | €11.47 | €1.11 | €40/hl | €453/hl |
| LPG | €13/t | €0.53 | €0.53 | €0.95 | €24/t | €37/t |
| Natural gas | - | - | €0.53 | €0.84 | €0.84/GJ | €1.37/GJ |
| **Industry** | | | | | | |
| Diesel* | €57/hl | €1.59 | €1.59 | €1.11 | €40/hl | €97/hl |
| Kerosene | - | - | €0.65 | €1.12 | €35/hl | €56/hl |
| LPG | - | - | €1.62 | €0.95 | €24/t | €65/t |
| Natural gas | - | - | €0.30 | €0.84 | €0.84/GJ | €1.14/GJ |
| **Business Heating** | | | | | | |
| Diesel | €57/hl | €1.59 | €1.59 | €1.11 | €40/hl | €97/hl |
| Heavy fuel oil | €22/t | €0.54 | €0.54 | €1.58 | €37/t | €59/t |
| Kerosene | €236/hl | €7.30 | €7.30 | €1.12 | €35/hl | €271/hl |
| LPG | €13/t | €0.53 | €0.53 | €0.95 | €24/t | €37/t |
| Natural gas | €0.15/GJ | €0.15 | €0.15 | €0.84 | €0.84/GJ | €0.99/GJ |
| Coal | €0.31/GJ | €0.31 | €0.31 | €1.43 | €1.43/GJ | €1.74/GJ |
| **Households Heating** | | | | | | |
| Diesel | €57/hl | €9.17 | €9.17 | €1.11 | €40/hl | €97/hl |
| Heavy fuel oil | €22/t | €5.11 | €5.11 | €1.58 | €37/t | €59/t |
| Kerosene | €236/hl | €10.19 | €10.19 | €1.12 | €35/hl | €271/hl |
| LPG | €13/t | €0.53 | €0.53 | €0.95 | €24/t | €37/t |
| Natural gas | €0.30/GJ | €0.30 | €0.30 | €0.84 | €0.84/GJ | €1.14/GJ |
| Coal | €0.31/GJ | €0.31 | €0.31 | €1.43 | €1.43/GJ | €1.74/GJ |
| **Electricity** | | | | | | |
| Business | €0.50/MWh | €0.14 | €9.50 | ETS | ETS | €0.50/MWh |
| Households | €1.01/MWh | €0.28 | €9.50 | ETS | ETS | €1.01/MWh |

* https://narodne-novine.nn.hr/clanci/sluzbeni/2020_12_148_2889.html

**BULGARIA**

| | Energy tax existing €/ energy unit | Energy tax existing €/ Gigajoule (GJ) | Adjusted energy tax rate (€/GJ) | Adjusted carbon tax €10/t$CO_2$ in €/GJ | Adjusted carbon tax €10/t$CO_2$ in €/energy unit | Revised tax rate, total €/energy unit |
|---|---|---|---|---|---|---|
| **Motor Fuels** | | | | | | |
| Petrol | €363/hl | €11.34 | €10.65 | €0.69 | €22/hl | €363/hl |
| Diesel | €330/hl | €9.17 | €9.17 | €0.74 | €27/hl | €357/hl |
| LPG | €174/t | €6.87 | €6.87 | €0.63 | €16/t | €190/t |
| Natural gas | €0.43/GJ | €0.43 | €0.43 | €0.56 | €0.56/GJ | €0.99/GJ |
| **Industry** | | | | | | |
| Diesel | €330/hl | €9.17 | €9.17 | €0.74 | €27/hl | €357/hl |
| Kerosene | €330/hl | €10.19 | €10.19 | €0.72 | €23/hl | €353/hl |
| LPG | €174/t | €6.87 | €6.87 | €0.63 | €16/t | €190/t |
| Natural gas | €0.43/GJ | €0.43 | €0.43 | €0.56 | €0.56/GJ | €0.99/GJ |
| **Business Heating** | | | | | | |
| Diesel | €330/hl | €9.17 | €9.17 | €0.74 | €27/hl | €357/hl |
| Heavy fuel oil | €205/t | €5.11 | €5.11 | €0.62 | €25/hl | €230/hl |
| Kerosene | €330/hl | €10.19 | €10.19 | €0.72 | €23/hl | €353/hl |
| LPG | - | - | - | - | €16/t | €16/t |
| Natural gas | €0.31/GJ | €0.31 | €0.31 | €0.56 | €0.56/GJ | €0.87/GJ |
| Coal | €0.31/GJ | €0.31 | €0.31 | €0.95 | €0.95/GJ | €1.26/GJ |
| **Households Heating** | | | | | | |
| Diesel | €330/hl | €9.17 | €9.17 | €0.74 | €27/hl | €357/hl |
| Heavy fuel oil | €205/t | €5.11 | €5.11 | €0.62 | €25/hl | €230/hl |
| Kerosene | €330/hl | €10.19 | €10.19 | €0.72 | €23/hl | €353/hl |
| LPG | - | - | - | - | €16/t | €16/t |
| Natural gas | - | - | €0.30 | €0.56 | €0.56/GJ | €0.86/GJ |
| Coal | €0.31/GJ | €0.31 | €0.31 | €0.95 | €0.95/GJ | €1.26/GJ |
| **Electricity** | | | | | | |
| Business | €1.02/MWh | €0.28 | €0.28 | ETS | ETS | €1.02/MWh |
| Households | - | €0.28 | €0.28 | ETS | ETS | €1.02/MWh |

# Annex 4
# Carbon Pricing Assessment Tool

The Carbon Pricing Assessment Tool is a spreadsheet-based model and aggregator of external models to support environmental tax reform and carbon pricing efforts. It allows for rapid estimation of the effects of carbon pricing and fossil fuel subsidy reforms along several economic and non-economic dimensions. These include critical macroeconomic variables, energy consumption, local and global pollutants, 'development co-benefits', distribution/equity, and poverty. Its objectives are to:

- Help decision-makers and analysts do quick diagnostics on the potential benefits from explicit carbon pricing and fossil fuel subsidy reforms to inform SCDs and other country strategies;

- Provide first estimates of benefits across different dimensions (from tax revenues to health) to start an engagement with country counterpart and identify areas where more in-depth analyses are needed or promising.

CPAT is being developed by the World Bank and the International Monetary Fund.

CPAT allows the user to input choices regarding the policy under investigation (such as a carbon tax trajectory, with different options for exemptions and recycling of the revenues) and modeling choices (e.g., choice between different data sources). The tool produces a series of assessment of the impact of the policy scenarios on several dimensions including:
- mitigation and energy efficiency (i.e., the reduction in GHG emissions, changes in energy consumption);
- macroeconomic and fiscal aggregates (GDP, tax revenues);
- air pollution and health (concentration, but also mortality and morbidity);
- transport (road fatalities and congestion);
- distributional impacts (per income decile, but also urban/rural, and industrial outputs)

A schematic view of the tool is provided in Figure A4.1.

This section provides a summary of the methodologies used by each of the modules, as well as basic comparison with state-of-the-art models that are specialized in the sub-dimensions of environmental fiscal reform analyzed in this report.

**Figure A4.1** CPAT model structure

### DASHBOARD

A chart-driven, user-friendly interface

**Structure:**
- carbon pricing policy – energy/carbon taxes, feebates, ETSs
- revenue use – tax reductions, transfers, expenditures
- complementary policies – fossil fuel & electricity subsidy reform
- advanced module options:
  - key projection sources (IMF, WB, IEA etc.)
  - elasticities (price, income, substitution)
  - rates of improvement
  - other module-specific options

### MANUAL INPUTS

An optional tab for advanced users

**Structure:**
- takes inputs from other models (e.g. CGE, DSGE, macrostructural) or where user has more detailed knowledge (e.g. prices, elasticities)

USER INPUTS

### MITIGATION MODULE

A reduced form energy-macro model

**Structure:**
- 4 sectors:
  - power — electricity from fossil fuels & renewable sources
  - residential
  - transport — road, rail, shipping & aviation
  - industries — 11 subsectors
- 15 energy sources: renewables & non-renewables (coal, natural gas, oil, etc.)

**Inputs (already in CPAT):**
- current domestic prices & taxes (from various sources)
- GDP projections (WEO, WB)
- international fuel price projections (IMF, WB, IEA, BNEF)
- elasticities (price, income, substitution; from various sources) & rates of improvement

**Outputs (all to year 2030):**
- energy consumption & prices
- GDP effects (via fiscal multipliers)
- tax revenues
- GHGs ($CO_2$, $CH_4$, SLCPs) & other climate forcing pollutants ($PM_{2.5}$, $NO_x$, $SO_2$, BC, NMVOCs) vs. NDC
- fossil fuel imports

ENERGY CONSUMPTION CHANGES

ENERGY PRICE CHANGES

MOTOR FUEL PRICE CHANGES

### AIR POLLUTION MODULE

A reduced form air pollution and health model

**Structure:**
- uses national emissions factors (IIASA's GAINs) by fuel-sector pairs, emissions-concentrations (TM5-FASST, EU JRC, and source app. studies), and dose-response functions (GBD 2019) to estimate health benefits of reductions in local air pollution ($PM_{2.5}$, $NO_x$, $SO_2$, $O_3$, $CH_4$, BC, NMVOCs, SLCPs)

**Outputs:**
- reductions in mortality & morbidity from reductions in local air pollutants — national totals by age group, fuel & sector source, and inside vs. outside of the country, lost wages & health expenditures

### DISTRIBUTIONAL MODULE

A cost-push microsimulation model for estimating effects on equity & industries

**Structure:**
- uses harmonized HH surveys (WB & country), IO tables (GTAP), and price changes in mitigation module sectors to model welfare effects of changes in prices (direct & indirect), cash transfers, taxes and expenditures

**Outputs:**
- consumption losses less income gains for deciles, urban vs. rural, and horizontal equity (p25, p75); impact on industrial input and output prices

### TRANSPORTATION MODULE

A reduced form model estimating effects on fatalities & congestion from motor fuel price changes

**Structure:**
- uses econometrically-estimated country-specific elasticities (accidents & congestion wrt motor fuel prices)

**Outputs:**
- road fatalities & congestion (peak & non-peak)

# Annex 5
# Methodological note on household impact of carbon taxes in Poland

## Estimating carbon tax

Estimates of the carbon tax that households would pay are based on their reported consumption values, based on the expenditures reported in the Household Budget Survey (HBS). Box 3.2 uses the most recent Input-Output table for Poland from 2015, and environmental economic accounts from the same year. The latter provides information on carbon dioxide emissions in Poland by economic activity and through direct emissions from households (for heating and transportation).

Two scenarios of carbon taxes are considered: the *lower-case scenario* and *upper-case scenario*. The *upper-case scenario* assigns a carbon tax equal to EUR 45 per ton of emissions to each sector. This is done in an additive manner, whereby the carbon tax is levied in addition to other excise taxes. In the *lower-case scenario*, there is a distinction between ETS and non-ETS sectors, with a carbon tax of EUR 15 per ton to non-ETS sectors, and EUR 45 to sectors that are already covered by the ETS regulations. The annual revenues from such carbon tax are equal to PLN 48.2 billion in the *upper-case scenario* and PLN 36.3 billion in the *lower-case scenario*.

Using information from the Input-Output table on total output at basic prices for the same CPA 2008 sectors, the share of carbon tax in the output of the sector is established. Those are used as price changes by sector that have both direct and indirect effects on final products and services purchased by households. For example, a carbon tax imposed on the *Transportation and Storage* sector, has direct effect on transportation services purchased by households, and will also indirectly affect multiple other products that use transportation and storage in their production process. The total price changes by sector are then imposed on expenditure items from the HBS that were mapped to CPA 2008 sectors. Carbon tax, like the excise tax, and unlike VAT, is assumed to cascade through the production process.

The carbon tax is assigned to households in line with their actual expenditures reported in HBS, which tends to fall below aggregate consumption in national accounts. Thus, the total amount of carbon tax imposed on households in the model is equal to PLN 33.0 billion in the *upper-case scenario* and PLN 28.5 billion in the *lower-case scenario* (60% of total revenues in the *upper-case scenario* and 56% in the *lower-case scenario*).

## Integrating the carbon tax into the microsimulation model

The carbon tax is than integrated into the SIMPL model developed at the Centre for Economic Analysis, CenEA, which is a comprehensive microsimulation model based on the Polish Household Survey Data, and the oldest running microsimulation model in Poland (see for example: Bargain *et al.* 2007, Morawski and Myck 2009, Myck *et al.* 2015, Myck and Trzciński 2019).

In the estimation of labor supply response, the discrete choice labor supply literature is followed (van Soest 1995, Blundell *et al.* 2000, Bargain *et al.* 2006, Brewer *et al.* 2006) and preferences are estimated using a mixed logit approach. The labor market choice observed in the data is assumed to maximize the utilities of the modelled individuals conditional on disposable incomes and leisure available in the specified labor market scenarios. Given the details available in the data, the model is based on three possible labor market scenarios (not working, working part time and working full time). Since the estimation process relies on the comparison of disposable incomes in the available labor market scenarios, information on wages is needed for those for whom wages are not observed in the data. These wages need to be imputed. This is done using the standard wage equation. In total five separate labor supply estimations are run, which are conditional on the demographic composition of the units that are modeled and the labor market status of the modelled individuals.

Disposable incomes in all the potential labor market scenarios are computed using the microsimulation model which covers the majority of fiscal instruments of the Polish tax and benefit system, such as social security contributions, personal income tax, as well as universal and means tested benefits (e.g. the Family 500+ Benefit, Family Allowance with supplements, the Housing Benefit and different elements of Social Assistance).

A limitation of the approach used in this paper from the perspective of carbon tax analysis relates to a lack of detailed behavioral, lifecycle or general equilibrium effects. In this case, labor supply responses are simulated but consumption switching behavior in response to price changes is not.

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