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The climate change challenge and fiscal instruments and policies in the EU

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Contents

Abstract

Fiscal policy plays a prominent role in climate change mitigation and adaptation. An optimal combination of revenue policies, in particular taxes, and expenditure policies, such as subsidies and investment, is essential in order to achieve greenhouse gas emissions targets. This paper analyses the main fiscal instruments in place in European Union Member States, focusing on specific issues, such as the fiscal impact of extreme weather events, the interaction between debt sustainability and climate change, the green investment gap and the distributional impact of climate policies. The paper aims to provide an overview of existing fiscal policies and of the main fiscal challenges for a comprehensive European climate change strategy.

JEL codes: H2, H5, H6, Q54, Q58, D63.

Keywords: climate change, carbon tax, debt sustainability, green investment, extreme weather events, redistribution.

Non-technical summary

The European Union (EU) has pledged to reach (net) carbon neutrality by 2050. This will require additional efforts on the policy front, many of which will have a fiscal angle.

Currently, all EU countries use a combination of fiscal revenue and expenditure policies to mitigate the effects of climate change. On the revenue side, the European Union Emissions Trading System (EU ETS) plays a prominent role. On the expenditure side, most of the policies involve investing in clean energy sources and improving energy efficiency.

The fiscal climate policies currently in place in EU countries are not ambitious enough to reach the target of "net zero" emissions. First, there is a carbon price gap between the current policies and the price needed to substantially reduce greenhouse gas (GHG) emissions. Second, green investment is below the level required to fulfil the target.

This paper starts by analysing the direct and indirect interplay of climate change and fiscal policy. One channel through which climate change affects fiscal soundness is its negative consequences on economic growth. For example, this is illustrated by the direct impact of extreme weather events on economic activity and fiscal balances. In the longer run, climate change can affect public debt sustainability through various transmission channels, including productivity, direct budgetary costs and interest rates.

The paper goes on to provide an overview of the various policy instruments at EU governments' disposal to tackle climate change, emphasising climate change targets, fiscal instruments and other regulatory policies. In particular, it sheds light on environmental tax policies to foster environmental protection and higher energy efficiency. There is significant heterogeneity across countries in the type and size of instruments used, as well as in terms of their evolution over time.

The paper delves deeper into the limitations of current policies in the fight against climate change, focusing on the carbon price gap and the green investment gap. Despite the recent stepping up of policy efforts thanks to Next Generation EU (NGEU) funding, current policy instruments may still be insufficient to encourage emission reduction through behavioural changes and increases in green energy and energy efficiency investments. Access to financing is a fundamental factor in fostering green investment policies, with green financing taking on greater significance at the national and European level.

Lastly, the paper addresses some additional considerations for the design of fiscal climate policies. First, it takes into account the need to compensate lower income groups that are more affected by climate change and the respective mitigation policies. Climate policies such as carbon pricing tend to be regressive, while climate change itself can overburden lower income households with less capacity to adapt than higher income households. In addition, it considers the repercussions of unilateral climate change policies. Although climate change is a global problem, most of the policy levers are national and heterogeneous across countries. Carbon taxation can entail a loss of competitiveness when it is not multilaterally imposed, discouraging climate change mitigation and adaptation efforts. These issues have informed recent discussions at EU level about the implementation of a Carbon Border Adjustment Mechanism (CBAM), as well as regarding the efficient recycling of carbon taxation revenues to mitigate the potentially adverse short-term effects of carbon taxes.

1 Introduction

Climate change is one of the most pressing challenges for humanity and requires governments to reduce greenhouse gas (GHG) emissions. Recent reports from the Intergovernmental Panel on Climate Change (IPCC) warned that, without additional action, an increase in the global average temperature of at least 1.5°C compared with the 1850-1900 period is highly probable. Other studies suggest that the rise in global temperatures may be even higher, amounting to as much as 4.3°C compared with pre-industrial levels by 2100 (Nunn et al., 2019). The European Union (EU) has a leading climate change strategy and has set itself the goal to reduce net GHG emissions to zero by 2050.[1] To achieve this, additional changes in consumption patterns and increased investment in alternative sources of energy and climate change adaptation are needed.

Fiscal policy plays a prominent role in the emissions reduction strategy, both through taxes and expenditures. Besides fiscal policy, governments can use command-and-control regulation, such as setting emissions standards, to support emissions reduction. Over the past few decades, most EU Member States have adopted a combination of energy taxes and clean energy investment to foster emissions reduction, although implementation is highly heterogeneous across countries. In addition, the creation of the EU Emissions Trading System (EU ETS) in 2005 was an important milestone, being the first multilateral instrument created to tackle climate change. A new policy initiative for EU-financed expenditure adopted during the coronavirus (COVID-19) crisis, the Next Generation EU (NGEU) programme, is also dedicated in large part to clean energy investments. Moreover, to finance the reforms and investments embedded in the recovery and resilience plans (RRPs), the European Commission plans to raise 30% of NGEU funds via the issuance of green bonds. However, the overall impact of the NGEU on the climate is unclear and not easy to assess. It will depend on the successful implementation of the RRPs.

Nevertheless, so far the use of fiscal instruments has been limited and insufficient to meet current climate-related goals. This paper describes the variety of fiscal instruments in place in EU countries to help meet climate change targets. This is particularly important, as homogenous statistical indicators on environmental challenges and policies are not readily available, but should be the basis for evidence-based policy decisions. It then sheds light on specific issues related to the interaction of climate change and fiscal policy, such as the fiscal effects of extreme weather events, fiscal sustainability issues, green financing and wealth redistribution. The scope of the paper is to underscore the current role of fiscal policy in the EU in meeting climate change targets and to provide an overview

[1] The outbreak of war in Ukraine in early 2022 and the ensuing energy crisis have put the energy transition at a crossroads. On the one hand, it may accelerate the use of renewable energy. On the other, it may postpone planned decarbonisation efforts or even increase the use of "dirtier" energy sources such as coal in the short term. Moreover, mitigation measures to limit energy price increases could imply higher emissions.

of the fiscal challenges ahead for a comprehensive European climate change strategy.

The paper is organised as follows. Section 2 takes stock of the fiscal repercussions of climate change by focusing on two specific aspects: the impact of extreme weather events on fiscal balances and the implications of climate change for fiscal sustainability. Section 3 outlines the current fiscal instruments in place in EU Member States, on both the revenue and the expenditure sides. Section 4 discusses gaps in investment needs and carbon pricing that need to be bridged in order to meet climate change goals. Section 5 delves into two pending issues, namely the impact on redistribution of climate change instruments and the issues related to a unilateral carbon tax. Section 6 concludes.

2 Macroeconomic and fiscal costs of climate change

The expected increase in global temperatures will generate both direct and indirect negative macroeconomic and fiscal effects.[2] Global temperatures have been increasing over the years; according to the IPCC (2021), the likely range of human-caused global surface temperature increase from 1850-1900 to 2010-19 is 0.8-1.3°C. Moreover, it finds that temperatures in Europe are set to rise at a rate exceeding global mean temperature changes. These dynamics will almost certainly increase the frequency of extreme weather events. The direct economic costs of climate change are associated with damages in capital stock and production, notably in climate-sensitive regions and sectors (for example, lower productivity of the agricultural and industry sector, substitution effects for the tourism sector), as well as adverse effects on trade, investment, the health system and migration flows (IMF, 2008; Dimitríjevics et al., 2021). Indirectly, there may also be second-round effects on inflation owing to supply shortages and on financial asset prices and financial stability (Dafermos et al., 2018; Andersson et al., 2020).

Estimates of climate change effects on output are very uncertain and depend heavily on assumptions and the modelling of feedback loops (for a survey of the estimates of GDP losses from rising temperatures, see ESRB, 2020 and NGFS, 2021). Kahn et al. (2019) find that per capita real output growth is adversely affected by persistent changes in temperature; in particular, a sustained increase in the average global temperature of 0.04°C per year – corresponding to a high GHG emissions pathway without specific climate mitigation targets – could reduce world real GDP per capita by more than 7% by 2100. Kalkuhl and Wenz (2020) estimate that an increase in global temperatures of around 3.5°C by the end of the century would reduce global output by 7-14% in 2100. According to the OECD (2015), a projected increase in global temperatures of 1.5-4.5°C would negatively affect the level of global real GDP in the range of 2-10% by 2100.

Behind these aggregate figures, it is also important to take into account that the output effects are set to be largely heterogeneous, both across countries and within countries (see Box 4) but also across sectors (Andersson et al., 2020). According to the IMF (2021), the effects on GDP depend on the annual average temperature: if the latter lies above an estimated threshold level of approximately 13-15°C, a further increase in the temperature will reduce GDP. Challenges related to climate change can affect different countries in different ways. Concerning the heterogeneity across sectors, Fernando et al. (2021) show that, in many regions, the largest impact is on the agricultural sector. In addition, smaller countries may face higher expected costs from extreme regional weather events.

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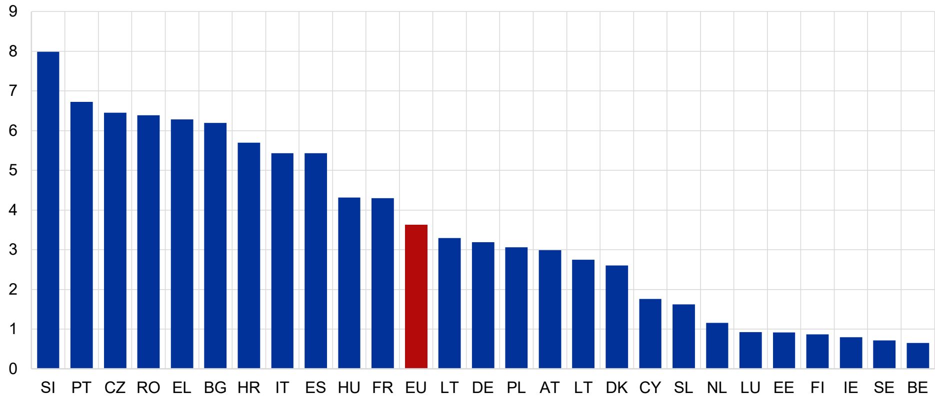
[2] Studies assessing the economic impact of climate change commonly estimate damage functions, which account for the output loss as a function of changes in global temperature (see, for example, Pindyck, 2013).

Extreme weather events may place a direct and indirect burden on public finances (see Box 1 and Box 2). The budgetary impact can be direct – higher public expenditure associated with relief measures, repairs and maintenance of infrastructure but also prevention measures (e.g. building of dykes) – as well as indirect, namely through an eroding revenue base as a result of output loss or higher public expenditure on social payments owing to lower incomes. Estimates of total cumulated GDP losses from extreme weather and climate-related events in the period 1980-2020 amount on average to 3.6% of 2020 GDP for the EU Member States shown in Chart 1, ranging from around 0.6% in Belgium to 8.0% in Slovenia.[3]

Chart 1

Cumulative GDP losses owing to extreme weather and climate-related events

(percentages of 2020 GDP, 1980-2020)



Sources: European Environment Agency, AMECO and own calculations.
Note: Malta is not included, as most of the events are related to transport accidents that occurred at sea but which are not specifically climate-related.

Empirical studies on the fiscal costs of natural disasters are scarce but point to a rather limited budgetary effect.[4] Using a panel vector autoregressive model over the period 1975-2008, Melecky and Raddatz (2015) study the role of debt market development and insurance penetration in facilitating fiscal responses following natural disasters. They find that public deficits increase less in countries with higher insurance penetration, as they can quickly allocate private resources to recover productive capacity rather than using public resources. Bräuer et al. (2009) find that direct annual fiscal costs for Germany will amount to €3.4-15.9 billion (0.1-0.3% of GDP) in 2100, reflecting shifts in foreign demand for German goods, tourism and pressures from migration and capital flows. Indirect costs are larger, estimated at €22.9-104.6 billion as a result of shifts in income and investment in less productive capital. Based on a computable general equilibrium model for Austria, Bachner and Bednar-Friedl (2019) find that, without counterbalancing fiscal instruments, public expenditure on disaster relief measures increases by 184% in 2050 compared with

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3 A small number (about 3%) of unique events is responsible for the majority (about 60%) of economic losses. In this regard, there is high variability in the figures across years. Overall, the average annual (inflation-corrected) losses in the EU27 have increased over time from around €9.5 billion in 1981-90 to €14.5 billion in 2011-20 (equivalent to 0.06-0.10% of GDP).

4 The fiscal costs of physical risks can differ compared with the costs of transition risks depending on the adaptation capacity (e.g. coastal protection) and mitigation capacity of each economy (see also CEPS-ZEW, 2010). However, the overall cost may be higher, as some of the costs might fall on the private sector via insurance.

the model base year (2008) (although these are rather small in levels) and unemployment benefits by 10% owing to lower output. Indirect effects on tax revenue stem from lower production and labour tax revenue. For a panel of 138 developing and developed economies for the period 1985-2007, Lis and Nickel (2010) find that, conditional on the occurrence of a large-scale extreme weather event, annual budget balances deteriorate by between 0.23% and 1.4% of GDP, with effects being larger for developing economies and not statistically significant for EU countries. Focusing on selected case studies of extreme weather events in the EU and the United States since 1990, Heipertz and Nickel (2008) estimate the total (direct and indirect) costs of extreme weather events on public finances to range from 0.3% to 1.1% of GDP.[5]

However, fiscal costs may increase, as the probability of extreme weather events increases over time. Assuming an increase of 3ºC in global temperatures above pre-industrial levels, the EU would face annual GDP losses of at least €170 billion (around 1.4% of EU GDP) (Szewczyk et al., 2020). As shown by Catalano et al. (2020), preventive interventions against catastrophic events may lead to smaller economic losses than either taking no action or waiting until remedial action is necessary. Based on estimates from the Climate Optimisation Model of the Economy and Taxation, Barrage (2020) concludes that optimising carbon taxes may increase welfare gains by 30% relative to an unmitigated climate change scenario. This is due to the fact that carbon pricing may prevent an increase in distortionary taxes designed to finance reactive adaptation policies. Moreover, governments may need to obtain accurate estimates of the potential fiscal costs as well as to devote resources to strengthening the resilience of infrastructure against climate change risks and enhance the efficiency of public investments. Fiscal buffers are also needed to mitigate the potential economic and social effects of climate change risks.

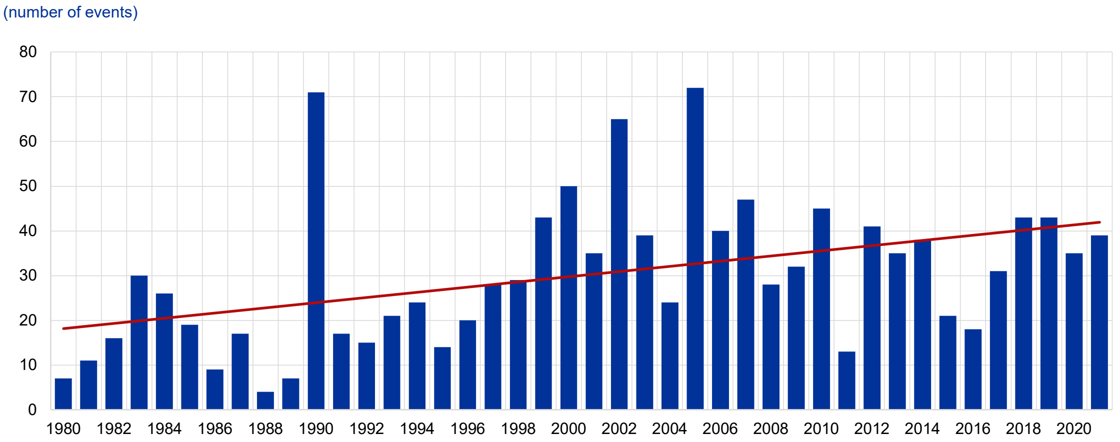
Box 1
The impact of extreme weather events on fiscal balances

While the frequency and intensity of extreme weather events have increased in recent decades, and many observers believe this trend is related to climate change, existing evidence points to a rather limited impact on fiscal balances. This applies in particular to advanced economies, where climate events tend to be less extreme and countries more resilient. We explore this issue, further focusing on European economies.

[5] For the United States, annual hurricane damage amounted to 0.16% of GDP in 2006 and is expected to rise to 0.22% in 2075. Annual estimated federal spending for relief and recovery ranges from 0.1% of GDP in 2016 to 0.13% in 2075 (CBO, 2016). Focusing on the direct fiscal effects of adaptation in the EU, Osberghaus and Reif (2010) find higher costs for transport infrastructure and flood protection.

Chart A

Number of extreme weather events in the EU, 1980-2021



Sources: Emergency Events Database (EM-DAT) and own calculations.
Note: The data cover several types of natural disasters, including earthquakes, floods, wildfires, landslides, droughts and severe storms.

Data on extreme weather events are taken from the Emergency Events Database (EM-DAT) maintained by the Centre for Research on the Epidemiology of Disasters.[6] The database contains several indicators that are useful for gauging the magnitude of extreme weather events, including the number of casualties and affected individuals, and estimates of the economic damages. To estimate the impact of extreme weather events on fiscal balances, we consider an unbalanced panel of 26 EU Member States during the period 1980-2021.[7] The dependent variable in our baseline formulation is the general government primary fiscal balance, expressed as a percentage of GDP. We include controls for the economic cycle, the lagged fiscal balance, the level of debt to GDP, long-term interest rates, as well as country-specific and time-specific effects. Instead of selecting one specific indicator as our proxy for the extreme weather event shock, we use the first principal component derived from the following (standardised) series: the number of extreme weather events, the number of casualties, the total number of affected individuals and the estimated damages, expressed in euro as a percentage of GDP and in per capita terms.[8]

We do not detect an economically significant relationship between extreme weather events and the fiscal balance when considering all countries and all shocks in the sample (Chart B). In this case, the previous year's fiscal balance, the change in contemporaneous real GDP, the level of debt and selected time dummies (i.e. those corresponding to the 2008 financial crisis, the 2012 debt crisis and, more recently, the coronavirus (COVID-19) pandemic) are identified as the relevant determinants of the fiscal balance and provide a reasonably good fit (R2 of around 0.7).

6 The database covers various types of natural disaster, including earthquakes, floods, wildfires, landslides, droughts and severe storms.

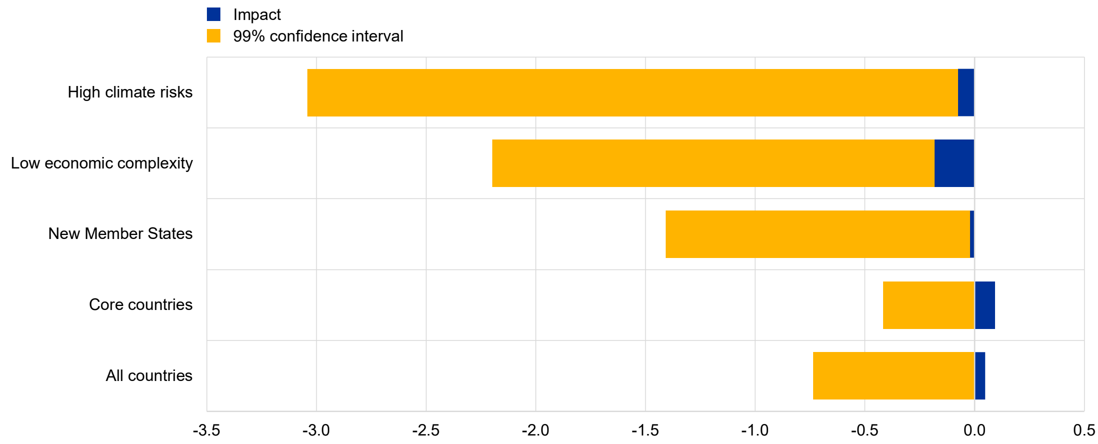
7 Data for newer Member States have typically only been available since the mid-1990s.

8 It is hard to identify one indicator that is always better than the rest at capturing the likely effects of extreme weather events on public finances. A synthetic indicator provides a valuable alternative.

Chart B

Impact of extreme weather events on fiscal balances

(percentages of GDP)



Source: Own calculations.
Notes: The shock is the principal component derived from the number of extreme weather events, casualties, affected individuals and the estimated damages expressed in euro, as a percentage of GDP and in per capita terms, as reported by EM-DAT. Results for the baseline case are in blue, while those for large shocks only (i.e. two standard deviations) are in yellow. New Member States include Bulgaria, the Czech Republic, Estonia, Croatia, Latvia, Lithuania, Hungary, Poland, Romania, Slovenia and Slovakia. Core countries include Belgium, Germany, Ireland, Greece, Spain, France, Italy, Luxembourg, the Netherlands, Austria and Portugal. The Economic Complexity Index (ECI) is based on Hidalgo and Hausmann (2009). The 2021 Global Climate Risk Index is from Eickstein et al. (2021).

The magnitude of the estimated coefficients for the effects of extreme weather events on the fiscal balance is rather small. This applies to both core EU countries and new Member States, and when considering only those countries that rank low in economic diversification or are more exposed to climate risks.

However, the conclusions change remarkably and the fiscal impact of natural hazards becomes substantially higher compared with the baseline case when considering only the largest weather events (i.e. at least two standard deviations above the mean).[9] The central estimate points to a deterioration in the fiscal balance of 0.74% of GDP, which increases to 1.39% for new Member States. The estimated fiscal impact can be even larger when considering countries that are less economically diversified than the sample average or that rank higher in terms of exposure to climate risks.

Overall, in line with existing evidence, our results for European countries suggest that the budgetary impact of extreme weather events is rather limited in the largest and richest economies for shocks with a magnitude that fall within two standard deviations of the sample average.[10] However, major natural disasters – which have been historically rare to date – can have a material impact on the fiscal balance. In particular, countries which have comparatively lower income levels, are less diversified and more exposed to climate risks can suffer even larger losses, calling for continued action to enhance their climate readiness and resilience.

[9] This corresponds to around 10% of the original sample.

[10] Clearly, this does not rule out that the fiscal position of local municipalities, and, more generally, economic activities located in the area exposed to the natural hazard can still suffer significant losses.

Box 2
Climate change and debt sustainability – channels of transmission

Climate change can affect public debt sustainability through various transmission channels, including (1) through its impact on output and the productive capacity of the economy, which could translate into lower government revenue and/or the need for higher spending; (2) through the direct budgetary costs associated with climate change; (3) through the price channel; and (4) through interest rates. All four channels can be ideally recast into "standard" debt sustainability analysis scenarios, in terms of lower growth, higher public expenditure, higher inflation and/or higher interest rates. However, the quantification of these effects is subject to great uncertainty. By way of example, there is an ongoing debate in the academic literature whether these effects are temporary or persistent (Newell et al, 2021; Diffenbaugh and Burke, 2019; Rosen, 2019). The long-term effects on output are particularly hard to gauge, as it is still unclear whether the risks mainly materialise at the level of output or its growth rate. Methods that penalise level of output or growth based on the increase in average temperatures have both been proposed (Batten, 2018). Because of such great uncertainty, it may well be the case that the DSA already incorporates the climate change costs.

Moreover, it is likely that climate change will affect the structure of economic systems in ways that are very difficult to incorporate into standard DSA scenarios (Bouabdallah et al., 2017). The European System of Central Banks is planning to work on integrating climate change into its standard DSA.

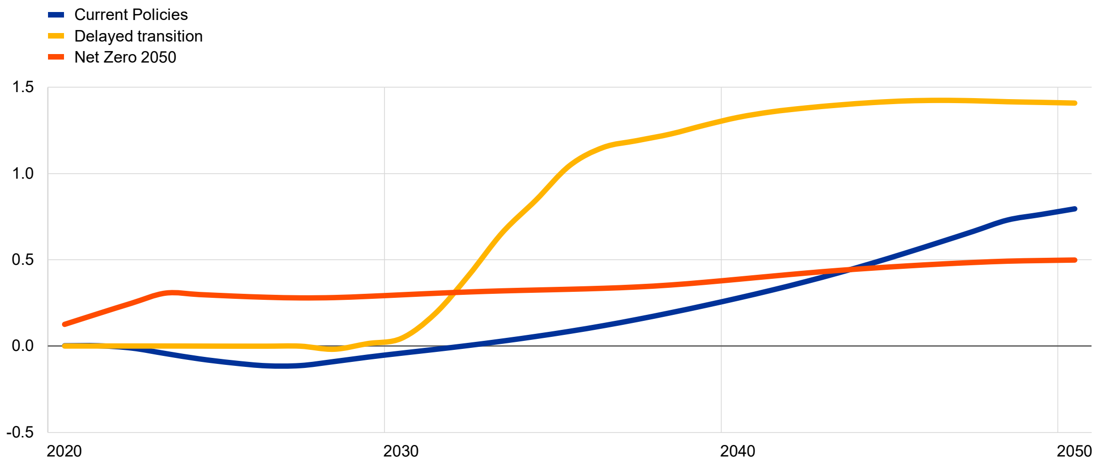
Concerning the output effects, climate change can affect both supply and demand (Batten et al., 2020). For the former, extreme weather events, the intensity and frequency of which are positively correlated with global warming (IMF WEO, October 2017), can reduce the endowments of some input factors (such as land) and destroy physical capital. Hours worked and labour productivity may also decrease in outdoor industries (such as construction) as a result of rising temperatures (Dell et al., 2014). These dampening effects also apply to the demand side of the economy. Private consumption and private investment are expected to decrease owing to lower household wealth and weaker firm balance sheets as well as expectations of feebler growth and higher uncertainty (Fankhauser and Tol, 2005). All of these elements, if not offset by appropriate policies, would have negative effects on debt sustainability.

Governments may take action to limit the negative effects of climate change, mainly through mitigation and adaptation policies. Mitigation policies, embedded primarily in emissions trading schemes, carbon taxes and other charges on pollution externalities, are deployed to decrease GHG emissions. Adaptation policies, which are intended to increase the resilience of the economy (such as by erecting safer and more sustainable buildings and infrastructure), require temporary increases in public expenditure. As long as the revenues from mitigation policies are not sufficient to finance this expenditure, government actions designed to fight climate change and improve fiscal sustainability in the long run may have adverse effects on budget balances in the short to medium term.

Chart A

Long-term interest rate trajectories in climate change transition scenarios

(percentage point changes)



Source: NGFS Climate Scenarios for central banks and supervisors, June 2021.

Climate change may also affect debt sustainability through the price and interest rate channel. Climate change could lead to higher prices in the short to medium term (stemming from structural changes or supply shocks due to higher energy prices), influencing debt levels through inflationary developments.[11] It may also create fluctuations in financial markets and lead to a repricing in bond markets that affects sovereign borrowing costs. Long-term interest rates are generally found to increase in climate change transition scenarios, reflecting the inflationary pressure created by carbon prices as well as the increased investment demand that the transition creates (NGFS, 2021) (see Chart A).

The effects of climate change on risk premiums for sovereign borrowing are more ambiguous. On the one hand, an increased preference for safe assets could have downward effects on government bond prices compared with riskier assets. On the other hand, the Network for Greening the Financial System (2021) finds a general increase in risk premia in scenarios with a disorderly transition, which could also negatively affect government bond markets.

Government borrowing costs may also be indirectly affected by higher contingent liabilities. Disruptions in financial markets due to climate risks and public support to bail out distressed financial institutions or insurers could have sudden and highly adverse effects on government borrowing costs, further exacerbating the direct costs from these events on government financing.

There may also be considerable differences in the way government borrowing rates are affected in different countries. Risk premia and sovereign spreads may react more sharply in countries with a higher exposure to climate change risks. The European Investment Bank (EIB) has developed a model to assess the exposure of individual countries to physical and transition risks, summarised in a sovereign risk score (EIB, 2021a).

Quantifying the impact of these channels in terms of debt ratios is extremely difficult owing to both data and methodological issues. The Fiscal Sustainability Report 2021 by the European Commission includes an “extreme event stress test” to assess the possible risks to public finances

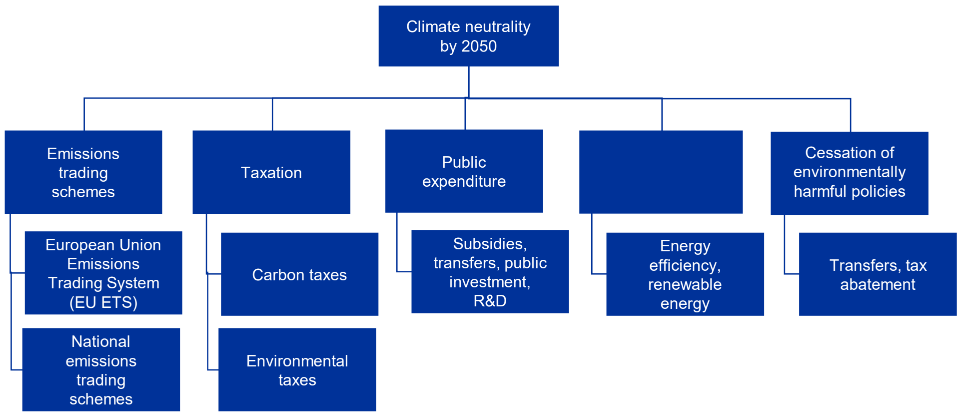
[11] For an overview of the price effects of climate change, see Breitenfellner et al. (2022).

associated with climate change. According to the Commission’s estimates, more extreme weather events following an increase in global temperatures of around 2°C over the next 20 years would lead to an increase in the ratio of public debt to GDP of around 5 percentage points in the Czech Republic and Spain, 3-4 percentage points in Greece, Hungary, Poland and Romania and around 2.5 percentage points in Italy. The impact would be slightly less than 2% of GDP in France and Austria and around 1% in Belgium, Germany and the Netherlands.

3 Current policies in the fight against climate change

EU countries rely on a variety of tools to encourage economic agents to reduce CO2 emissions (Figure 1) **so as to meet climate change targets.** This section provides an overview of the various fiscal policy measures in place, including their evolution over time and heterogeneity across countries. A particular focus is on environmental tax policies to foster environmental protection and higher energy efficiency and, given the distortions of the COVID-19 pandemic, on their magnitude in 2019. Other sets of policies consist of public expenditure measures or regulatory interventions (command-and-control policies). Furthermore, this section discusses the role of environmentally harmful policies.

Figure 1
Overview of policy measures to achieve climate neutrality by 2050



Source: ECB.

3.1 Climate change targets

The EU has set ambitious long-term targets to reduce GHG emissions and limit global warming in line with the Paris Agreement.[12] By 2030, the EU has committed to cut net GHG emissions by at least 55% compared with emissions produced in 1990. By 2050, the EU aims to achieve carbon neutrality.

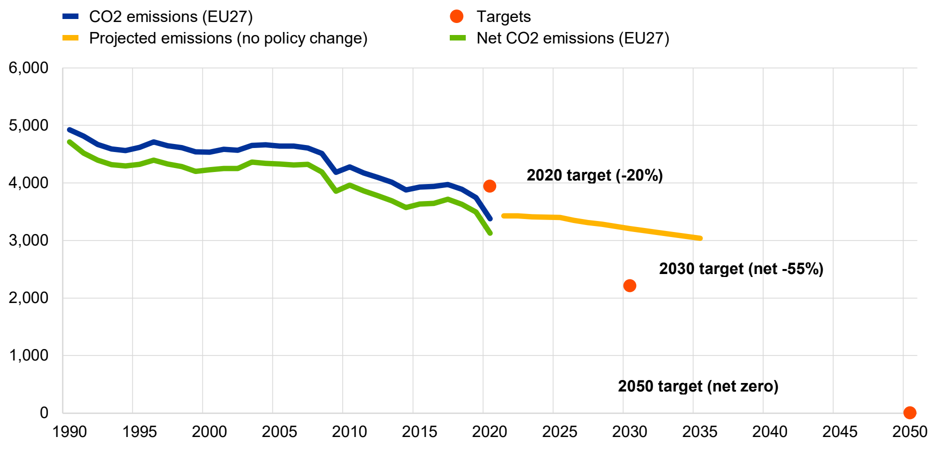
Based on current mitigation policies, significant additional policy efforts at EU and national level are needed to achieve the ambitious targets set for 2030 and 2050. The EU has achieved/exceeded its 20% GHG emission reduction target over

[12] The Paris Agreement is a legally binding international treaty on climate change, which was adopted by 196 parties in December 2015. Its goal is to limit global warning to well below 2 (preferably 1.5) degrees Celsius compared with pre-industrial levels. To achieve this goal, countries must submit, as of 2020, so-called nationally determined contributions every five years outlining concrete climate action plans. In addition, countries are invited to formulate long-term strategies to better guide their nationally determined contributions. As of 2024, countries will need to regularly report on progress made.

the past seven years (apart from in 2017). The pandemic-related recession is estimated to have pushed GHG emissions in 2020 around 31% below the 1990 reference levels (EEA, 2021), although most of that decrease has since been reversed as the EU economy has rebounded.[13] Without any additional action, the European Environment Agency (EEA) projects carbon emissions to fall by around 35% by 2030, thereby falling significantly short of the reduction target of 55% (see Chart 2).

Chart 2
GHG emissions and EU climate change targets

(millions of tonnes of CO2 equivalent (Mt CO2e); targets compared with 1990 levels, percentages)



Source: EEA.
Notes: Total and net emissions (in CO2 equivalents) in the EU27 countries. The projected total emissions assume no policy change and include land use, land use change and forestry. Net emissions take into account carbon removals from forestry activities.

An "effort-sharing" scheme has been put in place with binding national emission targets for 2020 and 2030 for the sectors not included in the EU ETS.[14,15] These targets vary across EU Member States, taking into account their level of economic development as well as cost efficiency considerations. Some countries have set themselves more ambitious targets for 2030 than foreseen under the "effort-sharing" scheme. Targets range from a 55% reduction compared with 2005 in Luxembourg to unchanged emissions in Bulgaria (Chart 3).[16] Based on 2021 estimates for emissions in 2020 and 2030 by the EEA, most EU countries have achieved their 2020 targets in the non-EU ETS sectors (i.e. road transport,

[13] Forster et al. (2020) estimate that the direct effect of the pandemic-related restrictions on the reduction of CO2 emissions will be negligible compared with a baseline scenario in which countries meet their stated nationally determined contributions.

[14] The Effort Sharing Regulation (ESR) was set up in 2014 to complement the EU ETS via annual national targets for the non-EU ETS sectors and to support the economy-wide reduction of emissions by 2030. Progress towards achieving the targets is assessed annually. In case of persistent shortfalls, a penalty in the form of higher reduction obligations is applied.

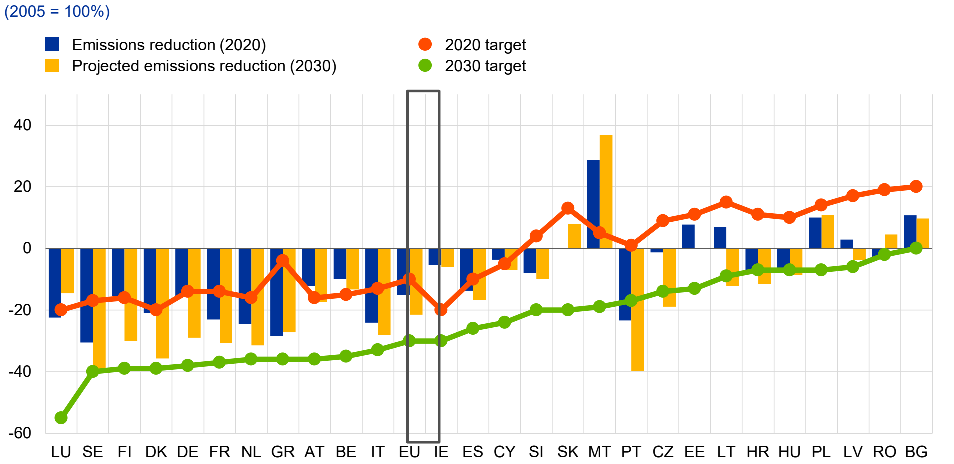
[15] The EU ETS is analysed in Section 3.4.

[16] As part of the "Fit for 55" package, a more ambitious emissions reduction target has been proposed for the sectors covered by the ESR, namely a reduction of 40% in EU emissions by 2030 compared with 2005, as well as amended national targets.

agriculture, heating of households and waste) but are expected to miss their 2030 targets, often by a considerable margin.[17]

Chart 3

National emission targets and projected emissions in non-EU ETS sectors



Sources: European Commission, EEA, national energy and climate plans and own calculations.
Notes: The chart shows emissions for 2020 and projected emissions for 2030 by the EEA, under the assumption of existing climate change measures. The latest available GHG projections are from 2021. Positive values suggest that current policies would result in higher emissions compared with 2005. The national targets for 2030 take into account the more ambitious targets set by some countries, namely Greece, Luxembourg, Slovenia and Slovakia, for the non-EU ETS sectors (information available in 2021). The latter are not reflected in the EU average target shown in the chart.

The impact of the COVID-19 outbreak in early 2020 led to a marked reduction in travel and economic activity, facilitating the achievement of emission targets for 2020. Emissions covered by the EU ETS fell by 13.3% in 2020 compared with 1990 levels, notably reflecting a sharp drop in aviation emissions by around 64%. Emissions in non-EU ETS sectors declined by 15% in 2020 compared with 2005, well below the 10% reduction target foreseen by the effort-sharing legislation. However, the pronounced decline in carbon emissions in 2020 is likely to be temporary and may be more than compensated for going forward due to possible changes in individual behaviour (e.g. commuting by private car instead of public transport) and also given the experience following previous crises (OECD, 2020a). On the other hand, the COVID-19 crisis offered a major opportunity to move towards a greener economy, in particular by fostering green public and private investment in support of the economic recovery following the impulse of NGEU, but also due to individual behavioural changes related to the spread of home working and digitalisation (see also Box 3).

Following the Russian invasion of Ukraine, the EU announced a plan to become independent from Russian fossil fuels by 2027. The plan, dubbed REPowerEU, does not modify the core targets of at least a 55% decrease in net GHG emissions by 2030 and climate neutrality by 2050, but has a marked focus on accelerating the green transition by targeting additional investments in renewable energy and energy savings. According to the Commission, REPowerEU will require an additional investment of €210 billion by 2027, on top of what is already needed to

[17] These estimates are based on the assumption that existing climate change policies will remain in place, but no new measures are assumed to have been adopted.

implement the Fit for 55 proposals, with (unrequested) recovery and resilience facility (RRF) loans providing most of the funding. At the same time, temporary measures to replace part of the Russian natural gas supplies and measures to mitigate energy price increases may have an adverse impact on limiting GHG emissions in the short run. The former may imply an increase in the use of "dirtier" energy sources, such as coal, and the latter implies a change in the incentives to limit energy use.

Overall, the estimates for 2030 suggest that substantial policy efforts will be required to meet the ambitious EU targets. Although many policy instruments are already in place, efforts are rather heterogeneous across countries. Moreover, there seems to be a need to make the mitigation policies more effective and broad-based across the economy. To shed more light on this, the following section will briefly present an overview of the mitigation policies that are already in place at national and EU level.

Box 3
Implications of the COVID-19 pandemic for climate change mitigation

The coronavirus (COVID-19) pandemic caused a severe global health and economic crisis. The enforced and voluntary mobility restrictions and suspension of non-essential business operations across Europe had a major impact on economic activity in 2020. EU real GDP recorded a decline of 5.9% in 2020, while private consumption and investment fell by 7.3% and 6.4% respectively, despite the large fiscal stimulus to mitigate the effects of the pandemic.

The COVID-induced drop in economic activity led to a sharp reduction in CO2 emissions in 2020. The International Energy Agency (IEA, 2022) estimates that global CO2 emissions fell by 5.1% in 2020 compared with 2019. Le Quéré et al. (2020) estimate an annual decrease of between 4.2% and 7.5%, which they argue is comparable to the annual rates of decrease needed over the coming decades to limit global warming to 1.5°C. This is in line with the estimates of the Intergovernmental Panel on Climate Change (IPCC, 2018). The IPCC finds that, by 2030, CO2 emissions need to fall by 45% compared with 2010 levels in order to limit global warming to or below 1.5°C, which implies an annual reduction in emissions of around 6.2%.[18]

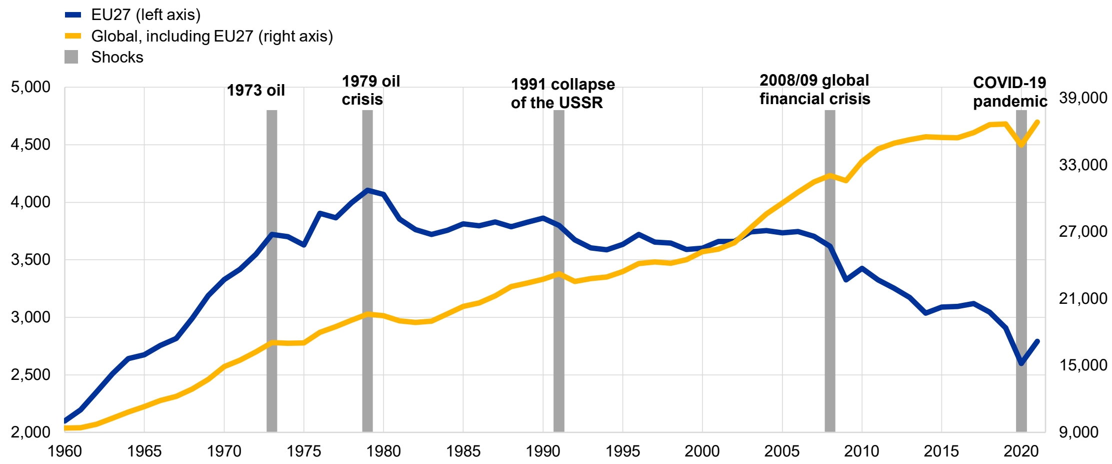
However, the COVID-19-related reduction in carbon emissions was temporary and does not alter the long-term challenges. The decrease resulted from governments' (pandemic-related) restrictive measures rather than policy choices to support the transition to a green and sustainable economy. The IEA (2022) estimates that global energy-related CO2 emissions rebounded by 6% in 2021, which more than reversed the decline observed in 2020. Indeed, the lessons from past crises, including the 2008 global financial crisis, suggest that crisis-related emissions reductions are temporary and are more than offset globally by increased emissions in the following years (OECD, 2020a) (Chart A).

[18] Even limiting global warming to just below 2°C, using the IPCC estimates for a necessary 25% decline in CO2 emissions by 2030, would require an annual reduction in emissions of around 3%.

Chart A

GHG emissions

(Mt CO2)



Sources: Global Carbon Project/Global Carbon Atlas (accessed on 29/03/2022)[19], OECD and own calculations.
Notes: Data for the years 2019 and 2020 are preliminary. For 2021, data are estimated based on IEA (2022) estimates of the percentage change in emissions.

The economic impact of COVID-19 has made it more challenging to enact the mitigation policies needed to achieve the climate targets in a sustainable manner. The 2020 recession, supply chain disruptions and the subsequent drop in energy demand increased uncertainty and generated delays in the installation of new energy infrastructure. Despite the initial forecasts for a slowdown in renewable energy capacity growth (see IEA, 2020b), renewable investment grew substantially in 2020, supported by technology improvements and cost reductions (see IEA, 2021a; 2021b). At the same time, however, the recovery in energy demand led to the use of more coal despite the significant growth in renewable power generation (IEA, 2022). Furthermore, volatility in oil and gas prices, such as the sharp decline observed in 2020 and the subsequent strong increase in 2021-22 (partly related to the economic recovery and decisions taken in 2020 to decrease capacity), may alter the incentives for firms to switch from fossil fuels to low carbon, energy-efficient technologies. This shows how climate policies play a significant role in stabilising climate-related investments (see OECD, 2020a, and Dechezleprêtre et al., 2011).

The crisis provides an opportunity to move towards a green, sustainable economy. To support the green transition, it will be important to make the more climate-friendly activities observed during the COVID-19 crisis into a more permanent feature. This implies limited travel activities and greater focus on the digital transition, by encouraging teleworking and the growth of digital businesses.

In this context, it is encouraging that the EU economic recovery packages will provide the opportunity to better align public policies with climate targets. The recovery and resilience facility (RRF) aims to support climate targets by allocating at least 37% of its funds to the green transition. This could help to achieve a faster reduction in emissions if policies are oriented towards green investments and encouraging the private sector to invest in clean technologies. The OECD (2020a; 2020b) recommends focusing on three areas to align public policy with climate objectives: (i) investing in low-carbon infrastructure, (ii) government support for innovation and start-ups, and (iii) carbon pricing.[20]. Such a policy mix would increase the incentives for firms to develop low-

[19] Friedlingstein et al. (2021) and Andrew and Peters (2021).

[20] See also Hepburn et al. (2020) and Bahar (2020).

emissions production processes and products. As new technologies become increasingly available, the cost of cutting emissions will decrease.

The pandemic crisis provides lessons not just for the next health crisis, but also for climate change risks. It showed the vulnerability of our societies to high-impact global shocks and the important role of public policies in mitigating risks, including climate-related ones. Pandemics and climate change have similarities, as they both entail large negative externalities at a global level and highlight the need to engage in coordinated global action and pay attention to scientific advice.

3.2 Public spending to mitigate climate change

Expenditure measures adopted to combat climate change are manifold and heterogeneous across countries. These measures include transfers to households and subsidies to firms to incentivise emission reductions and lower energy intensity, public expenditure to protect the environment, and public R&D spending to promote cleaner technologies and climate change mitigation. Most measures have been in place for several years and often reflect EU initiatives, such as those related to energy efficiency and a greater share of renewable energy.

Examples of these policy instruments are:

- Energy-efficient renovations of buildings: Almost all EU countries provide financial incentives for the energy-efficient refitting of residential buildings. These measures focus on replacing old, energy-inefficient electricity, heating and warm water systems with newer, energy-efficient ones, as well as improving buildings' thermal insulation.[21] Other examples include transfers for switching to domestic hot water heating systems (e.g. Cyprus, France and Malta) and solid fuel boilers (e.g. Belgium). Malta provides a direct benefit to households to incentivise lower electricity consumption (Eco Reduction scheme). Some countries (e.g. Greece, Cyprus, Malta and Portugal) have introduced such schemes for firms as well. These measures are usually granted in the form of transfers to households or subsidies to firms, and in some cases as tax incentives.[22] Measures that aim to improve the energy efficiency of residential buildings are particularly important, as household energy usage is not covered by the EU ETS.

[21] In Austria, for example, subsidies are provided for the transition from oil heating to "cleaner" heating systems, while in Portugal personal income deductions are applied for the purchase of energy-efficient heat pumps for personal use. In Latvia, some EU ETS revenues and EU funds (structural and RRF) are earmarked for the renovation of buildings (roof, basement and wall insulation) and the upgrading of windows (rather than the replacement of water or heating systems). If efficiency targets are met, the loans are converted to grants.

[22] Examples are CITE (an income tax credit scheme for expenditures related to certain energy or heat-efficient renovation projects for private dwellings) in France, tax credits from corporate income tax (e.g. in Greece for the leasing of low-emission company cars and construction of publicly available electric charging stations, in Hungary for the construction of electric charging stations and investments in energy efficiency targets, and in Malta for investments in technological solutions that provide higher energy efficiency) and a reduced VAT rate for energy-efficient expenditure on residential buildings (e.g. in Cyprus and Hungary).

- Car scrappage schemes: Financial incentives are provided for scrapping older vehicles and/or replacing them with cleaner or even electric models. In some countries, this also applies to company cars (e.g. France, Lithuania, Latvia, Hungary, Malta, Portugal and Finland). However, the literature does not provide concrete evidence on whether such schemes actually achieve their environmental objective (see Section 3.3).

- Higher penetration of renewable energy sources in electricity generation: Such schemes subsidise the price of electricity generated from renewables (e.g. Belgium, the Czech Republic, Cyprus, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Portugal and Finland). Malta, Cyprus, Latvia, Poland, Spain and Portugal have implemented support schemes for households installing PV systems and/or generating electricity from renewables. In addition, the number of renewable energy initiatives has significantly increased in the context of the RRPs in EU countries.

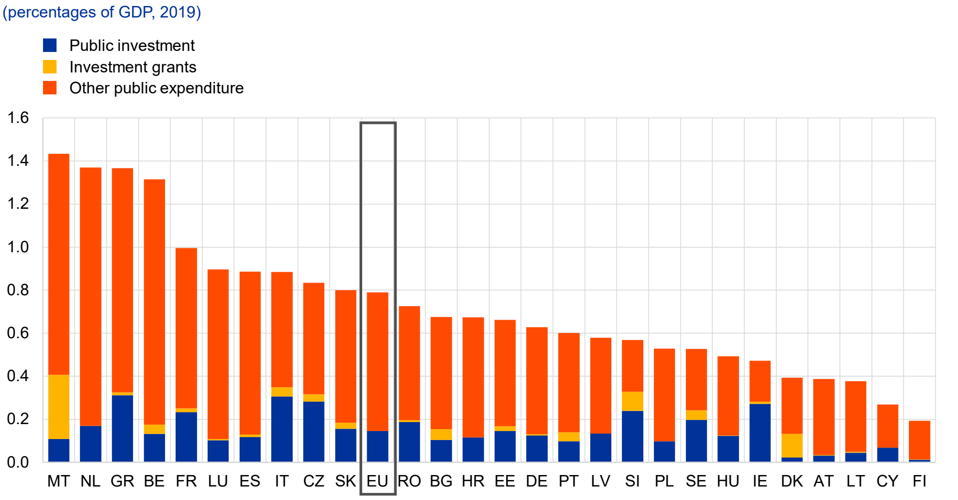
- Other sector-specific schemes: France and Germany have introduced schemes to support the green transition of the automobile sector, Germany to support programmes in hydrogen technology, Greece to support pollution abatements, and many countries to promote the use of public transport and the purchase of more energy-efficient durable consumption goods.

Based on information collected by national central banks in 2020, governments' climate-related spending between 2014 and 2020 was mostly directed towards investments in higher energy efficiency and cleaner energy use in public buildings, public transportation (e.g. in Latvia and Lithuania), "cleaner" electricity generation (e.g. in Greece), expansion of the charging infrastructure for electric cars and support for electric mobility research.

A comprehensive overview of these expenditures is lacking. According to Eurostat data (COFOG), general government expenditure for environmental protection in the EU reached 0.8% of GDP in 2019, ranging from 0.2% in Finland to 1.4% in Malta, Greece and the Netherlands (Chart 4). However, these expenditures consist of many different types of activities, e.g. waste and waste water management, which may be outsourced or otherwise classified outside the general government sector. Investment constitutes around a fifth of environmental protection expenditures, with EU Member States spending on average 0.15% of GDP in 2019 (ranging from 0.01% of GDP in Finland to 0.31% in Greece and Italy). These figures were broadly unchanged over time. Investment grants related to environmental protection seem less significant, with the exception of Malta (0.3% of GDP) and to a lesser extent Denmark and Slovenia (0.1% of GDP). As regards R&D expenditure on environmental protection, EU Member States spent on average only 0.04% of GDP in 2019, with almost a third allocating close to 0% of GDP (Eurostat data).

Chart 4

Public expenditure on environment protection and components



Sources: Eurostat and own calculations.
Notes: Total public expenditure on environment protection is the sum of public investment in environment protection (blue bar), investment grants (yellow bar) and other public expenditure (orange bar), which mainly includes intermediate consumption and compensation of employees related to environment protection. Information on investment grants is not available for Bulgaria, Lithuania and the EU. Provisional data are shown for France, Spain, Germany and Portugal.

3.3 Eliminating environmentally harmful policies

Eliminating environmentally harmful policies can be beneficial for the environment, in addition to having positive budgetary effects. By distorting price signals, environmentally harmful policies reduce incentives, both for households and firms, to move towards more efficient energy use. Environmentally harmful policies mainly comprise transfers and tax abatements (such as tax exemptions or tax credits) to households and firms. Often these policies were mostly designed for motives such as distributional aspects and competitiveness and, after an economic crisis, to provide some economic stimulus, although their effectiveness in this sense is mixed (Köppl and Schratzenstaller, 2021; Grigolon et al., 2016).

Among the environmentally harmful policies, reductions in energy tax obligations play a larger role than budgetary transfers in the EU. These reductions are defined as energy-related tax expenditure and can be measured by the differences in the effective tax rate across fossil fuel products and sectors (Chart 5). If there were no environmentally harmful tax expenditure in place, CO2 emissions from energy use would be taxed uniformly, at least when abstracting from other instruments such as the EU ETS. The effective tax rate varies considerably across energy sources and countries. It is generally higher for fuels, due to relatively high fuel excise taxes, than for heating oil, natural gas and coal.[23] Moreover, even within the group of fuels used for transport purposes, diesel enjoys a tax privilege over

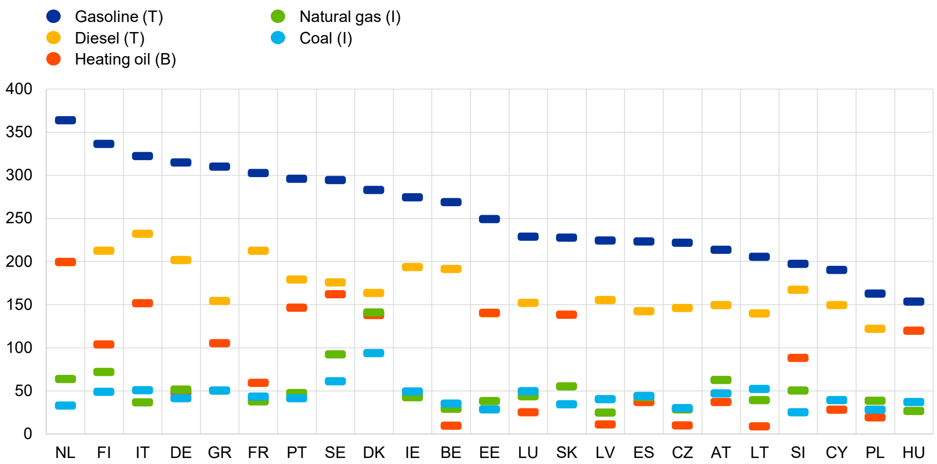
[23] For coal in particular, the low effective tax rate reflects its coverage by the EU ETS via the energy sector.

petrol.[24] In line with EU legislation, almost all EU Member States apply lower tax rates or provide tax rebates for the use of diesel in the agricultural sector. Some countries apply reduced tax rates for heating in remote areas (Cyprus) or for special sectors such as social institutions and hotels (Greece). Several countries try to partly offset the diesel privilege through higher circulation or registration taxes, which do not, however, affect the marginal cost of using a car (see European Commission, 2015).

Chart 5

Effective carbon tax rates per energy source in different sectors

(EUR per tonne of CO2, 2021)



Sources: OECD and own calculations.
Notes: The chart shows the effective carbon tax expressed in EUR/tCO2 for various energy sources, based on the tax rates applicable in 2021. The energy sources represent different sectors in the economy: the transport sector (T) using gasoline and diesel, the buildings sector (B) using fossil fuel heating, and the industry sector (I) using natural gas and coal (excluding the EU ETS). No data are available for Bulgaria, , Croatia, Malta or Romania. The data are sorted by the effective carbon tax for gasoline. No effective carbon tax is reported for natural gas (Cyprus).

The taxation of (company) cars and other transport is an important component of environmentally harmful tax expenditures. Several countries apply a favourable tax for the private use of company cars or fuel vouchers offered by companies (Belgium, Bulgaria, Germany, Greece[25], France, Italy, Lithuania, Hungary, Malta, Portugal, Poland and Finland). Another example is tax abatements for commuters if they are granted only on the distance between work and home, irrespective of the means of transport used, such as in Germany and Austria. Such tax credits may not only disincentivise the use of public transport, but also affect location choices, supporting urban sprawl. Moreover, tax credits are applied to international and domestic aviation (tax exemption for kerosene, VAT exemption for international flights), even though intra-EU flights are covered by the EU ETS. Several countries (Austria, Belgium, Germany, France, Hungary, Italy, Malta, Spain, Portugal, Slovakia and Finland) also had or still have (temporary) car scrapping regimes in place, which incentivise the replacement of old cars by new models either in the form of tax incentives or, more often, in the form of direct subsidies. If not well

[24] This privilege is enshrined in the Energy Taxation Directive, which allows lower minimum tax rates for diesel than petrol.

[25] In Greece, the tax exemption holds only for tool cars (i.e. cars provided to employees to serve the company's needs), whereas tax exemptions do not apply to company cars provided to managers.

targeted, these measures do not significantly reduce fuel consumption and fail to contribute to the achievement of environmental targets (see, for example, Grigolon et al., 2016; Köppl and Schratzenstaller, 2021). Moreover, the support of private means of transport over public transport may conflict with overall ecological objectives (such as reducing congestion and reducing ground sealing).

Several countries also provide tax reductions or tax rebates for energy-intensive industries, also to compensate for higher energy costs originating from the EU ETS. This preferential tax treatment is mainly motivated to ensure international competitiveness, neglecting environmental considerations. The Fraunhofer Institute for Systems and Innovation Research and ECOFYS (2015) investigate energy price privileges for energy-intensive industries in five EU countries, namely Germany, the Netherlands, France, Italy and Denmark. They find that all EU countries investigated have some tax privileges in place, mostly in the form of lower electricity tax rates and VAT rates and lower (renewable energy) surcharges to be paid by industries. In almost all countries examined, energy-intensive industries may be completely energy tax exempt (including VAT exemption). As found by Fedrigo-Fazio et al. (2013), the manufacturing, agricultural and forest sectors in Germany benefited from electricity and energy tax reductions of up to 60% of the standard tax rates for electricity and heating fuels (natural gas and liquefied gas) and up to 73% of the standard rate for heating oil. This tax privilege is also confirmed by Matthes (2017), who calculates the sum of taxes and surcharges for electricity-intensive industries to be €4.00/MWh, compared with €89.00/MWh (without concession fees and VAT) for non-privileged electricity consumers.[26] Finland, Austria and Latvia also provide total energy tax rebates or reimbursements for energy-intensive businesses (in Austria, for instance, amounting to an estimated 0.1% of GDP per year over the 2010-13 period) (Kletzan-Slamanig and Köppl, 2016; Locmelis et al., 2019).

Comparable cross-country data on environmentally harmful expenditure policies are rather scarce.[27] The OECD is collecting information on public transfers to promote fossil fuel production and consumption.[28] On aggregate, direct budgetary transfers in support of fossil fuels in the EU peaked in 2012 (at around €7.6 billion) but have been on a downward trend since 2016, mainly as a result of EU initiatives to foster climate change mitigation (Chart 6). In 2019, harmful public transfers declined by 15.9% on an annual basis, compared with a decline of 13.8% in 2018.[29] In recent years, EU Member States have gradually phased out public transfers

26 This difference mainly seems due to the energy surcharge (*EEG-Umlage*), which is reduced/waived for (energy-intensive) industries.

27 Public expenditure in support of fossil fuels may incentivise higher emissions and/or higher levels of resource extraction. Such measures can lower investment incentives for environmentally friendly products or technologies. While the examples above give an indication of the importance of environmentally harmful expenditure, they do not fulfil the requirement for a fully fledged database to assess and compare the order of magnitude across countries.

28 The OECD classifies expenditure based on the support provided for the production and consumption of fossil fuels as well as for general services. The latter refers to public transfers mainly associated with past production activities of fossil fuels and industry-wide funding. In this analysis, transfers that do not provide direct support for fossil fuel production and/or consumption are not reported (for example, those related to the rehabilitation of old mining regions).

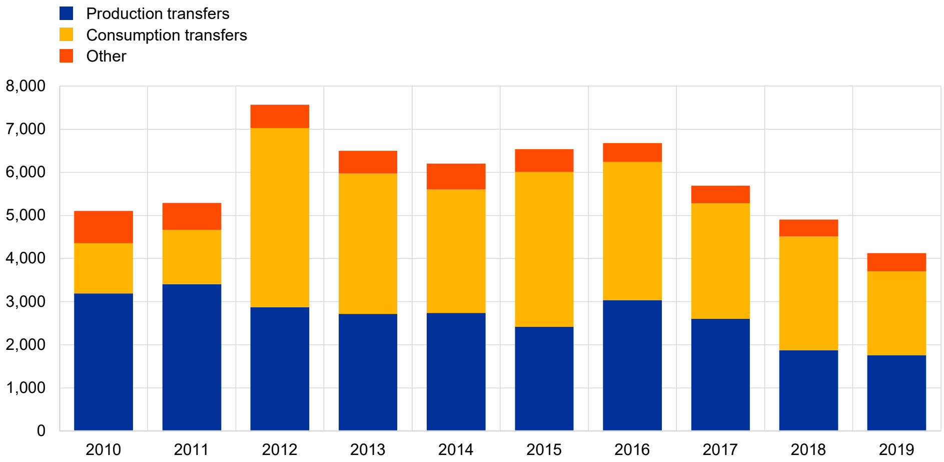
29 The COVID-19 period is not covered in this section, as the reduction in GHG emissions owing to the cyclical downturn could give a distorted view of the harmful expenditure policies in place.

supporting the production of fossil fuels, in particular coal, while transfers favouring the consumption of fossil fuels have increased compared with 2010 levels, notably due to stronger support measures for (low-income) households to compensate them for higher energy costs. Finally, other measures associated with past production activities of fossil fuels (notably coal) and industry-wide funding comprise a smaller proportion of total direct transfers.

Chart 6

Public transfers in support of fossil fuels in the EU over time and per type of transfer

(EUR millions, 2010-19)



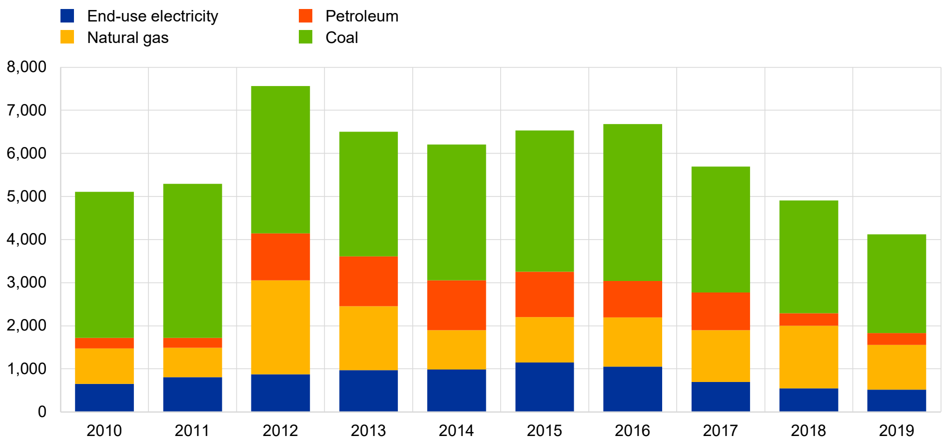
Sources: OECD and own calculations.
Notes: The chart decomposes total direct transfers into transfers for the production and consumption of fossil fuels as well as other transfers related to past production activities of fossil fuels and industry-wide funding (excluding measures not directly linked to environmentally harmful activities). EU aggregate figures refer to the unweighted sum of transfers in EU countries, except Austria, Bulgaria, Croatia, Cyprus, Denmark, Luxembourg, Malta, Portugal, Romania and Sweden, for which there are no available data.

Measures that support the production and consumption of coal represent on average over 50% of total public transfers. However, since 2016, their amount has been reduced (Chart 7). In 2019, total transfers related to petroleum products and natural gas declined compared with the previous year on the back of lower budgetary expenditure in support of their consumption. Still, these transfers are higher than their 2010 levels.

Chart 7

Public transfers in the EU per type of fossil fuel

(EUR millions, 2010-19)



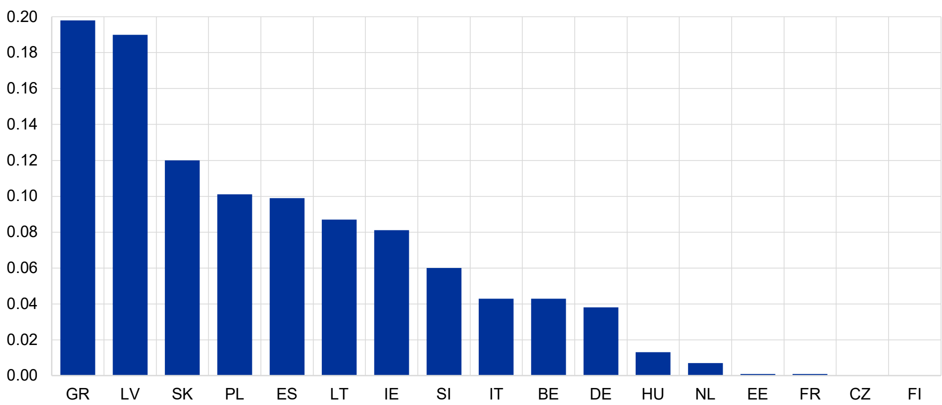
Sources: OECD, own calculations.
Notes: The chart decomposes total direct transfers per type of fossil fuel, excluding measures for fossil fuels (i.e. coal) not directly linked to environmentally harmful activities. EU aggregate figures refer to the unweighted sum of transfers in EU countries, except Austria, Bulgaria, Croatia, Cyprus, Denmark, Luxembourg, Malta, Portugal, Romania and Sweden, for which there are no available data.

The aggregate expenditures mask a high degree of heterogeneity across countries. Although direct budgetary outlays have declined since 2010 in many EU Member States, notably in Belgium, the Czech Republic, Hungary, Estonia and France, environmentally harmful subsidies remain in place in several countries. In 2019, total transfers in support of fossil fuels amounted to almost 0.2% of GDP in Greece and Latvia (Chart 8).

Chart 8

Public transfers in support of fossil fuel production and/or consumption

(percentage of GDP, 2019)



Sources: OECD Inventory of Support Measures of Fossil Fuels (March 2021) and own calculations.
Note: Transfers exclude measures that are not directly associated with increasing the production and/or consumption of fossil fuels (for example the rehabilitation of oil mining sites).

In general, environmentally harmful expenditure measures across EU Member States often have similar policy objectives as tax abatements, namely mitigating the impact of higher energy costs for (low-income) households and

energy-intensive industries. In particular, public expenditure measures in individual Member States are mainly focused on:[30]

- compensating higher energy costs in remote areas or for (low-income) households (e.g. Cyprus, Hungary, Italy, Ireland, France), thereby tackling energy exclusion. In Belgium, the heating social fund provides grants to low-income and indebted households, which supports the consumption of heating oil.[31] In Greece, oil companies receive a subsidy for supplying petroleum products to remote areas;
- Research and development funding related to the production, storage, transportation and distribution of fossil fuels (e.g. France and Italy). In 2019, budgetary outlays increased in Lithuania and Finland as a result of increased support measures for peat production and storage facilities;
- providing State aid to energy-intensive industries to compensate, among other things, for higher carbon costs (e.g. Malta, the Netherlands and Finland).[32,33] In Slovakia, electricity produced from domestic coal has been supported since 2005, while at the same time a State aid scheme exists to facilitate the closure of uncompetitive coal mines.

In several EU countries, environmentally harmful subsidies are gradually being phased out. These include aid for the coal industry in Germany as well as the levy charged on electricity consumption to finance purchases of peat-generated power in Ireland, although the latter has been partly offset by increased fuel allowances for low-income households. In Slovenia, the outlays related to the feed-in tariff for the use of natural gas in combined heat and power plants have been declining since 2015. In 2019, subsidies for the household energy bill declined substantially in Hungary. In Italy, the expenditure related to the free allocation of EU ETS emission allowances as a result of transitory rules pertinent to the implementation of measures needed to meet the Paris Agreement decreased markedly. However, due to strong energy price increases since the end of 2021 and during 2022, many countries in the euro area have temporarily introduced fiscal measures to compensate households and firms for the increase in energy prices, which counteracts the trend to phase out harmful subsidies.[34]

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30 Based also on the OECD database of public transfers in support of fossil fuels (information available in March 2021).

31 Following the sharp increase in the international prices of oil and other commodities as of mid-2021, several EU countries introduced measures to compensate consumers for the direct effects of higher energy costs. For more details on the measures in each EU country, see Sgaravatti et al. (2022).

32 The public sector agencies in Malta responsible for energy and water distribution are partly financed by the government through a subvention. Although the subvention for energy producers is earmarked for sustaining spare capacity, securing supply and supporting feed-in tariffs for the use of renewable energy sources, without public support, the entities could operate at a loss and would hence need to adjust tariffs and operating costs.

33 In Finland, according to Treasury data (WGPF), the compensation for EU ETS indirect costs for energy-intensive industries was €29.1 million in 2019.

34 In some countries, including Germany and the Netherlands, emergency measures to cope with the reduction of gas supplies from Russia include an increase in the use of coal in their energy mix.

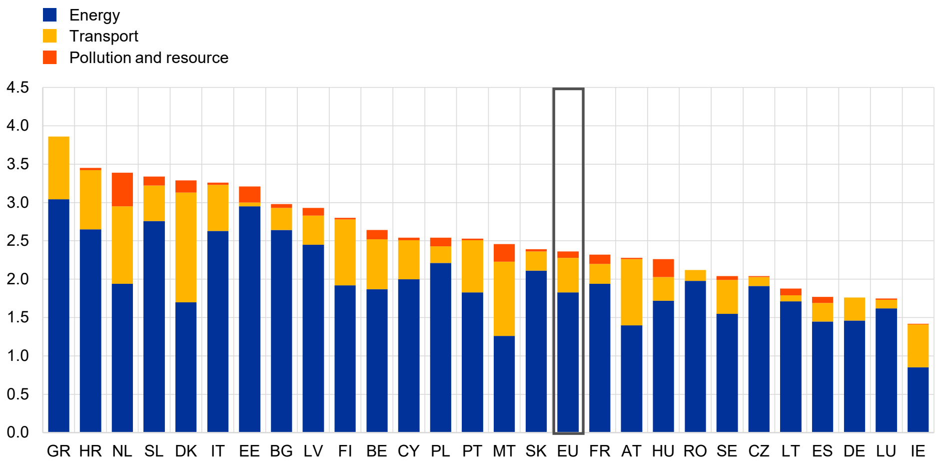
3.4 Revenues: energy taxes and other alternatives

All EU countries have environmental taxes in place, which are categorised into energy, transport, and pollution and resource taxes. Overall, environmental tax revenues are small compared with EU countries' total tax burden, representing only 5.9% of total tax revenues in 2019 (2.4% of EU GDP). Both their share of total tax revenues and the composition of environmental taxes have remained broadly stable since 2010.[35]

Chart 9

Environmental tax revenue across countries

(percentages of GDP, 2019)



Sources: Eurostat and own calculations.

Energy taxes

Energy taxes have been one of the main instruments used to fight pollution and reduce energy use in the EU. The Energy Taxation Directive establishes minimum tax rates on energy products for heating, transport and electricity.[36] In 2019, most countries applied a tax rate for the transport use of fuels significantly above the minimum rates. The Netherlands and Italy, for example, levy tax rates twice as high as the minimum tax rates for unleaded petrol (€359 per 1,000 litres), while Italy, Belgium and France levy diesel tax rates for cars which are almost twice as high as their minimum of €330 per 1,000 litres.[37]

On average, energy taxes account for around three-quarters of environmental tax revenues in EU countries (see Chart 9). These taxes, which comprise carbon taxes as well as excise taxes on energy products (e.g. coal, oil products, natural gas and electricity), mainly affect fossil fuel consumption both for heating and electricity

35 The COVID-19 pandemic resulted in a sharp decline in environmental taxes in 2020 owing to the cyclical downturn and reduced mobility following the adoption of strict containment measures. Environmental tax revenues are expected to pick up in 2021, reflecting the V-shaped economic recovery and the gradual relaxation of social distancing measures. Given these pandemic-related fluctuations, this section covers pre-pandemic developments.

36 See Energy Taxation Directive 2003/96/EC.

37 Information based on European Commission (2021e).

generation, thereby encouraging an energy-saving effect due to higher costs. In addition, some EU countries allocate a fraction of their energy tax revenues to fund a clean energy transition. Cyprus and Estonia also impose an additional excise tax to finance the clean energy transition.

The literature has identified carbon taxation as an effective incentive-based fiscal policy measure for climate change mitigation (see, for example, Krupnick and Parry, 2012). Carbon taxes are a price-based fiscal instrument that is directly linked to CO2 emissions and commonly applies to emissions that exceed certain thresholds or to installations which meet certain technological criteria. Carbon taxes, if set appropriately, can foster behavioural changes towards greater energy efficiency and green investment, thus helping to correct the negative externality of the pollution and affecting the income of the agents. However, their effectiveness depends significantly on the definition of the tax base (CO2 emissions or their source), the (number of) sectors covered and the use of the funds raised.

Only a few EU Member States have an explicit carbon tax in place. These include Denmark, Estonia, Spain, Ireland, Portugal, Sweden, Slovenia and Poland, while in some countries, such as France, Finland and Latvia, taxes on fossil fuels are only partly based on CO2 emissions.[38] A few countries, such as Luxembourg, Germany and the Netherlands, have recently introduced a carbon tax, applying relatively high rates. In Luxembourg, the carbon tax introduced in 2021 applies to emissions not covered by the EU ETS with a rate of €20/tCO2, while Germany sets the price at €25/tCO2[39] and the Netherlands has started off with a tax rate of €30/tCO2.[40] As of October 2022 Austria will implement a new carbon pricing instrument covering emissions outside the EU ETS; the price is set at €30/tCO2 in 2022 and is expected to reach €55/tCO2 by 2025.

Explicit carbon tax revenues in the EU are very low. These ranged in 2019 from 0.01% of GDP in Estonia and Spain to 0.4-0.5% of GDP in Sweden and Finland, respectively (Chart 10). This is partly explained by the coverage of carbon taxation, which differs across EU countries (for more details, see Section 4.2). In Spain, for instance, the carbon tax only applies to fluorinated gases, while some regional governments have introduced carbon taxes on GHG emissions not covered by the EU ETS.[41] Furthermore, carbon taxes cover a varying share of GHG emissions across EU countries, taxing only 3% of relevant GHG emissions in Spain but 40% in Denmark and 49% in Ireland, while in some countries (Ireland and Finland) there are

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38 Based on the country notes from the OECD's Taxing Energy Use 2019 and national sources (WGPF). In Latvia, taxes apply to CO2 emissions in combustion installations that fall below the threshold for inclusion in the EU ETS and are part of the Natural Resources Tax Law (see the country note for Latvia from the OECD's Taxing Energy Use 2019).

39 The national carbon pricing scheme introduced in Germany in 2021 covers the transport and buildings sector. The carbon tax rate will rise to €55/tCO2 by 2025 via auctioned allowances. The revenues are earmarked for the German Energy and Climate Fund.

40 In the Netherlands, the price is expected to rise to €125-150/tCO2 in 2030. See Luxembourg Budgetary Plan 2021 and Netherlands Budgetary Plan 2021.

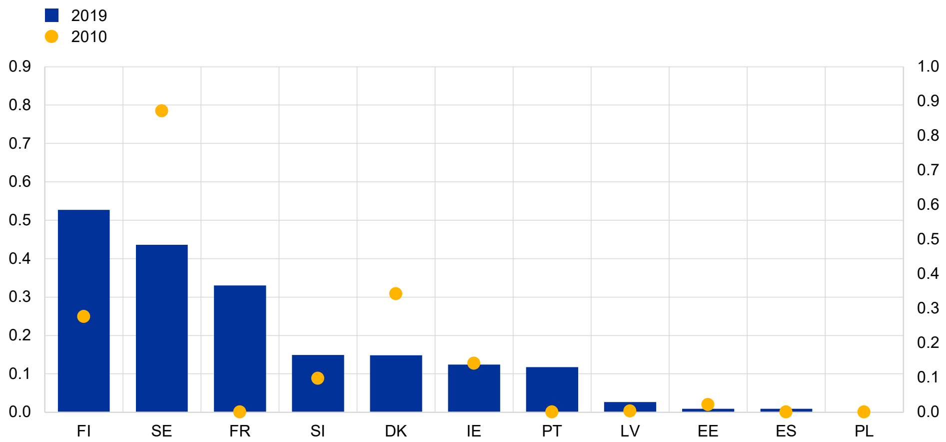
41 In the Czech Republic, although there is no explicit carbon tax, several legislative proposals for carbon taxation have been put forward in recent years.

overlaps between the coverage of carbon taxation and the coverage of GHG emissions by the EU ETS.[42]

Chart 10

Explicit carbon tax revenue

(percentages of GDP, 2010 and 2019)



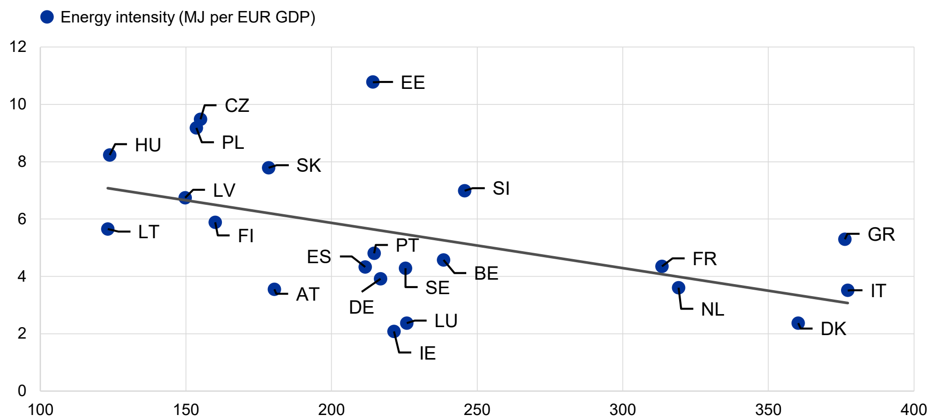
Source: World Bank Carbon Pricing Dashboard (data as of 1 November 2020).
Note: The chart depicts available data for EU Member States with explicit carbon taxes in place.

In a few Member States, government revenues from carbon taxes are earmarked for economic activities that support climate change adaptation and mitigation. Examples are Spain and Slovenia. In Ireland, carbon tax revenues are used in part to compensate those households most exposed to higher carbon costs. In Portugal, revenues are consigned to the Environmental Fund and, as of 2019, are used to finance the reduction of public transportation prices.

Chart 11

Energy intensity and implicit tax on energy

(MJ per EUR GDP; EUR per tonne of oil equivalent, 2019)



Sources: Eurostat, OECD and own calculations.
Notes: The implicit tax rate on energy is the energy tax revenues in relation to the corresponding energy consumption, expressed in oil equivalent. Energy intensity is taken from the OECD and is measured as units of energy (in millions of joules) per unit of GDP (in euro).

42 See World Bank Carbon Pricing Dashboard (data as of 1 November 2020).

One important aspect for climate change mitigation relates to the level of and change in energy efficiency and how this determines the energy intensity of certain sectors across countries. To this end, it is useful to look at the implicit tax rate on energy, which sets energy tax revenues in relation to energy consumption, and to compare it with an overall measure of energy intensity per country. Chart 11 reveals a negative correlation between the implicit tax rate on energy and energy intensity in the EU. Countries with higher implicit taxes on energy show a lower energy intensity of GDP, notwithstanding sectoral differences across countries.[43] This is particularly the case for Denmark, pointing to higher energy efficiency. On the other side of the spectrum are the Czech Republic, Estonia, Hungary and Poland, with low implicit tax rates and a rather high level of energy intensity. Nevertheless, higher energy taxes can have an adverse effect on international competitiveness if not compensated by higher energy efficiency, at least in the short term. Thus, these taxes may encounter some opposition from both industries and consumers.

Transport and pollution taxes

Apart from Estonia and Lithuania, transport taxes represent the second largest share of total environmental tax revenue for all EU Member States. Transport taxes (excluding fuel transport) are mainly levied on the sale, use and circulation of motor vehicles. In 2019, government revenues from transport taxes as a share of GDP were highest in Denmark (1.4%), followed by the Netherlands and Malta (1.0%) (Chart 9). Compared with other fiscal measures that incentivise climate change mitigation, transport taxes do not differ substantially across EU Member States. In many Member States (e.g. Spain, Cyprus, Lithuania, Greece, Latvia and Portugal), they include a CO2 component in favour of more energy-efficient cars. In Austria, Portugal, Hungary and the Czech Republic, environmentally friendly vehicles (i.e. electric vehicles) are exempt from taxation. Revenues from transport taxes are usually not earmarked to finance specific activities. However, in the Czech Republic, revenue levied from the road tax is linked to the maintenance and development of transport infrastructure.

Pollution and resource taxes represent only a small proportion of environmental taxes. These refer to a variety of taxes levied on measured or estimated emissions to air (e.g. NOx, SO2) and effluents to water as well as on waste management, noise (e.g. aircraft take-off and landing) and raw material extraction. In 2019, only a few EU countries stood out as recording higher government revenue from pollution and resource taxes as a share of GDP, ranging from 0.4% in the Netherlands to around 0.2% in Malta, Estonia and Hungary (Chart 9). In Germany, Greece and Romania, revenues collected from these taxes were either not in place or not significant.[44]

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43 The implicit tax rate reflects to some extent the production structure of the economy, namely it is more difficult for countries that rely on energy-intensive industries to impose higher energy taxes.

44 In Latvia, the Natural Resources Tax covers both principles: “polluter pays” and is exempted when environmental requirements are met. For example, the tax exempt applies for bio-mass materials, as well as for collected tyres. In 2020, exemptions amounted to EUR 247 million, representing 0.8% of GDP, which was almost seven times the total revenue from the Natural Resources Tax in the government budget. The amount of exemptions is expected to rise in the coming years. This might imply an achievement of climate objectives, although this is not directly reflected in budget revenue.

EU Emissions Trading System

The EU-wide Emissions Trading System (EU ETS) works on the “cap and trade” principle and steers the carbon price through allowances for CO_2 emissions that are traded at company level. The EU ETS was introduced in 2005 and covers three sectors – energy production, manufacturing and construction, and intra-EU aviation – which together account on average for around 40% of total GHG emissions in the EU. The number of GHG emission allowances was gradually reduced over time, although a significant proportion continues to be allocated freely.[45] Reducing the allowances has helped strengthen the price signalling effect of the EU ETS.[46] In fact, after hovering at very low levels for most of the first decade, the uniform carbon price increased steeply – especially during 2021 – and reached more than €90/tCO2 at the beginning of February 2022 (compared with an annual average of around €25/tCO2 in 2020).

Almost half of the CO2 emissions in the EU have been subject to the EU ETS. Government revenues from the auction of emission allowances under the EU ETS as a share of GDP vary across EU countries, ranging in 2019 from 0.7% and 0.5% in Bulgaria and Estonia respectively to around 0.3% in Romania and Greece, while they were very low in Luxembourg and Ireland (Chart 12). EU ETS revenues have been subdued in part due to the free allocation of permits (Chart 13). Indeed, the EU ETS has been introduced gradually in four phases (2005-07, 2008-12, 2013-20 and 2021-25), and the free allocating regime will only be eliminated by 2026. In 2021, prices almost tripled from January onwards (Chart 13). According to some studies, this increase signals that the market is functioning more effectively (see Lovcha et al., 2022).

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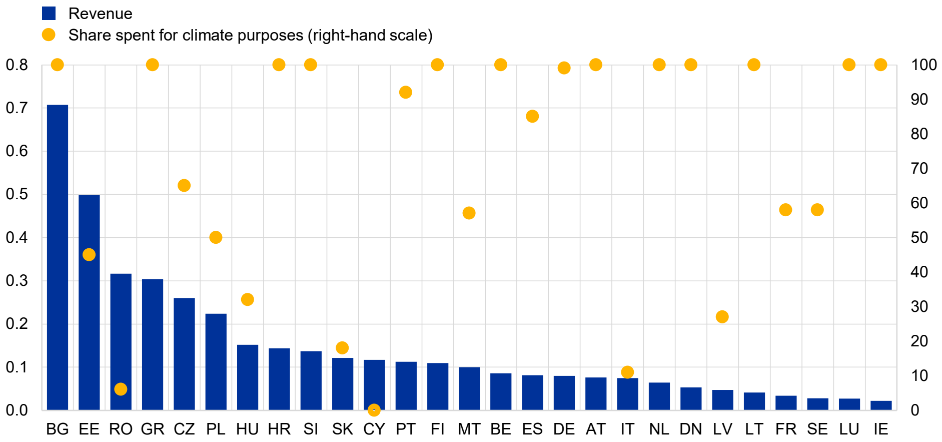
45 To foster the effectiveness of the EU ETS, the European Commission put forward in July 2021 the “Fit for 55 package” which includes a proposal to extend the EU ETS to more sectors such as road transport, building, and maritime transport. Moreover, to better shield internationally competing industries in the EU, discussion on a carbon border adjustment mechanism are on-going. The European Commission package foresees a gradual annual reduction by 10% of free emissions allowances over a ten-year period.

46 During the period 2013-2020 (Phase 3 of the EU ETS), the cap for stationary installations was reduced by 1.74% per year. This factor will increase to 2.2% over the period 2021-2030, although under the Fit for 55 package it may increase further to 4.2% annually.

Chart 12

Revenues from the EU ETS and the share spent on climate and energy purposes

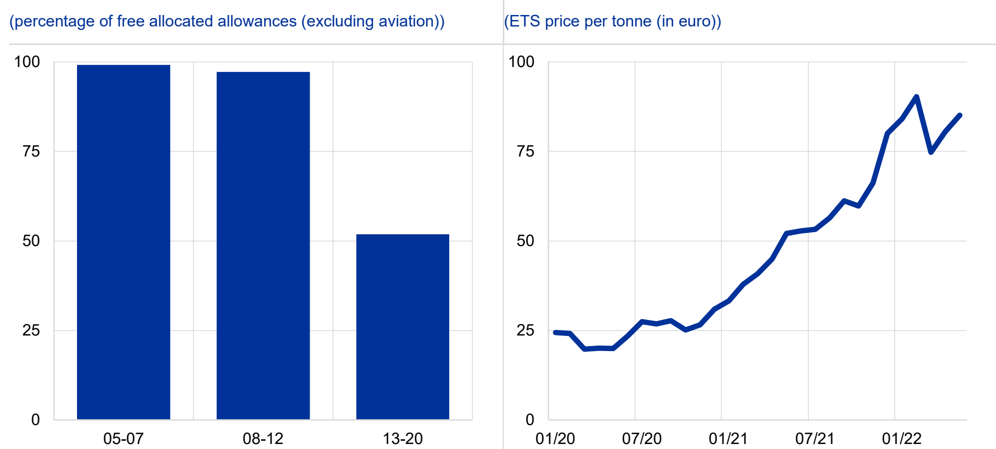
(percentages of GDP, percentages of revenues, 2019)



Sources: European Commission (2020a), National Tax Lists (February 2021) and own calculations.
Notes: The share of revenues spent for climate and energy purposes is based on revenue data reported by EU Member States and included in the EU Climate Action Report of November 2020. The latter may slightly differ from recent data on EU ETS revenues included in National Tax Lists. Data on the share spent on climate change purposes are missing for Cyprus.

Chart 13

EU ETS free allocation and price evolution



Sources: European Commission and Bloomberg.

EU ETS provisions foresee that at least 50% of the revenues are spent on climate policies. In 2019, EU Member States spent on average 77% of EU ETS revenues on climate change purposes (European Commission, 2020). However, the share varies significantly across countries, and in a few cases it is well below the 50% threshold (Chart 12). In some EU Member States (e.g. Germany, Greece, Hungary, Latvia and Portugal), government revenues raised from the EU ETS are earmarked as subsidies to incentivise emission reduction and support renewable energy sources and energy efficiency in residential buildings. After the surge in energy prices in 2022, some EU countries, such as Italy, Greece and Poland, allocated (increases in) EU ETS revenues to cushion the impact of higher energy prices on households and companies.

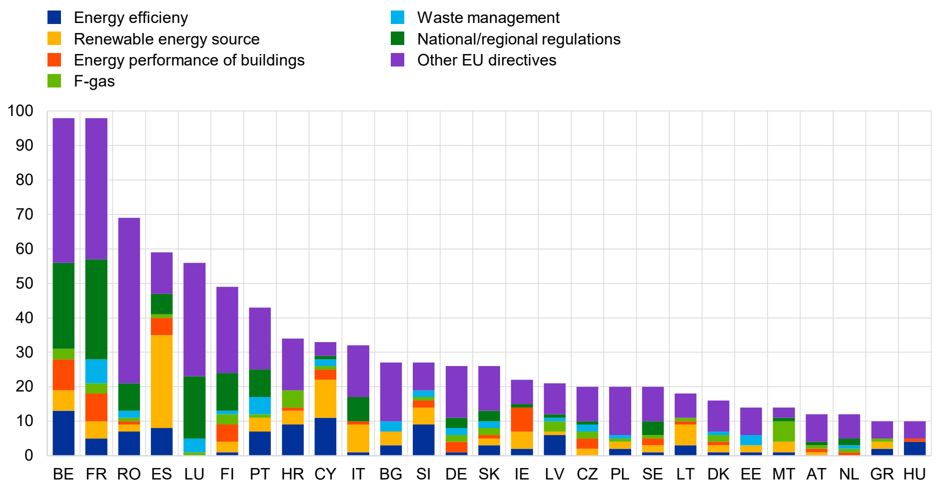
3.5 Regulatory policies

To foster climate change mitigation and support the transition towards a low carbon economy, many different regulatory policies have been put in place at national and EU level.[47] These policies take the form of permissions, prohibitions, standards or enforcement, in contrast to economic instruments that rely on financial incentives. They focus on a variety of areas, including standards for the energy performance of buildings, requirements regarding the use of renewable energy sources, CO2 emission standards for cars and vans, regulations for industrial emissions and requirements to foster energy efficiency (for example in the agricultural and transport sectors). A large majority of these command-and-control policies reflect regulatory initiatives set at EU level, which needed to be implemented into national legislation. On average, most regulations relate to energy efficiency and renewable energy sources (Chart 14). However, there are a large number of important EU directives for which only a few regulations are in place and which are subsumed in the chart under “other EU directives”. The total number of regulations to mitigate climate change has increased considerably over the past two decades, from an average of 16 regulations per country in 2000 to around 77 by 2019.

Chart 14

Regulatory policies on environmental protection

(number of policies, 2019)



Sources: EEA and own calculations.
Notes: The chart shows the cross-country distribution of different regulatory policies on environment protection at the EU and national levels. While parts of the regulations are directly linked to climate change mitigation, the chart also covers regulations related more broadly to environmental protection (e.g. waste management). The category “other EU directives” subsumes a variety of regulations, including standards on CO2 emissions from cars and vans, promotions of energy efficiency in the agricultural sector and promotions of clean and energy-efficient road transport. “National/regional regulations” includes environmental standards that are not linked to an EU regulation.

As most of these policies reflect regulations initiated at EU level, it may appear surprising to see large cross-country differences. In 2019, for example, Belgium and France had (with almost 100 regulations) ten times more regulations in place than the Netherlands, Greece or Hungary (Chart 14). However, the number of

[47] This overview of different climate change policies does not allow for an assessment to be made about their effectiveness. For a more detailed analysis, see, for example, IMF (2019) and the literature cited therein.

regulations does not necessarily provide a good proxy for their scope, implementation and effectiveness, but may rather depend on other factors, such as the different degree of federalism across countries.

4 What is needed to achieve the EU's 2030 climate target?

There are large gaps in green investments and carbon pricing that need to be bridged in order to ensure the attainment of the EU's 2030 climate target. This section provides an overview of the green investment needs and carbon pricing gap that are estimated to be required to comply with the Fit for 55 package objectives, i.e. a reduction in EU emissions of at least 55% by 2030, relative to 1990 levels. Furthermore, the section includes a box on the latest developments concerning the EU taxonomy, with a closer look at the trajectory of EU green public bond issuance.

4.1 Green investment gap and the NGEU programme[48]

Estimates quantifying the additional green investment needed to reach the 2030 climate target – i.e. reduce GHG emissions by at least 55% compared with 1990 levels – vary widely. Generally, estimates of green investment should be treated with caution given the high degree of uncertainty and large differences depending on the time horizon, the sectors studied and the underlying assumptions, including in relation to other policies implemented such as carbon pricing. The European Commission (2020a and 2021a) estimates the additional green (public and private) investment needed at EU level by 2030 at around €520 billion per year (around 3.7% of 2019 GDP). This includes €392 billion annually in energy system investments (including transport) as well as €130 billion annually to meet wider environmental objectives such as environmental protection and resource management[49] (see Chart 15).

[48] The green investment needs mentioned in this section do not include the additional investment required to achieve the REPowerEU plan presented on 18 May 2022. REPowerEU aims to mobilise around €300 billion of funding between 2022 and 2030 (2.1% of 2021 EU GDP) on top of the needed investment to fulfil the Fit for 55 objectives. The largest share of funding will come from unused RRF loans (€225 billion or 75% of the total) (European Commission, 2022c).

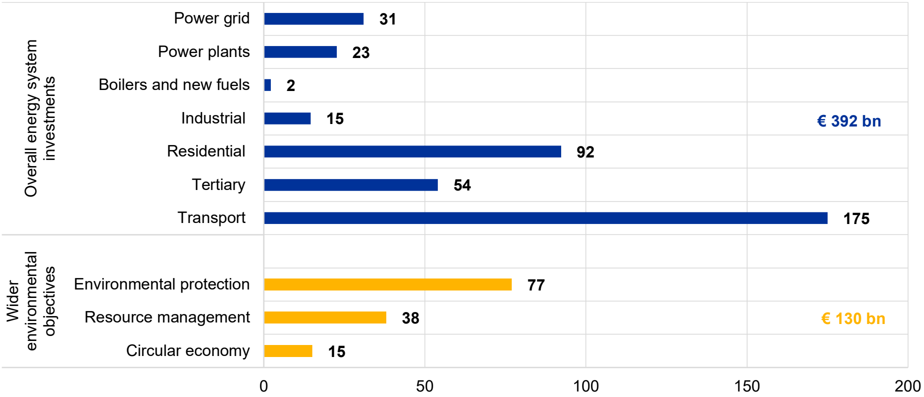
[49] These estimates may be lower than actual needs, as they do not include greater adaptation needs in the future (for example to take into account the increased frequency of extreme weather events) or investment needs to increase energy independence from external fossil fuel producers; moreover, the investment needed to achieve wider environmental objectives (€130 billion) is consistent with the previous emissions reduction target of 40% (European Commission, 2020a).

Chart 15

Investment gap

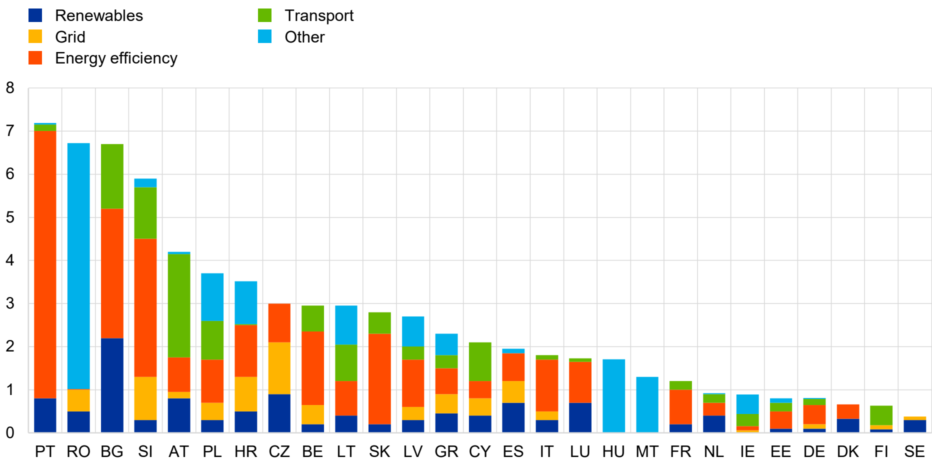
a) Sectoral breakdown of the green investment gap in the EU

(EUR billions, annually in 2021-30)



b) Green investment needs by country and category

(percentages of GDP, annually in 2021-30)



Sources: Panel a: European Commission (2020a and 2021a). Panel b: European Investment Bank (2021b).
Note: Panel a: The overall energy system investments amounts are compared with the 2011-20 average, while the wider environmental objectives are compared with 2016 levels.

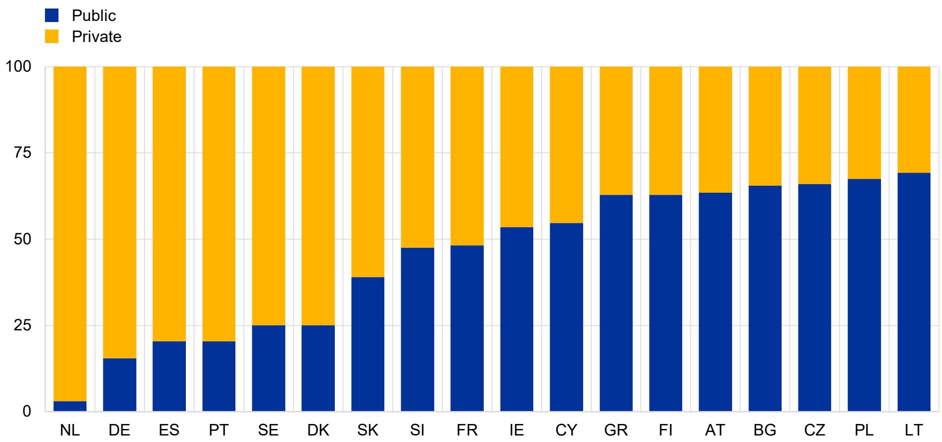
Most of the green investment gaps are in the transport and residential sectors. The European Commission identifies most of the additional investment needs in the transport sector (€175 billion per year) and in the residential and tertiary sectors (€146 billion per year) (see Chart 15, panel a). The investment needs identified in the renewable energy sector (power grid and plants) are considerably lower, which may reflect the strong surge in the share of renewable energy consumption over the past two decades, reaching 20% in the EU in 2019.

Green investment needs differ not only across sectors but also across countries. Based on countries' national energy and climate plans (NECPs) for the period 2021-30, the largest investment gaps are identified in Portugal, Romania and Bulgaria (amounting to around 7% of GDP per year), while in Denmark, Finland and Sweden the annual investment needs are well below 1% of GDP (see Chart 15, panel b). However, the investment needs set out in the NECPs would need to be scaled up to achieve the EU’s more ambitious 55% emission reduction target for 2030, as they were made before the target was revised.

Chart 16

Public and private sources of additional green investment needs

(percentages of total, average for 2021-30)



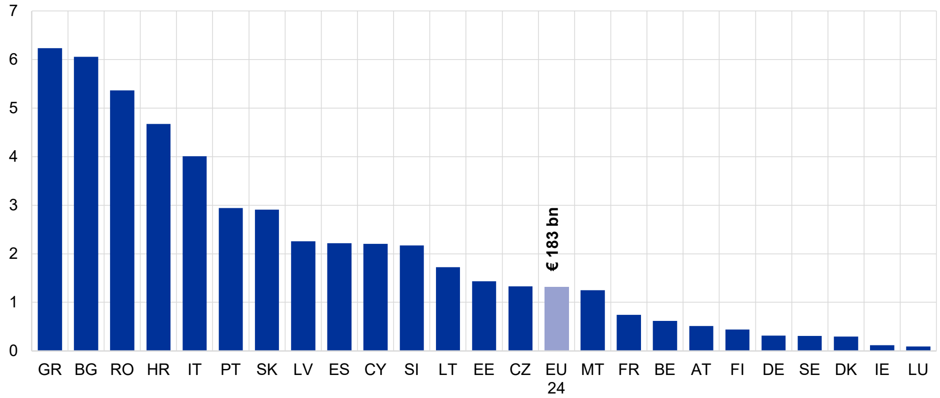
Source: EIB (2021b), based on NECPs to reach the 40% emission reduction target.
Note: In the EIB report, data for some countries are missing.

Although a large share of the green investment will need to be borne by the private sector, the public sector will have a crucial catalyst role to play in supporting the transition. The public sector can contribute either directly, through public investment, or indirectly, for example through co-financing, private-public partnerships or State guarantees. According to the EIB (2021b), the (unweighted) share of green public investment at EU level is expected to amount to 45% of total green investment, with large differences between countries (see Chart 16). If taken at face value and based on the Commission estimates adjusted for the revised 2030 emission target, this would imply almost 1.8% of EU GDP (€235 billion) in annual additional green public expenditure in 2021-30.

Chart 17
Recovery and resilience plans

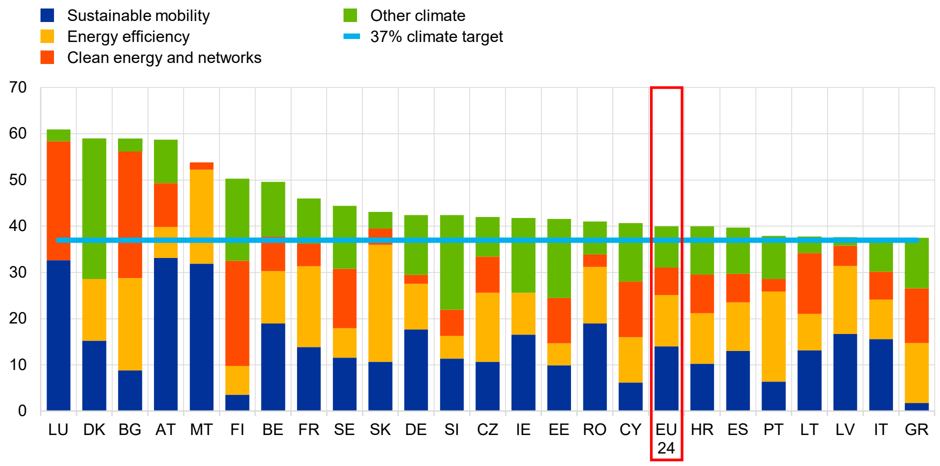
a) Amount requested in the RRPs for climate measures per country

(percentages of 2019 GDP, 2021-26)



b) Expenditure towards climate objectives in the RRPs per policy area and country

(percentages of total expenditure)



Sources: Panel a: European Commission (2022a) and own calculations. Panel b: European Commission (2022a) and own calculations.
Notes: Panel a: EU24 refers to the 24 EU Member States that endorsed the RRPs at the end of May 2022. Panel b: EU24 refers to the 24 EU Member States that endorsed the RRPs at the end of May 2022.

NGEU's RRF will help finance around 6% of the additional green investment needs. In the EU24 RRPs that were endorsed at the end of May 2022, the amount requested for climate measures amounts to €183 billion (i.e. 1.3% of 2019 EU GDP and 40% of the RRF funds requested so far). As a percentage of 2019 GDP, there are large differences across Member States, ranging from more than 5% in Greece, Bulgaria and Romania to less than 0.4% in countries like Germany, Sweden and Denmark (see Chart 17, panel a). If a linear distribution is assumed over the course of the six-year programme, the RRF green component of the approved plans covers around 6% of total additional investment needs until 2026. In terms of policy areas, on average across EU countries with endorsed plans, around 75% of the resources will be devoted to sustainable mobility, energy efficiency and renewable energy and networks (see Chart 17, panel b). However, the overall impact of NGEU on the climate is unclear and not easy to assess, as underlined in two recent reports by the

European Court of Auditors. The first report sheds light on major weaknesses in the European Commission's reporting on climate spending within the EU budget (European Court of Auditors, 2022a). The second identifies risks to the successful implementation of RRPs with respect to climate goals (European Court of Auditors, 2022b).

Instruments to finance green investment are being developed. Efforts to set up dedicated instruments to finance green investment relate to both the development of sustainable finance standards and the issuance of green bonds. Governments play an important role in both (see Box 4 for an overview of the EU taxonomy and the increasing issuance of green public bonds).

Box 4
The EU taxonomy and green public bonds

The EU Taxonomy Regulation is a central piece of legislation in the EU sustainable finance agenda, which aims to scale up sustainable investment and the financing of the European Green Deal. Its goal is to define activities that substantially contribute to environmental objectives.[50] The Regulation entered into force on 12 July 2020 (European Commission, 2020b), but its implementation is still ongoing. A first delegated act was adopted on 21 April 2021, containing the technical criteria to identify sustainable activities for the first two objectives of the taxonomy, i.e. climate change adaptation and mitigation (European Commission, 2021b). Following political controversy over the inclusion of gas and nuclear energy, the European Commission decided to separate these two sectors from the delegated act, which then entered into force on 1 January 2022. In February 2022 the Commission adopted a complementary delegated act to cover certain gas and nuclear energy sources which entered into force and applies as of January 2023 (European Commission, 2022b and 2022d).

The taxonomy is relevant for public finances as it is expected to play a key role in the European Green Bond Standard (EU GBS) proposal.[51] Green bonds are an important element in closing the sustainable financing gap by reallocating capital towards sustainable projects. Proposed on 6 July 2021, the EU GBS aims to foster the growth of the green bond market, strengthen the environmental relevance of green bonds and reduce the risk of greenwashing by setting voluntary best practices for green bonds.[52] Importantly, the standard would require the proceeds raised through green bond issuance to be fully aligned with the EU taxonomy. Compared with private issuers, it is envisaged for sovereigns to have some flexibility concerning the external review of the EU GBS and the project-level alignment with the taxonomy.[53]

The EU GBS proposal is designed to be compatible and coexist with other existing market standards for green bonds, such as the International Capital Market Association's (ICMA's) Green

50 For simplicity, we refer to activities that substantially contribute to environmental objectives as "sustainable" or "green" activities. See European Commission (2020c).

51 The EU GBS must be approved by the European Parliament and European Council – expected in 2022 – and followed by an implementation period prior to entry into force.

52 For further details on the establishment of the EU GBS, see European Commission (2021c) and European Parliament (2022a).

53 The flexibility consists of using state auditors or other public entities instead of registered external reviewers to review the allocation report, as is common practice among the EU Member States already issuing green bonds. There is also an exemption from having to demonstrate project-level EU taxonomy alignment for certain public expenditure programmes. See European Commission (2021c).

Bond Principles – currently used by the majority of green bond issuers – and the Climate Bonds Initiative's Climate Bonds Standard.[54] However, the EU GBS goes one step further by requiring complete alignment of funded projects with the EU taxonomy and the registration and supervision of external reviewers (European Commission, 2021d). This makes the EU GBS standard more restrictive than other standards and therefore more difficult to comply with for green bond issuers. Only a part of the currently issued green bonds would be EU GBS-eligible, since some investments are either excluded (e.g. waste-to-energy renewable technologies) or do not adhere to the reporting standards (Commerzbank, 2021).

The issuance of green public bonds is gaining ground in the EU. According to ICMA statistics, green bonds issued in the EU accounted for the highest share of globally issued green bonds in 2021 at 49% (€247 billion out of €503 billion). This amounts to around 1.7% of EU GDP in 2021, divided between supranational, sovereign and other government (0.7 percentage points) as well as private sector issuance (1.1 percentage points). Hence, public issuers (sovereign, other government and supranational) make up a large share of the total green bond issuance in the EU, at 38% in 2021. The upward trend seen in recent years is expected to continue, also due to the European Commission's substantial supranational green bond issuance of up to €250 billion by the end of 2026 to finance the green measures in the NGEU (European Commission, 2021f).[55] In 2021 the leading EU countries for sovereign green bond issuance as a percentage of GDP were Italy, France and Spain (Chart A).[56]

The labelling of certain gas and nuclear activities as green could undermine the credibility of the framework. Because certain gas and nuclear activities are bundled into a single complementary delegated act, it is unlikely that blocking majorities will be reached, since many Member States support the inclusion of at least one of the two energy sources. However, this compromise risks undermining the credibility of the EU GBS, as the taxonomy could be perceived as flawed or tainted by greenwashing. This could ultimately threaten its adoption and cause investors to opt for different green bond standards, thereby defeating the purpose of the taxonomy as a unified reference framework.

Natural gas and nuclear energy investments are excluded from the green component of recovery and resilience plans (RRPs). At the time the RRPs were requested, the taxonomy did not classify certain natural gas and nuclear energy sources as sustainable, which meant that these were not considered as green expenditure. Hence, the green bond proceeds that raised by the European Commission will not be used for investments in these two energy sources.

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54 The Green Bond Principles (GBPs) dominate the market in part due to their less strict requirements than the Climate Bonds Standard (CBS). On the one hand, the GBPs define a clear process for project selection and fund allocation, but they do not provide a clear definition of green economic activities and only recommend a third-party external review. On the other hand, the CBS, in addition to the requirements of the GBPs, includes a taxonomy that defines green economic activities and requires green bonds to be certified by approved external reviewers. The latter has more in common with the EU GBS. For more information, see European Parliament (2022b).

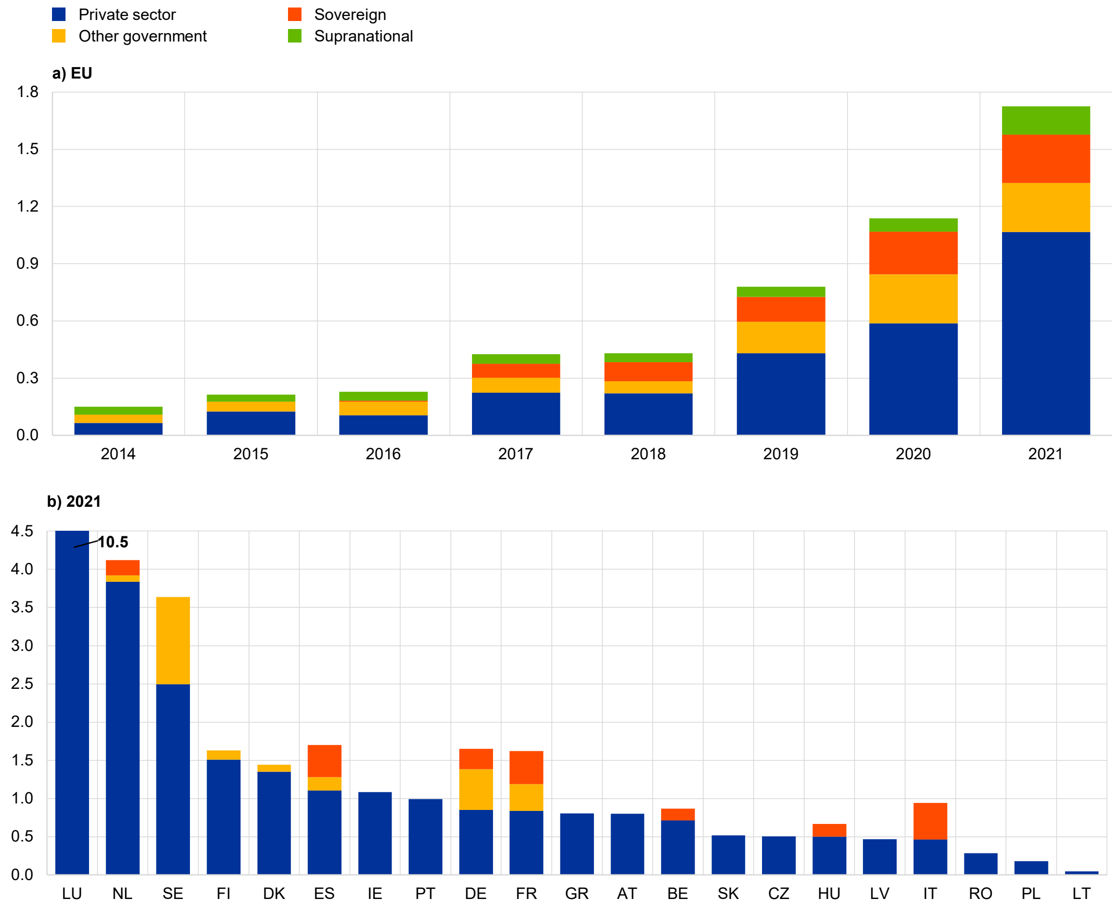
55 For the NGEU green bond issuance, the European Commission adopted the existing ICMA green bond framework instead of its EU GBS based on the EU taxonomy since the EU GBS regulation is still under negotiation and is, therefore, not yet applicable. Nevertheless, it has been aligned, to the extent feasible, with the proposed EU GBS.

56 The 11 EU countries that issued sovereign green bonds at some point between 2016 and 2021 are PL, FR, BE, IE, LT, NL, DE, HU, SE, ES, IT, and LV.

Chart A

Green bond issuance by issuer type in the EU

(percentages of GDP, EU trajectory since 2014 and by EU Member State in 2021)



Sources: DG-Market Operations (ICMA database), European Commission and own calculations.
Notes: "Supranational" includes issuance by all supranational entities headquartered in the EU. "Other government" includes local and regional governments, development banks and government agencies.

4.2 The carbon pricing gap

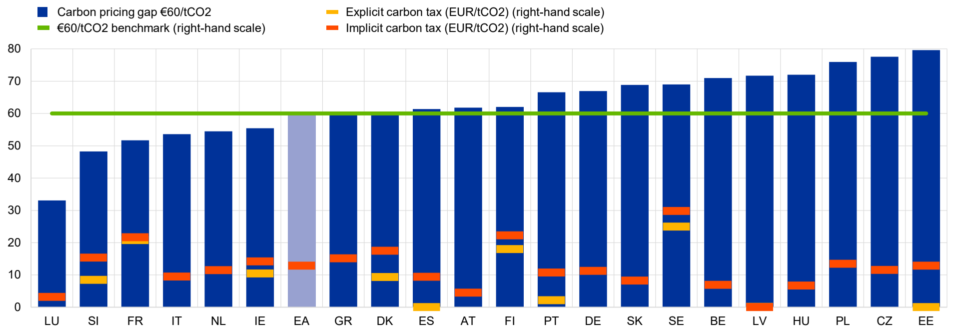
Carbon prices, both in the form of taxes and trading schemes, were relatively low in the EU in 2018. Indeed, in that year, the average explicit carbon tax across all sectors of the economy – weighted by the sectors' share of total emissions – varied across countries from €0.1/tCO2 in Estonia and Spain to around €20/tCO2 in Finland and France, and €25/tCO2 in Sweden (Chart 18). The implicit carbon tax combines the explicit carbon tax with EU ETS carbon pricing, weighted by the sectors' share of total emissions. However, the average explicit and implicit carbon taxes might be overestimated when accounting for the cumulative distribution of carbon taxes, which tends to be strongly skewed if only a small fraction of emissions in an economy is highly taxed, such as for fossil fuels. To account for this, the OECD developed the carbon pricing gap, which compares the percentile distribution of the actual carbon rate with a benchmark – in this case the carbon benchmark of

€60/tCO2.[57] A high carbon pricing gap value points to only a low fraction of emissions being taxed. Taking Finland as an example, although fossil and bio traffic fuels are highly taxed, most other CO2 emissions are only taxed to a small extent. For the economy as a whole, this results in a carbon pricing gap of 62 percentage points compared with the benchmark of €60/tCO2 (Chart 18).

Chart 18

Explicit carbon tax and the carbon pricing gap

(EUR per tonne CO2 emissions, 2018)



Sources: OECD and own calculations.
Notes: The average explicit carbon tax (in EUR/tCO2, yellow lines) is shown for 2018, including for countries where a proportion of the fossil fuel taxes is explicitly linked to CO2 emissions. The average implicit carbon tax covers the explicit carbon tax and EU ETS carbon pricing. The carbon pricing gap (blue bars) is measured by the difference between the actual effective carbon rate for every percentile of emissions and a benchmark value, for which the OECD benchmark value of €60/tCO2 (green line) is used. A high-carbon pricing gap indicates that the distribution of carbon taxed emissions is strongly skewed towards a few subsectors. The carbon pricing gap for the euro area is replicated using a similar albeit less granular approach. No data are available for Lithuania and non-OECD countries. While the carbon pricing gap accounts for the EU ETS, it is based on data from before the introduction of the Market Stability Reserve.

The sizeable carbon pricing gaps suggest that carbon taxation in EU countries is too low and fragmented to achieve the EU emission reduction targets. While deriving the optimal level of carbon taxation is far from trivial and crucially depends on the underlying assumptions and efficiency of other policies in place, using a rough benchmark of €60/tCO2 – as suggested by the OECD – seems reasonable. The IMF (2019) propagated that a carbon price of USD 75/tCO2 would be required globally to ensure the Paris Agreement is met. More recently, the European Commission (2020d) simulated the carbon price required in order to achieve the more ambitious EU emission reduction target of 55% by 2030 under different policy scenarios.[58] Under the scenario that assumes an extension of the EU ETS to the building, road transport and intra-EU maritime navigation sectors, a carbon price of €60/tCO2 would be required to meet the 55% target.[59]

57 See OECD (2018) and OECD (2019) for detailed discussions on the carbon pricing gap and the benchmark. The OECD also replicated the exercise with a less strict benchmark of €30/tCO2.

58 A carbon price is an important component of the EU's strategy against climate change. Other instruments are fines on pollution or subsidies for not polluting.

59 In the various scenarios proposed by the European Commission (2020d), which differ in the importance of the policy instruments (including regulatory policies), the required carbon price varies between €32/tCO2 and €65/tCO2.

5 Relevant issues for climate change policy design

When designing climate change policy, two issues that significantly affect the policy mix need to be borne in mind: (1) the impact of taxes and other instruments on wealth distribution, as some of these may have more of an impact on poorer households; and (2) the loss of competitiveness of a country when carbon taxation is not multilaterally imposed.

5.1 The distributional consequences of carbon pricing

Although there is broad consensus on using carbon taxation to mitigate the adverse effects of climate change, there is vigorous debate over its distributional consequences. While carbon and energy taxes are environmentally effective and economically efficient, their distributional effects influence their political acceptability. Estimates of the progressivity or regressivity of carbon taxes depend on several factors: the level of economic development of a country[60], the specific environmental policies implemented[61], how the carbon tax burden is measured and the modelling choice (partial or general equilibrium effects)[62].

A large part of the literature concludes that carbon taxes exacerbate inequality: taxing carbon emissions is found to be regressive (Sterner, 2012), mostly because energy-intensive goods are typically necessities. An increase in the prices of these goods may therefore disproportionately endanger the purchasing power of poorer households. In addition to the relative price movements, other factors – such as the labour market – matter when evaluating the heterogeneity of responses to carbon taxes across households. In particular, the regressive effects found by Känzig (2022), who identifies carbon pricing shocks using EU ETS data, primarily depend on the sectoral composition of labour: poorer households work in sectors more negatively affected by the energy price surge. The role played by the expenditure share of disposable income spent on energy goods – larger for low-income households – is less significant, accounting for only one-fifth of the overall drop in consumption. However, fiscal policy that targets the most affected households could reduce the distributional consequences of climate policies. Moreover, the fall in aggregate consumption would be lower than in the competitive equilibrium without a redistribution scheme.

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[60] For developing countries, empirical evidence shows a tendency towards proportional or progressive effects (Wang et al., 2016), possibly explained by the lack of affordability of energy for poor households.

[61] For transport policies – such as fuel and car taxes – Pyddoke et al· (2021) find that welfare losses in Sweden are larger the lower households' income; Bureau (2011) concludes that carbon taxes on car fuels in France are regressive before revenue recycling.

[62] Andersson and Atkinson (2020) find that the Swedish carbon tax on transport fuel is regressive when measured against annual income but progressive when measured against lifetime income.

Other studies, however, reach the opposite conclusion. Feindt et al. (2021), for example, point to a mostly neutral or even slightly progressive effect of a European carbon tax at national level, but an overall regressive impact at aggregate level owing to the strongly negative effect in some poor countries, mostly located in eastern Europe. This stands in contrast to other studies, which tend to find a more modest regressive impact. Beznoska et al. (2012) focus on the impact of price increases in the electricity sector; they quantify that the first-round effects of the EU ETS on German households range from just over 1% of expenditure for households in the first quintile to 0.5% for those in the highest quintile.

Finally, the literature emphasises that the effects of a carbon tax on redistribution, as well as its political feasibility, ultimately depend on the way its revenue is rebated (Fried et al., 2018; Paoli and van der Ploeg, 2021). As pointed out by Goudler et al. (2019), the welfare effects of a carbon tax due to changes in the prices of goods and services that households purchase is regressive, while those attributable to policy-induced changes are progressive. Overall, analysing the carbon tax policies across US household groups under alternative redistribution schemes (lump sum rebates, cuts in employee payroll taxes, cuts in individual income taxes, cuts in corporate income taxes), climate change policies induce a welfare increase for the poorest households. Similarly, focusing on carbon taxes implemented at the provincial level in British Columbia in mid-2008 and the associated progressive redistribution scheme, Konradt and Weder di Mauro (2022) find that real household income fell significantly, especially for the richest households, which cut back on the consumption of non-tradable goods and particularly services.

It is important to remember that climate change itself increases inequalities, regardless of the policies aimed at tackling it. The idea of not implementing environmental policies to avoid disadvantaging the most vulnerable segments of the population should be reconciled with the evidence that physical risks from climate change exacerbate inequality by income, race and geography. As pointed out by Avtar et al. (2021), the southern United States, characterised by the lowest per capita income of the US regions, will experience the greatest total direct damages from climate change. Moreover, climate change is expected to enlarge inequalities because it affects some countries more than others; specifically, according to the JRC PESETA IV model (Feyen et al., 2020), southern European countries will be more negatively affected by climate change than other European countries.

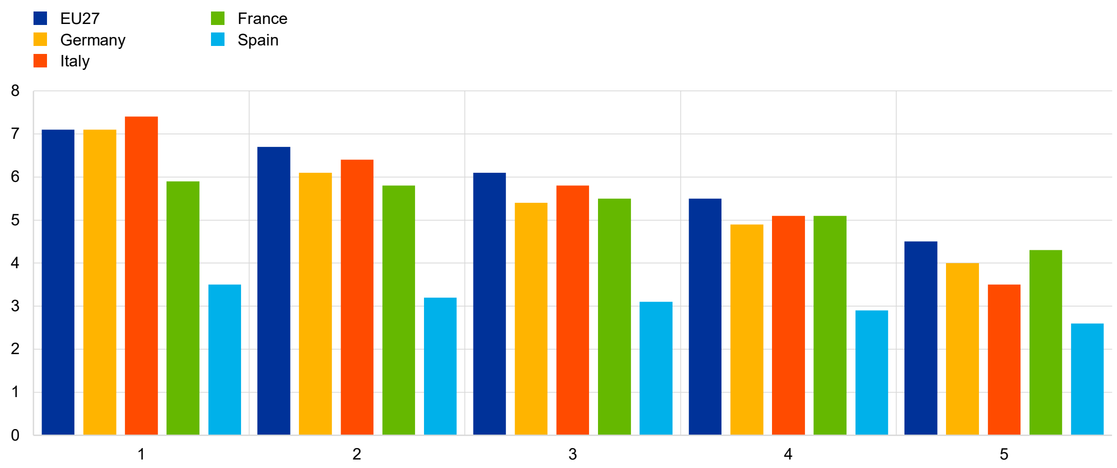
Box 5
The distributional effects of introducing a carbon tax – the case of Italy

Among climate mitigation instruments, carbon taxes seem the most powerful and efficient, as highlighted by several international institutions (WEO, 2020; FM, 2019). However, there is also evidence to suggest that this form of taxation has regressive effects (Sterner, 2012), as the expenditure share for electricity, gas and other fuels (excluding for transport use) is relatively higher for lower income quintiles, as shown in Chart A. This difference across income quintiles can be seen in Germany and Italy, where households from the lowest income quintile spend almost twice as much of their disposal income (around 7%) on electricity, gas and other fuels compared with the highest income quintile.

Chart A

Expenditure share for electricity, gas and other fuels by income quintiles in 2005

(percentages of total consumption expenditure)



Source: Eurostat.

This box shows – on the basis of an ongoing research project[63] – the distributional consequences of hypothetically introducing a tax on CO2 emissions in the case of Italy, and the optimal design of policies aimed at compensating the households most affected by higher energy costs stemming from carbon taxation. The analysis is based on a partial equilibrium model to quantify the aggregate demand effects on households generated by a carbon tax. In the model, there are heterogeneous agents (along the income dimension) and four different types of goods, namely electricity, heating, transport and a bundle of composite goods. The first three goods represent the energy-intensive sector. The model is calibrated to match the expenditure shares of the different goods by income quintiles as obtained in the Bank of Italy BIMic microsimulation model (Curci et al., 2017).

It is worth noting that the only source of heterogeneity across households considered here refers to the productivity level, ignoring other relevant factors – such as the sectors where workers are employed and the geographic area in which they live – to quantify the distributional consequences of climate change policies. Indeed, Douenne (2020) shows that, for the case of France, these factors are important. This result shows the complexity of designing an efficient and well-targeted compensation scheme.

Two hypothetical alternative levels of carbon taxes are applied: €50 and €100 per tonne of CO2. This interval contains the carbon tax level suggested by the IMF Fiscal Monitor to limit global warming to 2°C or less, which corresponds to USD 75 per tonne of CO2. For each taxation level, we take the pass-through of carbon taxes into goods prices from the estimates by Faiella and Lavecchia (2021). These price increases have a more marked negative effect on the purchasing power of poorer households, who devote a larger proportion of their total consumption expenditure to energy-intensive goods.

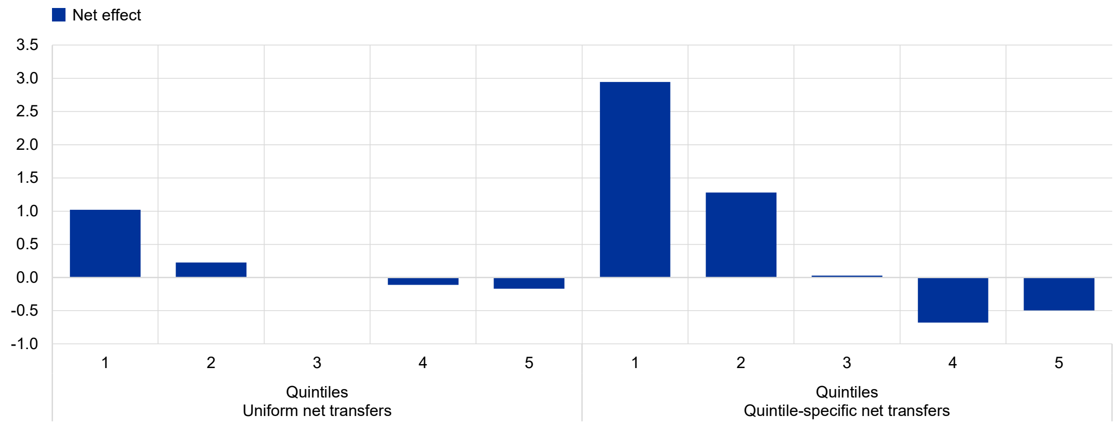
[63] Caprioli, F. and Caracciolo, G. (2022), "The distributional effects of carbon taxation in Italy", mimeo.

In the model, it is assumed that the government rebates revenues from carbon taxes through lump sum transfers, which can be either uniform or income quintile-specific. The question is about the optimal redistribution scheme to compensate low-income households; the scheme solves for the lump sum transfer maximising a utilitarian social welfare function.

Chart B

Optimal net transfers for a carbon tax equal to USD 50 by quintile

(percentages of income)



Source: Own elaboration.

Chart B shows the distributional effects of the optimal redistribution for the two types of transfer schemes. If the government does not differentiate between households according to their income, the uniform transfer brings about a gain for the first two income quintiles and a loss for the highest two, leaving the third one unaffected. This redistribution result takes into account both the nominal transfer and the change in after-tax income (net of savings) owing to the higher prices of energy-intensive goods. If, instead, the transfer is quintile-specific and the maximisation problem of the government is also subject to the constraint of not making the first three income quintiles worse off[64], the redistribution from richer to poorer households is much larger compared with the previous case. In both cases, the negative net transfers for the fourth and fifth quintiles are related to the fact that the amount of energy-intensive goods they consume is higher than that of the first three (even if their expenditure share is lower); the transfers they receive are not sufficient to compensate them for the price increases.

Chart C shows, for the quintile-specific transfer scheme, that on aggregate, carbon taxes effectively discourage the consumption of carbon-intensive goods, especially for heating. Chart D shows the same results for each quintile of income distribution. Since the households in the first quintile are the beneficiaries of large transfers, they increase their consumption of energy-intensive goods. The result reflects the assumption that the consumption level of households in the first quartile for such goods is very close to the subsistence level; although the prices of these goods increase due to carbon taxation, they tend to consume more to increase their utility. On aggregate, however, the lower consumption of households in the other quintiles more than offsets this increase.

[64] The carbon taxation scheme does not generate enough revenue to make every quintile better off, so that we focus on schemes which remain feasible for the government without increasing public debt. In the absence of this constraint, the redistribution would favour the first two quintiles even more.

Chart C

Effect on quantities for a carbon tax equal to USD 50 and quintile-specific transfer scheme

(percentage change variations)

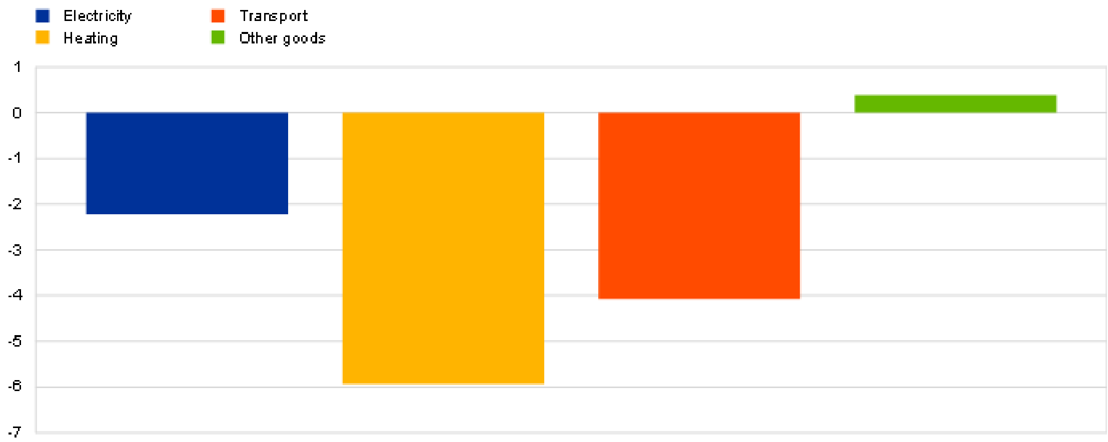
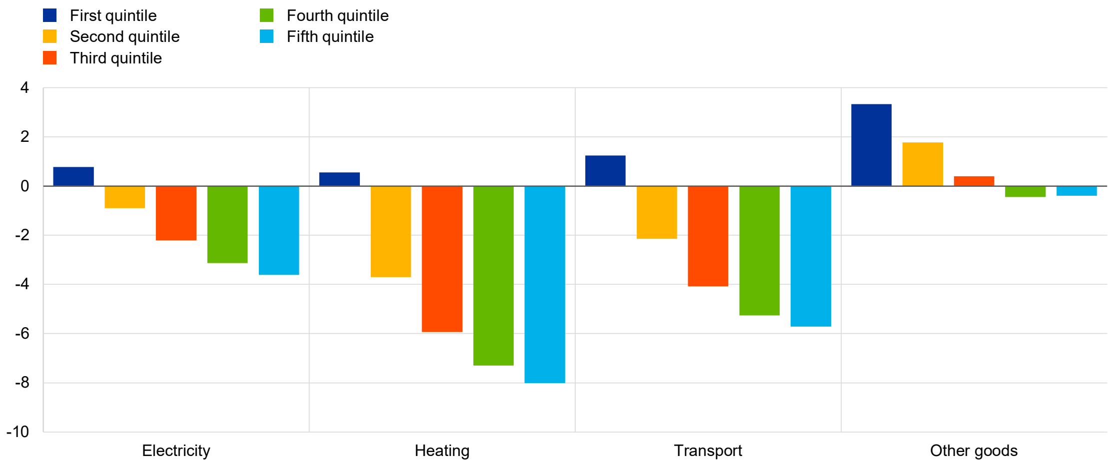


Chart D

Effect on quantities for each quintile for a carbon tax equal to USD 50 and quintile-specific transfer scheme

(percentage change variations)



5.2 Loss of competitiveness

One major pending issue related to carbon taxation is the problem of carbon leakage, namely the transfer of production to countries with laxer emission constraints. In the case of the EU, most studies show small or non-significant carbon leakage due to the EU ETS implementation (see Dechezleprêtre and Sato, 2017, for a comprehensive literature review). Nevertheless, more recently, Misch and Wingender (2021) calculate a carbon leakage rate for an aggregate of 14 EU countries and the United Kingdom of 15%.[65] In addition, Joltreau and Sommerfeld (2019) indicate that there could be a combination of reasons for this small effect, including the free allocation of permits during the first phases of the EU ETS, an overallocation of permits and the role of innovation. Indeed, up to 2020, those sectors more prone to be affected by carbon leakage were included in a list that made them eligible for a 100% free permit allocation. Nevertheless, with the gradual phasing out of the free allocation system, the carbon leakage issue may arise again.

Two main options may be considered for the EU: a globally agreed carbon tax and a CBAM, entailing the combination of a tax on imports depending on their GHG content and compensation to exporters for the carbon prices paid in the EU. In relation to the former, Parry et al. (2021) propose a carbon tax floor, a minimum price per tonne of CO2 emitted, agreed by a small group of key emitting countries. Nevertheless, even if an agreement is reached, some form of CBAM will be necessary with respect to the remaining countries. Moreover, as negotiations on a globally agreed carbon tax may take some time, some countries are analysing the possibility of complementing their existing carbon price scheme with a CBAM. For instance, on 15 March 2022, the European Council agreed on the introduction of an EU CBAM to compensate for the elimination of the free permits allocation under the EU ETS. However, the impact of a CBAM may be uncertain depending on the specificities of the mechanism as well as the second-round effects on EU competitiveness from trading partners’ policy responses: on the one hand, a border adjustment corrects for competitiveness losses assuming that tax rebates for exporters are in place, while on the other hand, non-EU countries may retaliate by adopting higher border taxes with an opposite impact on EU firms. In effect, the international coordination of carbon-based trade policies is the optimal solution.

Another relevant consideration is the impact of the fiscal revenues obtained from the carbon tax and the border tax. Whether the additional revenues are used for public investment, household transfers, debt consolidation or other purposes has an impact on economic activity and competitiveness. As recent experience shows, following the rapid surge of energy prices in 2021 and 2022, governments may have political incentives to introduce extraordinary measures to mitigate the impact of higher energy costs on business and households. Although these may be effective in the short term, only the transformation of energy generation can moderate and even revert the loss of competitiveness in the medium term. Moreover, these measures prevent the goal of the carbon tax: to modify the behaviour of households and businesses so that they reduce their consumption of energy, increase their energy efficiency and use green energy sources. Estrada and Santabárbara (2022) conclude that the economic impact of the introduction of a carbon tax in Spain would be smaller if the additional tax revenues were used for investment or the compensation of other more distorting taxes than for debt consolidation. Nevertheless, as shown in the previous section, some measures may be necessary to moderate the impact on lower income households.

[65] Aggregate EU14 plus the United Kingdom includes: Belgium, Denmark, Germany, Ireland, Greece, Spain, France, Italy, Luxembourg, Netherlands, Austria, Portugal, Finland, Sweden and the United Kingdom. Carbon leakage rate is defined as the proportion of the decrease in country emissions due to a climate tax that is offset by an increase in emissions in the rest of the world.

Finally, the impact on competitiveness depends on the capacity to switch from a fossil fuel-based economy to a greener one. From a technical perspective, fossil fuels and greener alternatives are not yet perfect substitutes. Therefore, more investment in the research and development of alternative energies is needed. As shown in Section 4, governments still have a significant green investment gap; using carbon tax revenues for investment could therefore enhance potential growth while enabling a quicker energy transformation.

6 Conclusions

Climate change is one of the most pressing challenges for humanity, and governments have a key role to play in its mitigation. Additional measures are needed to achieve the EU's new target of carbon neutrality by 2050. This paper has provided an overview of the main fiscal measures implemented in the EU and the main gaps that still exist. Indeed, governments should enlarge the scope and nature of fiscal measures to reduce GHG emissions. Moreover, stronger collaboration in the international community will be essential to achieve a worldwide reduction in GHG emissions. A global carbon tax would be optimal in reducing carbon emissions, as it would minimise economic distortions and reduce international trade tensions.

In addition, green public investment will have to increase over the coming decades and act as a catalyst for private investment. A comprehensive investment strategy would help promote the economic transformation needed to reduce GHG emissions. European initiatives, such as NGEU, and green financing may also facilitate this green transformation. In order to assess the NGEU's impact on climate goals, improvements are needed in the reporting on climate expenditure and the assessment of RRPs.

Finally, governments must consider inequality when designing their climate change programmes. Climate change will certainly have a stronger impact on those with fewer resources. The impact of climate change will be greater for populations in the lower income distribution, and therefore an increase in inequality is expected. Accordingly, when designing a climate change strategy, governments should include a compensation mechanism for those with fewer resources, as they will be more affected by both the economic impact of climate change itself and the fiscal measures adopted to counter it.

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