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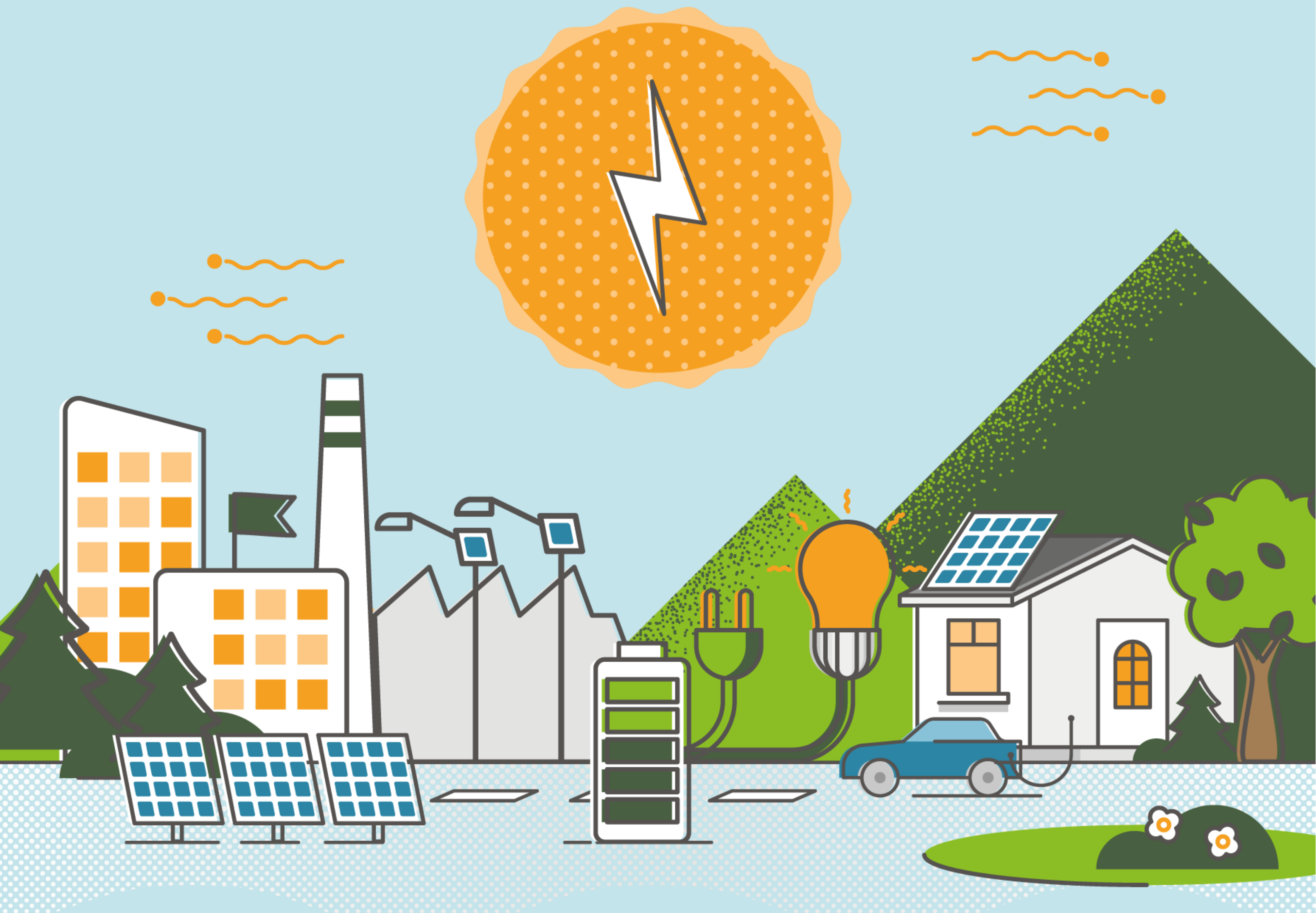
ENERGY TAXATION AND ITS SOCIETAL EFFECTS

INGRIDA MURAUSKAITE-BULL, AURA CARAMIZARU



Joint Research Centre

EUR 30552 EN

Contact information
Name: Ingrida Murauskaite-Bull
Address: European Commission, Joint Research Centre (JRC), P.O. Box 2, 1755 ZG Petten, The Netherlands
Email: Ingrida.MURAUSKAITE-BULL@ec.europa.eu
Tel.: +31 224 56 5092

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Contents

Abstract

Taxes account for a significant share of the final price of energy products in the EU. Energy taxes provide flexible and cost-effective means for reinforcing the polluter-pays principle and for reaching objectives of the European Green Deal. However, as energy taxation raises the price citizens have to pay for their energy, the poor are at risk to be more burdened by energy price increases than the wealthy. This report provides a detailed overview of energy taxation – the current policy context, household energy prices and the impact of energy taxation on financially disadvantaged citizens. The Energy Taxation Directive (ETD) that is currently under revision is also discussed together with the EU Emission Trading Scheme (ETS) and national carbon taxes as the main instruments used in the EU to reduce the greenhouse gas (GHG) emissions. Furthermore, as the redistribution of the tax revenue is crucial for the success of the energy transition, we explore different ways of using the revenue of energy taxation such as supporting further efforts to cut the GHG emissions or offsetting the burdens on the poor by increasing welfare benefits, re-investing the revenue through special schemes (e.g. renovation subsidies), supporting households with lump-sum transfers and other.

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Authors

Ingrida Murauskaite-Bull

Aura Caramizaru

Executive summary

Energy taxes are key instruments for achieving the environmental targets set by the European Union (EU), moving towards a decarbonised economy, incentivising consumers to use energy sources alternative to fossil fuels and raising revenue. They vary across consumers (industry and households), energy products (like electricity and gas) and across Member States. For households, they represent on average 40 % of the electricity price, 25 % of the gas price and 31 % of the heating oil price (European Commission, 2019a). By increasing the prices of environmentally harmful goods in relation to other goods, energy taxes encourage consumers to shift their consumption patterns in a more sustainable direction. However, these taxes can be burdensome for low-income households and have a regressive effect.

Energy taxation is the largest part of environmental taxes (others being transport taxes and taxes on pollution and resources) which in the EU in 2018 represented 2.4 % of GDP, and 6.0 % of total tax revenues collected. This revenue can be used in different ways, a matter that we explore in the report; supporting further efforts to cut the greenhouse gas (GHG) emissions or offsetting the burdens on the poor by increasing welfare benefits, re-investing the revenue through special schemes (e.g. renovation subsidies), supporting households with lump-sum transfers and other. The redistribution of the tax revenue is crucial for the success of the energy transition. Well targeted redistribution contributes towards the public acceptance for the transition as a whole, reduces energy poverty and social exclusion among the Member States.

This report provides a detailed overview of the main energy taxation instruments in the EU and its implications on society. We analyse the current context of the energy taxation and energy prices, in particular on electricity and transport, look at how energy and climate policies affect consumer energy bills, and the impact they have on low-income households. The Energy Taxation Directive (ETD) that is currently under revision is also within the focus of the report together with the EU Emission Trading Scheme (ETS) and national carbon taxes as the main instruments in the EU that reduce the GHG emissions. These instruments also need to be aligned to encourage the cost-effective emissions reduction, which is not fully the case at the moment. For example, the ETD needs to be more aligned with the EU ETS to encourage cost-effective emissions reduction.[1]

Policy context

The energy sector and the energy policy in the EU are evolving to enable the transition to clean energy. The EU aims to achieve sustainable growth for a more resource efficient, greener and more competitive economy, and the energy taxation serves as a tool enabling such transition. The European Green Deal emphasizes the importance of ensuring that energy taxation is aligned with the climate objectives.

The European Commission initiated a review process of the Renewable Energy Directive as well as the Energy Efficiency Directive to make sure they help achieve the increased climate, energy and environment ambitions. Also, the ETD, that has remained unchanged since its adoption in 2003, is currently being revised under the criticism of not contributing to the EU climate and energy policy objectives that have largely evolved in the meantime.[2]

According to the 2019 Commission Communication[3], energy taxation, carbon pricing systems and revised subsidy structures should play a crucial role in meeting the climate neutrality target. The use of economic tools for the benefit of the environment is promoted in the EU Environment Action Programme, the EU sustainable development goals and the Europe 2020 strategy.

Key conclusions

Although energy taxation is essential for reaching climate neutrality targets, if the energy taxes are regressive they make it difficult to carry out environmental tax reforms. The regressivity of energy taxes depends on multiple factors, such as taxed commodity, the level of country's economic development and the way the collected revenue is used. For low-income households it is important to consider how to alleviate and/or compensate for the regressive impacts of energy taxation.

From a social perspective, one of the best ways to redistribute the tax revenue is re-investing it through social schemes like means-tested renovation subsidies that can reduce the energy poverty among the vulnerable

[1] European Commission (2019b). Evaluation of the Council Directive 2003/96/EC of 27 October 2003 Restructuring the Community framework for the taxation of energy products and electricity. SWD(2019)332final.

[2] ibid

[3] European Commission (2019c). A more efficient and democratic decision making in EU energy and climate policy. COM(2019) 177 final.

populations in the Member States. Overall the redistributive policies should be designed to target low-income households as directly as possible. For example, if using the lump-sum transfer scheme, such transfer should target lower income households rather than all households. If such approach is followed, part of the energy revenue could also be allocated to sectoral restructuring.

1 Introduction

As there is an increasing concern regarding global warming and the EU moves towards climate neutrality by 2050, the topic of energy taxation is being widely discussed. Energy is one of the most essential aspects for our society. It is universally used across residential, commercial, transportation and industrial sectors. Energy is used for everything, from heating and cooling our homes to driving to work. As global warming is becoming the key priority for the European citizens as well as policy makers, the transition to climate neutrality is crucial. The energy sector and the energy policy in the EU are evolving to enable this transition.

The EU has set clear policy objectives in the energy area and aims to achieve increased shares of renewable energy, reductions in greenhouse gas (GHG) emissions and improvement in energy efficiency. The EU expects to reduce emissions by at least 55% by 2030. The Commission initiated a review process of the Council Directive 2009/28/EC ('Renewable Energy Directive') as well as the Council Directive 2012/27/EU ('Energy Efficiency Directive') to make sure they help to achieve the increased climate, energy and environment ambitions. Also, the European Green Deal, described as "our new growth strategy", highlights the importance of ensuring that energy taxation is aligned with climate objectives.

There is a growing body of literature on how energy taxation can serve the purpose of internalising the negative environmental costs of energy use (Zhang & Baranzini, 2004; Nguyen, 2016). Moreover, there are various ideas in recent papers regarding the use of revenue collected from environmental taxes (Andreoni, 2019; Borozan, 2019) and insights on whether the energy taxation in Member States should at all change (Voulis et al., 2019). These aspects are crucial to discuss to understand how much the energy tax revenue contributes to the budget and where that money is used.

Taxes account for a significant share of the final price of energy products in the EU. Council Directive 2003/96/EC ('Energy Taxation Directive' or ETD) lays down the minimum levels of taxation for products used as motor or heating fuel and for electricity. Above the minimum requirements, Member States are free to set their national rates as they see fit. This directive, that has remained unchanged since its adoption in 2003, is currently being revised under the criticism of not contributing to the EU climate and energy policy objectives that have largely evolved in the meantime.

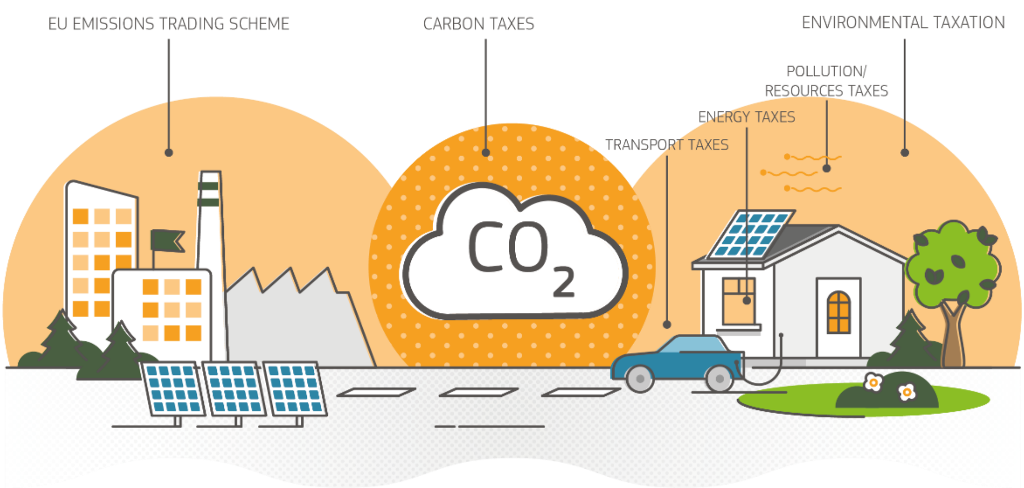
In the EU, energy taxes constitute a considerable part of the final consumer's energy bill. For example, in 2019, the average share of energy taxes in the total electricity bill was 30 % and varied from 6 % in Malta to 64 % in Denmark (Eurostat, 2020a). As energy taxes increase the prices of environmentally harmful products, such as electricity produced using fossil fuels, these taxes mostly aim to encourage consumers to shift their consumption patterns to a more sustainable direction. They also raise revenue for the governments to help finance public spending on sustainable energy solutions or redistribute it in other ways. Some environmentalists believe energy taxes are necessary to reduce GHG emissions. Opponents of energy taxes warn of their unintended consequences, such as increased energy prices, which could reduce the amount of disposable income for families and individuals and contribute to problems such as energy poverty, social exclusion and acceptance of energy transition as a whole. Energy taxes affect the costs of many different forms of energy: heat, fuel, and electricity, which all are necessities of the modern life. While the purpose of such tax is to incentivise consumers to use alternative energy sources and raise revenue, it can be a heavy burden for low-income households and have a regressive impact.[4]

This report provides a detailed overview of energy taxation – the current policy context, household energy prices and the use of revenue from energy taxation. It also analyses the impact of energy taxation on financially disadvantaged citizens. Although the energy taxation is an extremely important fiscal instrument, the EU ETS and national carbon tax also highly contribute to the reduction of the GHG emissions. As these economic instruments contribute to achieving some of the same environmental goals like energy taxes, they are also discussed in the report (like Figure 1 shows). Another reason for including the EU ETS is a lack of coordination between the current ETD and the EU ETS, which is one of the points raised in the ongoing revision of the ETD.[5]

[4] A regressive energy tax is a tax applied uniformly, taking a larger share of income from low-income earners than from high-income earners.

[5] European Commission (2019b). Evaluation of the Council Directive 2003/96/EC of 27 October 2003 Restructuring the Community framework for the taxation of energy products and electricity. SWD(2019)332final.

Figure 1: Economic instruments used in the EU that help to achieve environmental goals



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The report is structured in the following manner. Firstly, the chapter 2 discusses the implementation of energy taxes, their definition and their regressive nature. Chapter 3 provides an overview of the current context of energy taxation, such as policy context and a comparison between energy and other environmental taxes among the Member States. Energy and climate policies, such as national carbon tax, the EU ETS and the ETD are discussed in chapter 4 which provides a broader understanding how they reduce the GHG emissions and how they affect consumers. The report proceeds by explaining current energy, in particular electricity and transport, prices in the EU. Lastly, we analyse the impact of different energy taxation schemes on vulnerable households and how the collected revenue gets recycled back to the economy.

2 A brief history and definition of energy taxation

Although energy taxation in the EU is not a new phenomenon; prior to the 1980s, it was used only for raising revenue and reducing oil imports (Weisbach, 2011). Energy taxation has developed drastically since the 1980s when it was introduced for gasoline taxes to achieve environmental targets (unleaded gasoline was preferred over leaded gasoline as it has less environmental impact) (European Environment Agency, 2005). These taxes began to emerge as economic instruments associated with the 'polluter pays' principle that requires environmental costs to be internalised and included in the prices of those goods and services which cause pollution when being produced or consumed (European Environment Agency, 2005). Figure 2 shows the evolution of the energy taxation in the EU.

In the following decade, the use of energy and carbon taxes spread further due to their potential to raise revenue for the national budget as well as environmental considerations. According to Speck (2008), while Denmark and Sweden were one of the first ones to revise their energy taxation schemes and initiate changes, countries like the Netherlands and Germany followed shortly afterwards by introducing energy and carbon taxation as an instrument for tackling global warming. For instance, Germany initiated taxation on electricity and energy products in 1999 (European Environment Agency, 2005).

A proposal for a common CO_2/energy tax in the EU was introduced in 1992. It was a revenue-neutral tax based half on carbon content and half on energy value (European Commission, 1992). It extended the taxation to non-carbon fuel sources, like nuclear power, provided tax relief for energy intensive industries, among other issues. Although most Member States supported energy taxation as a tool combating climate change, an agreement could not be reached (Klok, 2002; Klok, 2005; Hasselknippe & Christiansen, 2003). The Mineral Oils Directive was the only EU legislation regulating minimum taxation levels for energy products before 2003 when the ETD was introduced.[6] The Mineral Oils Directive concerned only oil used for transport or heating as well as natural gas used for heating; while taxation of all other energy products, like electricity, was decided at the individual country level.

In 1997, the Commission submitted a Directive restructuring the Community framework for the taxation of energy products.[7] This proposal was not as ambitious as the 1992 CO_2/energy taxation proposal that was primarily based on the environmental reasons and was introduced more as internal market and taxation one, aiming to extend and improve the existing legislation for the taxation of mineral oils to cover all energy products in the internal market (Speck, 2008). Later, this proposal was also called the 'Monti proposal', after Prof. Mario Monti, then Commissioner for Taxation (Hasselknippe & Christiansen, 2003). As several Member States expressed their opposition towards the new Directive, and the taxation and fiscal matters were subject to unanimity rule, the proposal was blocked by long negotiations.

In 2001, the Commission claimed that the qualified majority vote for certain taxes was essential and the shift towards environmental taxes is slow (European Commission, 2001). Thus, the proposal to replace the unanimity voting with the qualified majority vote, based on the so-called 'enhanced cooperation' mechanism, was put forward (European Environment Agency, 2005, Jorgensen, 2003).[8]

Finally, in March 2003, the proposal for energy taxation resulted in the current directive that sets out minimum levels of taxation for energy products among the Member States. It also improved the 1992 legislation by widening the scope of the energy taxation to other energy products (Rocchi et al., 2014). This directive is further discussed in section 4. Then, 15 months after the adoption of the ETD, in January 2005, the Emissions Trading Scheme (ETS) went into effect. The main features of this system were laid out in the Green Paper on Greenhouse Gas Emissions Trading within the European Union in 2000 (European Commission, 2000). The paper analysed reasons for implementation of an EU-wide cap-and-trade system to limit GHG emissions to provide more support for policies dealing with energy efficiency and renewable energy. This system was also viewed as a tool to meet emission reduction targets to which the EU and the Member States had committed in the Kyoto Protocol (Denny Ellerman et al., 2016). A trial period of the European ETS (2005–2007) was followed by a second stage (2008–2012) that corresponded to the Kyoto protocol

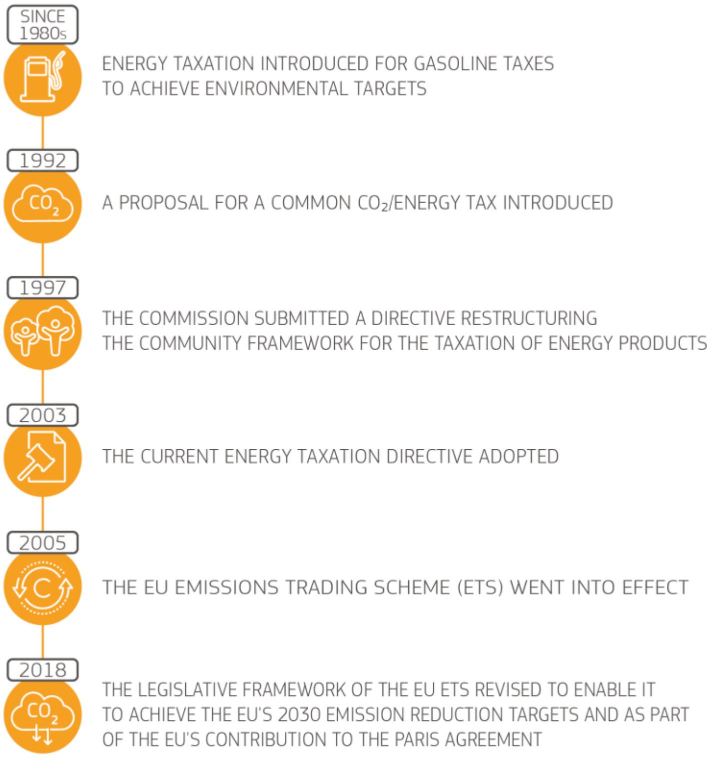
[6] Directive 92/82/EEC of 19 October 1992 on the approximation of the rates of excise duty on mineral oils.

[7] European Commission (2019b). Evaluation of the Council Directive 2003/96/EC of 27 October 2003 Restructuring the Community framework for the taxation of energy products and electricity. SWD(2019) 332 final.

[8] Enhanced cooperation mechanism allows closer cooperation between Member States in limited areas, such as energy taxation, where they can agree on, adopt and implement new measures. The Treaty of Amsterdam provided the legal framework for this mechanism and Article 43 enabled its application in the field of energy taxation. The Treaty of Nice also supported this revised rule and developed it further.

commitment period, and now the market is finalising its third phase (2013–2020). The ETS scheme covers energy activities (like combustion plants, mineral oil refineries and coke ovens), production and processing of ferrous metals (like production of pig iron), mineral industry (such as factories producing cement, glass or ceramics) and other industries. In 2012, aviation was also added to the ETS scheme; however, due to international confrontation, it was applied to European flights only. The scheme also faced multiple criticisms, such as unfair distributional effects and even facilitation of fraud (Branger et al., 2013). The ETS mechanism is further discussed in section 4.

Figure 2: The timeline of energy taxation adoption in the EU



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2.1 Energy taxes – part of environmental taxes

It is important to differentiate between energy taxes, transport taxes (taxes that are directly related to the ownership and use of transport vehicles), pollution taxes and resource taxes – all of which fit under the environmental taxes definition. According to a definition by the OECD Glossary of Statistical Terms, environmental tax is "a tax whose tax base is a physical unit (or a proxy of it) that has a proven specific negative impact on the environment". Following the classical explanation by Fisher et al. (1996), energy taxes are the ones that are levied on the energy use, for instance, for electricity, while carbon taxes are expressed per unit emitted CO_2. Energy taxes include mainly resource taxes, consumer taxes (e.g., oil taxes, car/ship taxes), and emission taxes, such as carbon taxes, sulphur taxes, and nitrogen taxes (Wang et al., 2018). It is an excise tax as it is a tax on a particular good that is paid by the seller and is passed on to the buyer as part of the cost. An energy tax, being excise tax, is imposed on both fossil fuels and carbon-free energy sources, according to their energy (or heat) contents, with renewables usually being exempted (Zhang & Baranzini, 2004; Parry et al., 2012; Voulis et al., 2019). Although energy taxes alter the price of energy use (and that consequently reflects marginal environmental damages), countries do not always introduce this excise tax primarily for environmental purposes – sometimes policy intentions might be different (OECD, 2019a). There are countries that have introduced carbon taxes with the main objective being carbon emissions mitigation, and some refer to environmental objectives to motivate relatively high excise taxes on energy. Energy tax policy entails the use of taxes (financial disincentives) and tax subsidies (incentives) to alter the allocation or configuration of energy resources (Herz, 2006). Energy taxes and subsidies normally aim to either fix a distortion issue in the energy market or achieve a social, economic, environmental, or fiscal objective (Herz, 2006).

Following the traditional Pigouvian framework, environmental taxes, including energy taxes, should equal marginal damages and be levied directly on the source of emissions (Pigou, 1920). After the development of the rationale for environmental taxation, Baumol and Oates (1971) discussed cost-effectiveness of the pricing and standards approach to energy taxation. Environmental taxes were considered as an appropriate tool for implementing the 'polluter pays principle' (Baumol & Oates, 1971). However, current political realities differ from these theoretical bases. Energy taxes in different Member States generally differentiate between energy users (industry and households), also special tax provisions are in place, including reduced rates for some energy products, tax reductions for industry (or individual sectors), and similar (Speck, 2008). Moreover, the classical Pigouvian excise taxes approach does not differentiate between the timing of electricity consumption, which is only true for electricity produced from fossil fuels and not renewable resources (Jacobson & Delucchi, 2011; Voulis et al., 2019). Electricity produced by renewables, especially in times of high solar/wind generation leads to direct consumption of electricity, therefore, has low environmental impact. If there is a lack of solar/wind generation, aspects like storage or transportation of produced electricity (or production from non-renewable resources) are required which, in turn, increases the environmental damage. The way Voulis et al. (2019) rightfully emphasize, the low environmental impact of renewables and the optimality of real-time retail pricing make a case for the elimination of energy taxation in energy production systems that contain high share of renewables.

Although time-dependent energy taxes do not exist yet, energy produced by renewables faces various levels of tax exemptions, depending on the Member State's regulations. In order to promote renewables, apart from tax exemptions, countries might also use different instruments, such as feed-in tariffs, quota obligations, soft loans, tax allowances, among others (Reiche & Bechberger, 2004). While countries have chosen different promotion strategies for renewables, scholars like Reiche & Bechberger (2004) detect no ''natural'' superiority of any instrument because the success depends on the respective framework conditions in the individual country as well as the specific style of the used promotion models. The provision that renewables can be partially or fully exempt from energy taxes also already exists in the ETD (European Commission, 2019b).

2.2 Regressive nature of energy taxes

A relatively large number of studies demonstrates the regressive nature of energy taxes (Baumol & Oates, 1988; Metcalf, 1999; Zhang & Baranzini, 2004; Fullerton, 2008; Chiroleu-Assouline & Fodha, 2012). Low-income earners pay a higher amount of their incomes on taxes compared to high-income individuals under a regressive tax system as the government assesses tax as a percentage of the value of the asset that a taxpayer consumes or purchases. In their book on environmental policy, Baumol & Oates (1988) provide a chapter on distributional effects and issue two 'challenges'. Firstly, research on distributional effects has to be intensified and the topic of regressive taxation has to be treated more seriously. The second challenge is related to testing if the environmental policy is regressive, and if so, what could be done about it. Fullerton (2008, 2010) provides a detailed literature overview on distributional effects, and a few summary points are as follows: Energy taxes are regressive as they raise the price of fossil-fuel-intensive products, which is a high fraction of low-income households' expenditure. Those with low-income budgets normally prioritise food and shelter rather than improvements in environmental quality. If the more financially advantaged benefit the most of decreased pollution, this effect is also regressive.

Vandyck & Van Regemorter (2014) agree that energy taxes raise the prices for certain commodities (like petrol) that disproportionally affect low-income earners, and present their results on macroeconomic and distributional effects of increased oil excises in Belgium. They discover that if the revenue is used to raise welfare payments (e.g. pensions and unemployment benefits), it affects low-income groups positively, but if the energy tax revenue is used to lower distortionary labour taxes, the tax shift is regressive. Metcalf (1999) also discussed this issue and similarly claimed that the usual recycling of the environmental tax revenues through a decrease in the labour tax rate could be regressive.

However, there is also a number of studies that claim energy tax having a very weak distributive impact. Speck (1999) summarizes the literature that agrees with energy taxes being regressive but highlights moderate impacts on low-income individuals, depending on the tax (heating, transport) as well as on the distribution of benefits resulting by improved environment quality among the population. Similarly, Zhang & Baranzini (2004) assess the economic impact of carbon and energy taxes, and based on the results from empirical studies, conclude that generally distributive impacts are not significant and surely less than it is often perceived.

Goulder et al. (2019) assess the distribution of the impacts across US household income groups of carbon taxes under a variety of revenue-recycling scenarios and find that the distributional consequences of policies depend on the welfare measure employed. Their results show that the expenditure-side effects are typically regressive, but this can be offset by income-side effects (falling wages and capital returns, or indexing transfer incomes to consumer price index (CPI) changes). They also demonstrate that both the scale and the regressivity or progressivity of the overall impacts depend importantly on the method of recycling, which exerts a strong influence on the source side. For example, the extent of progressivity was significant under lump-sum recycling, payroll tax and individual income tax recycling (Goulder et al., 2019).

A recent Commission's paper on employment and social developments in Europe (European Commission, 2020d) discusses the importance of compensating low-income households who might be disproportionally effected by energy taxation or trying to alleviate the regressive impacts as a whole. The paper says that the progressivity of energy taxation can be alleviated by transferring a part of the revenue from energy taxes back to households via schemes such as renovation and renewable energy subsidies.

Also, the Commission's Impact Assessment accompanying the 2030 Climate Target Plan[9] notes the fact that the climate ambition for 2030 will affect relative consumer prices in the economy, which will then affect households in contrasted manners. The analysis combines the JRC-GEM-E3 model with the household budget survey (HBS) of 2010 to estimate the distributional effects on households in the EU. They discover that changes in relative prices caused by the higher climate ambition would impact lower income individuals significantly more than the top income individuals. However, several policies can mitigate the negative distributional effects. Rising costs of energy can be compensated with lump sum transfers, support for energy investments, progressive tax rates or using carbon revenues to provide more targeted support for sectoral restructuring. Section 6.3 further explains the possible use of tax revenue.

[9] European Commission (2020a). Impact Assesment accompanying the 2030 Climate Target Plan. COM (2020) 562 final

3 Current context of the energy taxation

3.1 Taxation as one of the tools for climate-neutrality

The EU has increasingly discussed the importance of climate-neutrality and set clear targets on how to achieve it by 2050. In November 2016, the Paris Agreement, ratified by the EU, entered into force. It includes a long-term goal to keep the global temperature increase to well below 2°C above preindustrial levels and to pursue efforts to keep it to below 1.5°C. Then, in November 2018, the Commission presented its Communication 'A Clean Planet for all - A European strategic long-term vision for a prosperous, modern, competitive and climate-neutral economy'[10] that includes a vision for the 2050 climate-neutrality objective. The strategy shows how Europe can lead the way to climate neutrality by investing into technological solutions, empowering citizens, and aligning action in areas such as industrial policy, finance, or research – while ensuring social fairness for a just transition. Also, it states that taxation and climate action and energy policies should be aligned. In the Strategic Agenda for 2019-2024, the European Council identified "building a climate-neutral, green fair and social Europe" as one of its key priorities.[11] In March 2019, the European Parliament released a resolution on climate change, endorsing the objective of net-zero greenhouse gas emissions by 2050.[12] In addition, the 2030 Climate Target Plan[13] proposes a higher ambition for emissions reduction for the next decade and details the climate and energy policies needed to get us there.

These objectives as well as additional ones were also part of the European Green Deal (one of the six ambitions for Europe presented in the Political Guidelines for the next European Commission 2019-2024[14]). The Commission's Communication 'The European Green Deal' was presented on 11 December 2019.[15] It sets a long-term objective of Europe becoming climate-neutral by 2050, increases the climate ambition towards 55 % GHG emissions reductions for 2030, and proposes the first 'Climate Law'. Slowing down global warming and mitigating its effects is the main goal of the European Green Deal but it will run through all policies – from transport to taxation, food to farming, industry to infrastructure. It also recognises the necessity of putting in place an enabling framework that benefits all Member States and encompasses adequate instruments, investments and incentives to guarantee a just, socially balanced as well as cost-effective transition to a carbon neutral economy. As the transition can only succeed if it is conducted in a fair and inclusive way, and this requires additional funding, the Sustainable Europe Investment Plan and a new Just Transition Fund, for example, will help meet the additional funding needs, leaving no one behind.

According to the 2019 Commission Communication[16], energy taxation, carbon pricing systems and revised subsidy structures should play a crucial role in meeting the climate neutrality target (European Commission, 2019c). In particular, it was highlighted that a future energy taxation framework should support the clean energy transition; contribute to sustainable and fair growth as well as reflect social equity considerations.

The EU has generally favoured economic tools that provide cost-effective means for reinforcing the polluter-pays principle as well as reaching environmental policy targets. Well-designed taxes send the right price signals and provide the necessary incentives for sustainable activities of consumers, producers and users. Energy taxation helps to reduce the GHG emissions, increase energy efficiency, and hold accountable those who, in one way or another, contribute to negative environmental impacts. Energy taxes, however, differ strongly between countries, sectors and fuels which is the result of a mix of policy objectives.

3.2 Main energy taxation trends

In 2018, total environmental tax revenue in the EU amounted to EUR 324.6 billion, representing 2.4 % of EU GDP and 6.0 % of total EU government revenue from taxes and social contributions. This is a 3 % increase in nominal terms from the previous year and almost 50 % higher than in 2002. In 2018, Member States collected EUR 252.2 billion from energy taxes, which accounted for more than three-quarters of the total

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[10] European Commission (2018). A Clean Planet for all A European strategic long-term vision for a prosperous, modern, competitive and climate neutral economy. COM(2018) 773 final. Also known as Long Term Strategy (LTS).

[11] European Council (2019). A New Strategic Agenda 2019-2014.

[12] European Parliament (2019). Resolution of 14 March 2019 on climate change. P8_TA(2019)0217.

[13] European Commission (2020b). Communication on the 2030 Climate Target Plan COM (2020) 562 final

[14] Political Guidelines for the Next European Commission 2019 – 2024.

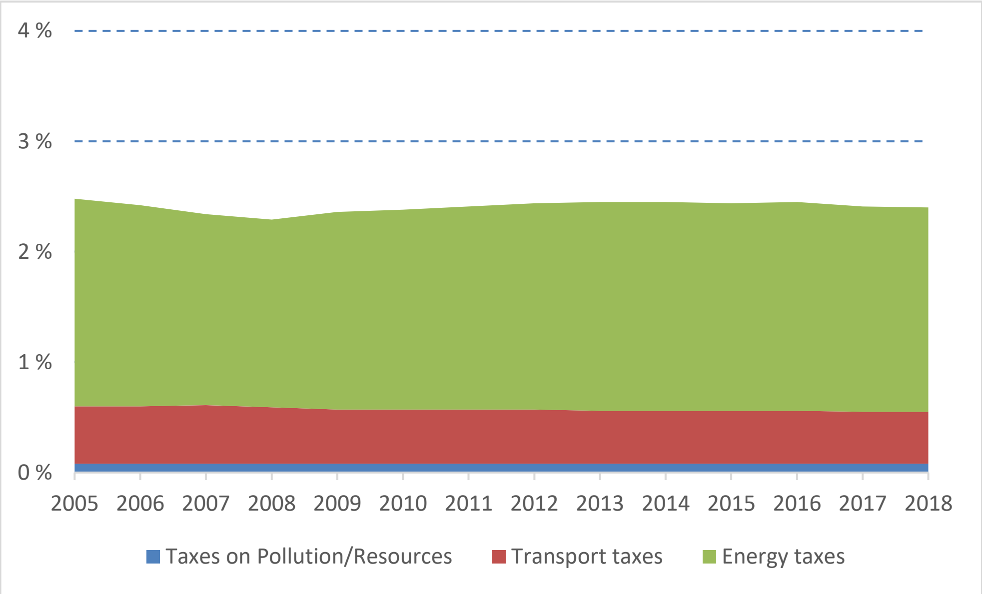
[15] European Commission (2019d). Communication on the European Green Deal. COM(2019) 640 final.

[16] European Commission (2019c). A more efficient and democratic decision making in EU energy and climate policy. COM(2019) 177 final.

revenues from environmental taxes, followed by transport taxes (about 20 %), and pollution and resource taxes (3.3 %) (Eurostat, 2020b).

Figure 3 represents the environmental tax revenue between 2005 and 2018 as share of GDP. Overall, the environmental tax revenues were very stable, between 2.29 % and 2.49 %. Although there was a dip in 2008, their share in GDP rose again slightly up to 2012, mainly due to the growth in energy taxes. Tax revenues of transport and pollution/resources have remained stable over time.

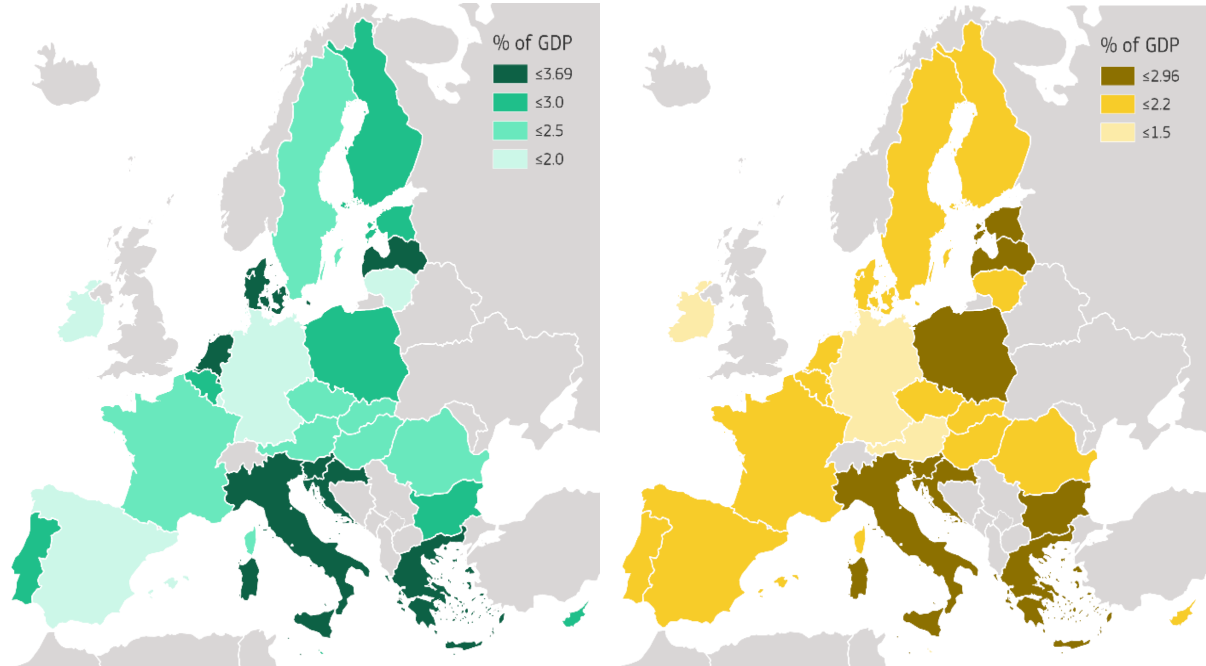
Figure 3: Environmental tax revenues, 2005 – 2018 (% of GDP)



Source: Eurostat data (code ENV_AC_TAX)

The practices and levels of environmental taxation vary considerably between countries. Figure 4 and figure 5 represent the composition of environmental tax revenues as a share of GDP in 2018. Energy tax revenues constitute the main component of environmental tax receipts for almost all countries. The left side of figure 4 on the share of environmental taxes of GDP shows quite a big fluctuation between the Member States. Environmental tax share was the lowest in Ireland (only 1.56 %) and the highest in Greece (3.69 %). On the other side, for the energy tax, Ireland had the lowest share here as well (0.97 %) and Slovenia had the highest one (2.96 %). Taxes on energy accounted for over half of the environmental tax revenue in all EU Member States in 2018, being by far the largest source of environmental taxes in Czechia, Romania, Luxembourg and Lithuania (with more than 90 % share of the total environmental tax revenue).

Figure 4: Environmental tax (left) and energy tax (right) revenues in the EU, 2018 (% of GDP)

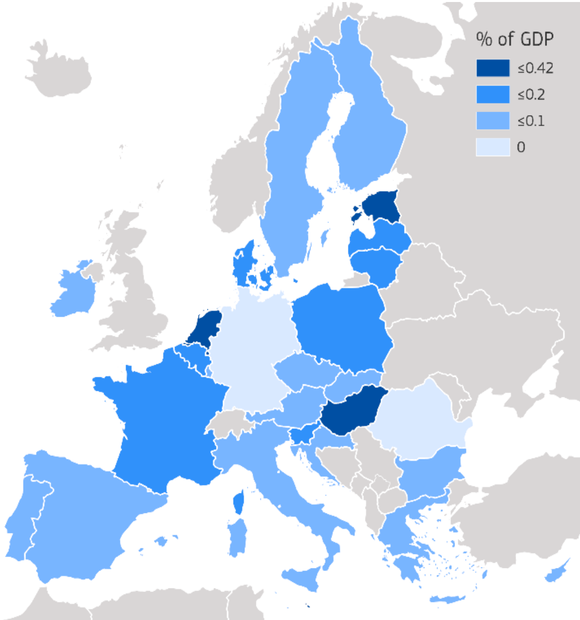


Source: Eurostat data (code ENV_AC_TAX)

Transport tax and pollution/resources tax revenues as share of GDP are illustrated in figure 5. Transport taxes are all taxes that are directly related to the ownership and use of transport vehicles, including the taxes related to infrastructure use but they do not include transport fuel taxes. The lowest share of transport tax in 2018 was observed in Estonia (0.5 %) while the highest share was in Denmark (1.5 %). Transport taxes were the second-largest component of the environmental tax revenue for all EU Member States but Estonia and Lithuania.

Pollution and resource taxes account for a very small portion of the environmental tax revenue. They group a variety of taxes, levied e.g. on waste, water pollution and abstraction. In many European countries, such taxes were introduced later than energy or transport taxes and only marginal values of this category of taxes are reported up to now. As yet, we see in figure 5 that two countries – Germany and Romania – collected no revenue from it. The Netherlands collected the highest share of this tax in Europe which was 0.42 % of GDP. Hungary and Estonia also stand out, recording shares of pollution and resource taxes that, although small, are larger than in other EU Member States.

Figure 5: Transport tax (left) and pollution/resources tax (right) revenues, 2018 (% of GDP)



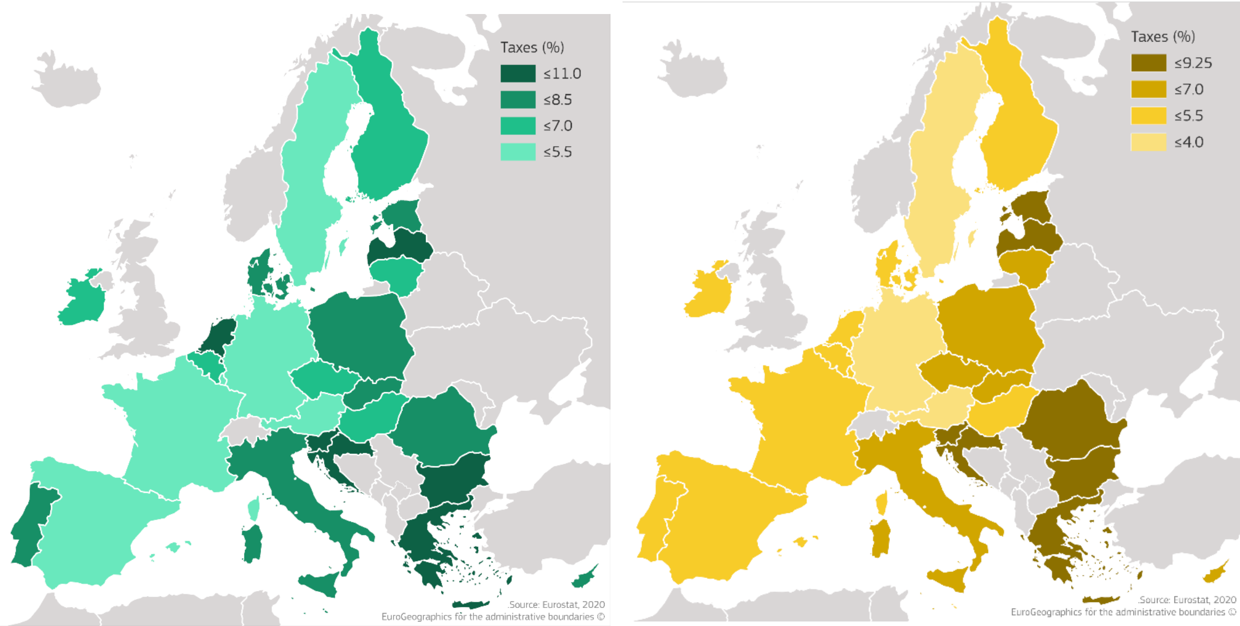
Source: Eurostat data (code ENV_AC_TAX)

Overall, the share of environmental taxes varies quite strongly between the Member States. The largest share of GDP from environmental taxes was in countries like Greece, Denmark, Croatia, Slovenia, Latvia, the Netherlands and Italy. Therefore we see that there is no regional classification in Europe when it comes to environmental taxes. In order to have a clearer picture on how the environmental taxes look like compared to other taxes, we also include figure 6 and figure 7 that contain environmental taxes and its different components as a share of total taxes and social contributions in 2018.

Left hand side of the figure 6 shows that the contribution from environmental taxes to total government revenue from taxes and social contributions varied significantly across the Member States in 2018, with the highest shares recorded in Latvia (10.9 %), Bulgaria (9.8 %), Greece (9.5 %), Slovenia (9.4 %) and Croatia (9.3 %). At the other end of the scale, the smallest shares were observed in Luxembourg, (4.4 %), Germany (4.5 %) and Sweden (4.8 %).

When it comes to energy taxes specifically, Latvia had the highest share here as well (9.25 %), Bulgaria was second (8.59 %) and Slovenia third (7.87 %). The lowest energy taxes share was calculated in Austria (3.35 %) and Sweden (3.64 %).

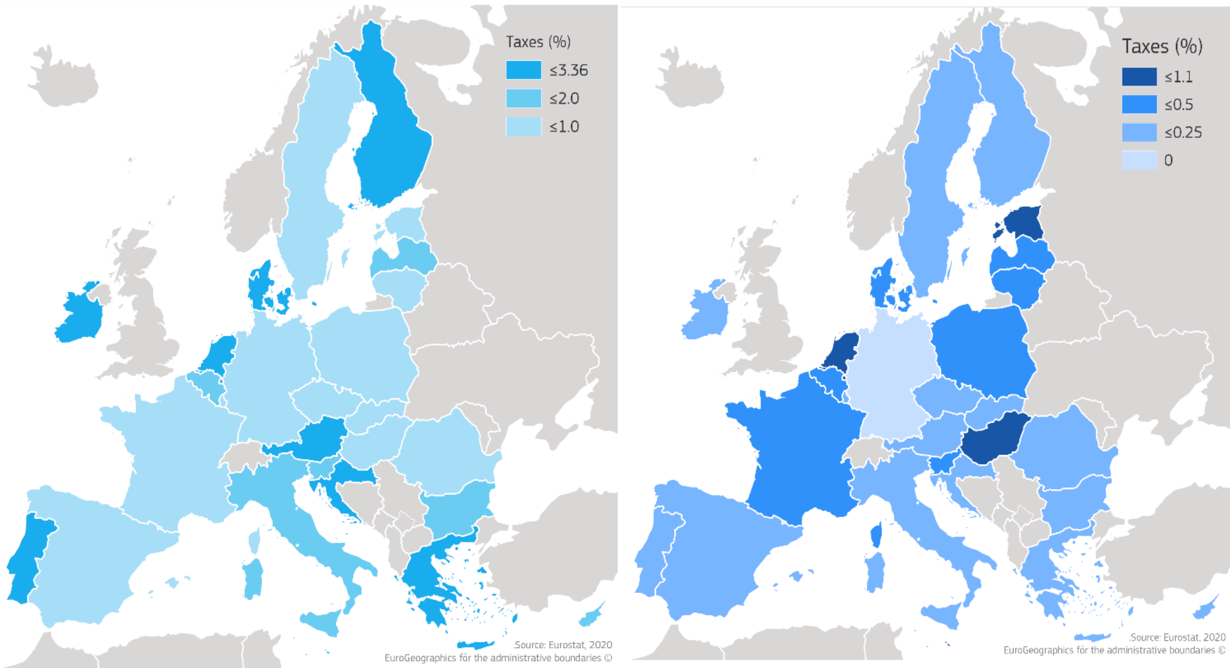
Figure 6: Environmental tax (left) and energy tax (right) revenues as a share of total taxes and social contributions in 2018



Source: Eurostat data (code ENV_AC_TAX)

Figure 7 shows transport and pollution and resources taxes as a share of total taxes and social contributions. The share of transport taxes was the highest in Denmark (3.36 %), Malta (3.33 %) and Ireland (2.59 %). At the other side of the scale, the lowest share of transport taxes was recorded in Estonia (0.16 %) and Lithuania (0.28 %). In terms of taxes on pollutions and resources, their highest share was in the Netherlands (1.1 %) and Estonia (0.84 %). In Germany, however, the share of pollution and resources taxes was 0 %, and other countries were close to 0 %, such as Cyprus and Romania (0.02 %).

Figure 7: Transport tax (left) and pollution/resources tax (right) revenues as a share of total taxes and social contributions in 2018

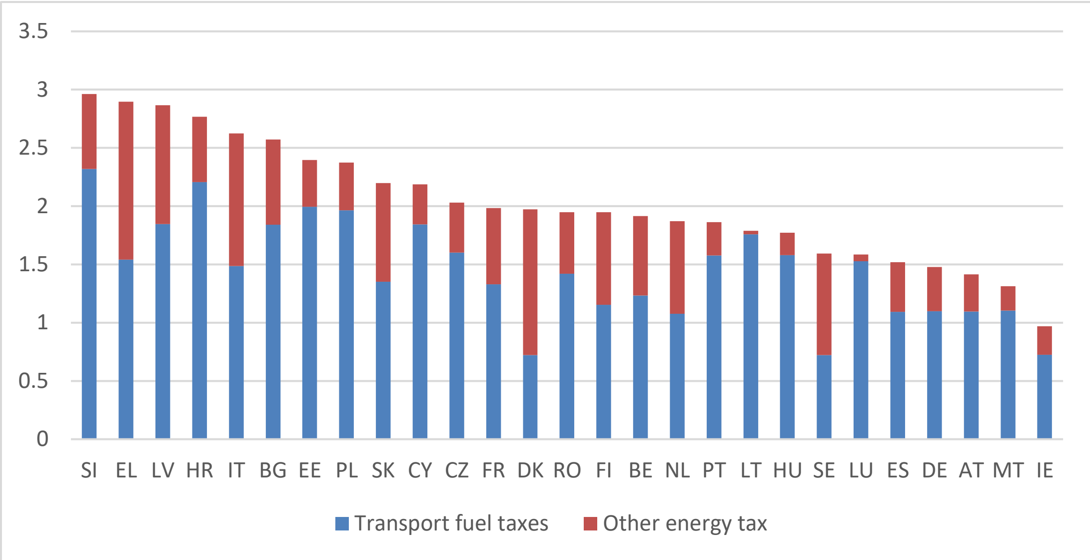


Source: Eurostat data (code ENV_AC_TAX)

Looking into energy tax revenues alone and examining them further, it is clear that transport fuel taxes take up the majority of the total energy tax revenues. Transport fuel taxes are taxes such as on oil and gas. As Figure 8 shows, in most countries, transport fuel taxes constitute more than two thirds of energy tax revenue. In four Member States (Lithuania, Luxembourg, Hungary, Portugal), transport fuel represents over 85 % of energy tax revenue.

Overall, we see that energy taxes are a traditional source of government income. Some Member States rely quite heavily on environmental taxes as they can take up nearly 3.7 % of GDP, and nearly 3 % of them can be collected from energy taxes.

Figure 8: Energy tax revenues by Member State, 2018 (% of GDP)



Source: European Commission, DG Taxation and Customs Union, based on Eurostat data

4 Energy and climate policies affecting consumer energy bills

4.1 Reducing greenhouse gas emissions

There are different instruments that put a price on environmental harm such as greenhouse gas emissions. One is via environmental taxation that sets a price directly levied on the carbon intensity of fuels which are used to produce energy. Another is a cap-and-trade system such as the EU ETS, the world's first major carbon market. In addition to mitigating emissions, carbon pricing can raise revenues for social policies, spur economic growth and reduce other taxes, such as income taxes (Advani et al., 2013).

The main instruments to reduce greenhouse gas emissions in the EU are the EU ETS, the ETD and carbon taxes. Whereas the EU ETS is mainly determined at the EU level, carbon taxes are applied at the national level. The ETD leaves some flexibility for Member States to design their energy taxation systems[17].

4.1.1 EU Emissions Trading Scheme

The EU ETS is a climate instrument that targets CO_2 emissions from energy use. Launched in 2005, the scheme covers around 45 % of the EU's greenhouse gas emissions and remains the world's largest carbon pricing instrument. The EU ETS limits emissions from more than 11 000 installations from power generation, energy intensive industries, and airlines. The EU ETS has expanded more rapidly than carbon taxes. The choice of instrument and its design are affected by circumstances specific to the jurisdiction, including its emissions profile, constitutional provisions and political considerations (Haites, 2018).

The EU ETS sets a limit on the level of emissions and allocates permits to energy users. Companies covered by the EU ETS receive or buy emission allowances to allow for a cost-efficient outcome. They can also buy limited amounts of international credits from emission-saving projects around the world[18]. The system has been subject to recent reform to correct the surplus of emission allowances and the EU ETS price.

Free allowance allocation with varying degrees of auctioning and benchmark allocation has been more common in the first two phases of the EU ETS (2005 – 2012) to prevent competitiveness losses in certain industrial sectors at risk of carbon leakage. Now in its third phase (2013 – 2020), auctioning in the EU ETS is the default method for allocating allowances. The power sector auctions all of its allowances, whereas in the other sectors there is a transitional phase to auctioning. For the industrial sector, 80 % of its allowances were distributed for free in 2013; this proportion is expected to decrease to 30 % in 2020[19].

Phasing-down the free allocation of allowances is considered to reduce distributional distortions for markets and consumers. Free allowance allocations act as a subsidy, reducing costs only for those who receive free allowances, at the expense of those who do not and who bear more costs (the effects are known as so-called windfall profits for companies) (IEA, 2020). Moreover, free allowances restrict the creation of revenue for the governments that would otherwise be accumulated through auctioning. Revenue from allowance auctioning can be used to invest in further climate mitigation or addressing distributional impacts by compensating low-income households (IEA, 2020).

The shift towards stricter benchmarking since 2013 reduced the over-allocation of free allowances (IEA, 2020). However, it increases the carbon leakage risks. The windfall benefits happened in the first phases of the ETS, and it has now been corrected. The European Commission set new rules for a fourth phase (2021 – 2030) with adjustments to accelerate the deployment of low carbon technologies.

4.1.2 National carbon taxes

Carbon taxes and EU ETS are both policies regulating the GHG emissions and together they cover over 20% of global emissions (Haites, 2018). Many of the carbon taxes are in Member States that also have an ETS, generally covering different emissions sources. At present, the national carbon tax is still not very common in the EU. The majority of EU countries have not yet introduced country-specific CO_2 taxes. Such taxes appear, however, to be levied in Sweden, Denmark, Slovenia, Ireland, France, Finland, Portugal, Latvia, Poland and Estonia.

[17] European Commission (2019b). Evaluation of the Council Directive 2003/96/EC of 27 October 2003 Restructuring the Community framework for the taxation of energy products and electricity. SWD(2019)332final.

[18] https://ec.europa.eu/clima/policies/ets_en

[19] ibid

The theory of a carbon tax is that the government designates the emissions sources subject to the tax and sets the tax rate per unit of emissions (Conway et al., 2017). National carbon taxes can be an effective way to reduce CO_2 emissions (Sen & Vollebergh, 2018). They aim to internalise the social cost of energy use such as greenhouse gas emissions and air pollution by putting a price on carbon. Possibilities for charging carbon include a fuel tax or a tax directly on carbon dioxide emissions (Hájek et al., 2019). The carbon tax for electricity is usually based on the carbon intensity of the generation mix and the carbon taxation of fuels (Flues & Thomas, 2015). Carbon taxes tend to apply to fossil fuels with limited coverage of energy and industrial sources while the opposite is true for the EU ETS (Metivier et al., 2018).

In the 1990s, several European countries started to introduce carbon taxation as a way to integrate economic and environmental policies. Finland, Norway, Sweden and Denmark were the first countries to experiment with carbon taxes by shifting the focus of taxation away from means of production to pollution (Abdullah & Morley, 2014). The reasons included a concern over climate change and an interest to reduce labour taxes and unemployment (Ekins, 1999; Andersen, 2004).

Over the past decades, EU member states continued to introduce carbon taxes in addition to the EU ETS Scheme. Carbon taxes can play a role in reducing emissions from sectors outside the EU ETS that have to decarbonise. In 2018, carbon tax rates varied from as low as 0.07 EUR/t CO_2 in Poland to 112.08 EUR/t CO_2 in Sweden, which has the highest carbon tax rate (Table 1). Most countries base their carbon taxes on the energy use, instead of CO_2 content (OECD, 2019b). The carbon taxes of Estonia and Latvia are more similar to the emissions trading systems (OECD, 2019b).

Table 1: Carbon taxes in EU Member States

Country	Year	Carbon tax rate EUR/t CO_2*	GHG emissions covered	Application of the tax
Denmark	1992	23.21	40 %	All consumption of fossil fuels (natural gas, oil and coal). GHG emissions mainly from the buildings and the transport sectors.
Estonia	2000	2	3 %	Generation of thermal energy (all fossil fuels).
Finland	1990	62	36 %	CO_2 emissions from mainly the industry, transport and buildings sector. All fossil fuels except for peat.
France	2014	44.60	35 %	CO_2 emissions from mainly the industry, transport and buildings sector. All fossil fuels.
Ireland	2010	20	49 %	CO_2 emissions from all sectors with some exemptions for the power, industry, transport and aviation sectors. All fossil fuels.
Latvia	2004	5	15 %	CO_2 emissions from the industry and power sectors. All fossil fuels except peat.
Poland	1990	0.07	4 %	Various environmental emissions such as CO_2 emissions, dust, sewage and waste.
Portugal	2015	7	29 %	CO_2 emissions from mainly the industry, transport and buildings sector. All fossil fuels.
Slovenia	1996	17	24 %	CO_2 emissions from the combustion of fossil fuels (including coke) and incineration of combustible organic substances.
Spain	2014	15	3 %	Emissions of fluorinated greenhouse gases (F-gases) from all sectors.
Sweden	1991	112.08	40 %	CO_2 emissions mainly from the transport and buildings sector. All fossil fuels.

Source: (OECD, 2019b), Carbon Pricing Dashboard, 2019. *Tax rates as applicable on 1 July 2018, with the exception of Poland and Spain (1 September 2018).

In many instances, the carbon taxes that have been introduced are not applicable to installations covered under the EU ETS. There are, however, some exemptions for fuels used for energy generation that participate in the EU ETS. In Portugal, EU installations are taxed for the fuel oil and natural gas used to generate electricity at lower rates of the carbon tax[20]. Other exemptions also apply to tax mechanisms. In Ireland, Slovenia and Denmark, certain energy-intensive industries, power production, aviation and shipping are exempt from the carbon tax[21]. In Finland, there are also exemptions for fuels for electricity production, commercial aviation and yachting (Leu & Betz, 2016). In Denmark, energy-intensive industries are largely exempt if they enter a voluntary agreement on energy efficiency (Leu & Betz, 2016). In Sweden, there is no energy or carbon tax on electricity generation but non-industrial consumers have to pay a tax on electricity consumption (Johansson et al., 2000).

[20] https://carbonpricingdashboard.worldbank.org/map_data
[21] ibid

Some carbon tax mechanisms include measures for the protection of vulnerable and low-income households. Ireland aims to redistribute its revenue in order to protect vulnerable energy consumers and raise the fuel allowance for vulnerable households. Portugal's carbon tax wants to redistribute the revenues in the form of income tax relief to lower-income families. Also, vulnerable consumers are partly exempted from the carbon tax. Sweden combined the introduction of its carbon tax in 1991 with reductions in general energy taxes to avoid increases in general taxation and negative effects on low-income households[22].

4.1.3 Energy Taxation Directive

The EU made an attempt to standardise energy taxation practices as early as the beginning of the 1990s. However, it was only after many stages and the ratification of the financially more heavyweight Emissions Trading Directive that the ETD was approved in 2003. It lays down the structure of energy taxation and relatively low minimum tax rates for fuels and power.

The ETD sets the EU rules on the taxation of energy products and electricity. It covers products used as motor fuel or heating fuel (i.e. to operate engines or to produce heat) and electricity. Other uses of energy products, such as their use as raw material, and some uses of electricity fall outside the scope of the Directive. All these products are also bound by the common provisions applicable to all products subject to excise duties set out in Council Directive 2008/118/EC[23] or "the Horizontal Excise Directive".

The primary objective of the ETD is to support the proper functioning of the internal market by avoiding double taxation and other distortions of trade and competition between energy sources and energy consumers and suppliers. The ETD identifies the energy products subject to the harmonised rules for excise duties, sets minimum levels of taxation, lays down the conditions for applying tax exemptions and reductions, and establishes specific rules (in addition to the main rules provided for in the Horizontal Excise Directive). It also contains some procedural rules – depending on their national needs, the Member States can apply excise duty rates above the minimum levels of taxation set by the Directive, and all revenue from the excise duty goes entirely to the Member States.

The legal basis of the ETD is Article 113 of the Treaty on the Functioning of the European Union (TFEU)[24] for the harmonisation of indirect taxes "to ensure the establishment and the functioning of the internal market and to avoid distortion of competition". At the time of its adoption, the ETD represented a positive contribution to the EU legislative framework, but it has subsequently remained unchanged, despite the fact that technologies, energy markets, the climate emergency and the EU legislative framework have evolved and changed significantly since its adoption. For example, in the current ETD there is no link between the minimum tax rates of fuels and their energy content and CO_2 emissions.

The 2011 Impact Assessment of the ETD[25] states that the Directive is not consistent with the new policy framework and contains several shortcomings from the perspective of the functioning of the internal market. In particular, it raises problems such as:

1) current minimum rates being based on the volume of energy products consumed not reflecting the energy content or the CO_2 emissions of the energy products, leading to inefficient energy use and distortions in the internal market;
2) lack of coordination between the ETD and the EU ETS Directive in terms of CO_2 taxation;
3) two provisions allowing for special treatment of certain energy consumers - article 9(2) allows three Member States (BE, LU and DK) to apply levels of taxation for heating gas oil below the minimum level of taxation and article 15(3) allows Member States to apply a level of taxation down to zero to energy products and electricity used in agricultural, horticultural or piscicultural works, and in forestry.

In 2015, due to the unanimity rule between Member States, negotiations at the Council failed and the proposal made in 2011 was withdrawn, and the scope and structure of the Directive remained unchanged. In

[22] https://www.carbonpricingleadership.org/blogs/2019/10/18/should-every-country-on-earth-copy-swedens-carbon-tax

[23] Council Directive 2008/118/EC of 16 December 2008 concerning the general arrangements for excise duty and repealing Directive 92/12/EEC.

[24] European Union (2012). Consolidated version of the Treaty on the Functioning of the European Union (TFEU). Official Journal of the European Union. C, 326, 47.

[25] European Commission (2011). Impact Assessment Accompanying document to the Proposal for a COUNCIL DIRECTIVE amending Directive 2003/96/EC restructuring the Community framework for the taxation of energy products and electricity. SEC (2011) 410. vol. 1, vol. 2.

September 2019, the Commission published a report on the evaluation of the ETD[26] that also highlights that high discrepancies in national energy tax rates are not in line with other policy instruments and can lead to fragmentation of the internal market. This evaluation used five evaluation criteria (effectiveness, efficiency, relevance, coherence and EU added value) and discovered the following:

1) The current Directive is not effective enough as its rates on electricity and natural gas are too low and can have no positive influence on the internal market. It also fragments the internal market due to a common use of optional tax exemptions and differing implementation of the ETD.

2) In terms of resources required and changes generated, the Directive did not cause any considerable regulatory burden or costs for the Member States.

3) The ETD covers a continuously reducing share of the EU's energy mix and is not relevant to the current use of energy products.

4) Regarding the coherence part, the ETD contains overlaps, gaps and inconsistencies that if fixed, could better contribute to the achievement of the EU targets in the areas of energy, environment, transport and global warming. Currently, there even are sectoral exemptions or reductions that oppose some of the EU policies.[27] The Directive also needs to be more aligned with the EU ETS to encourage cost-effective emissions reduction.

5) Lastly, the outdatedness of the Directive hampers its EU added value for a good functioning of the single market.

4.2 Promoting renewable energy sources

The main types of policy support for the deployment of renewable technologies include:

- Feed-in-tariffs (FIT) – power producers have a guaranteed access to the grid and receive a fixed payment for each unit of generated electricity independent of the electricity market price.
- Feed-in-premiums (FIP) in the form of grants, bonuses premiums – plant operators have to market the electricity generated directly at the electricity market and receive an additional payment on top of the electricity market price (Banja & Jégard, 2017).
- Green certificates (GCs); - policies requiring suppliers to have a certain share of renewable generation in their supply portfolio.
- Investment grants – usually available for the construction of smaller and medium-sized renewables (hydropower, PV installations); and research and development for renewables.

The organisation of each support scheme may occur either through administrative procedures or through tendering procedures (CEER, 2018). Many EU countries started to adjust their renewable support schemes towards market-based models. There is therefore a growing trend to switch towards using competitive auctions or tenders when determining the level of subsidy (Banja & Jégard, 2017).

Overall, energy subsidies in Europe increased from EUR 148 billion in 2008 to EUR 169 billion in 2016. During this time, renewable subsidies (mainly wind and solar) experienced a threefold increase, up from EUR 25 billion to EUR 76 billion (European Commission, 2019a).

In 2018, renewable energy represented 18.9 % of energy consumed in the EU, on a path to the 2020 target of 20 % (Eurostat, 2020c). Promoting the use of renewable energy has many potential benefits as it reduces the GHG emissions, diversifies the energy supply and reduces dependency on fossil fuel markets. Growing use of renewable energy sources also creates jobs in 'green' technologies.

Figure 9 and 10 demonstrate the share of renewables in two large energy consumption sectors – electricity and transport. In terms of renewables in electricity, the highest share was in Austria (over 70 %), followed by Denmark and Sweden (over 60 %). On the other side of the scale there were countries like Malta, Hungary, Luxembourg and Cyprus, all of which had less than 10 % of renewables in their electricity consumption.

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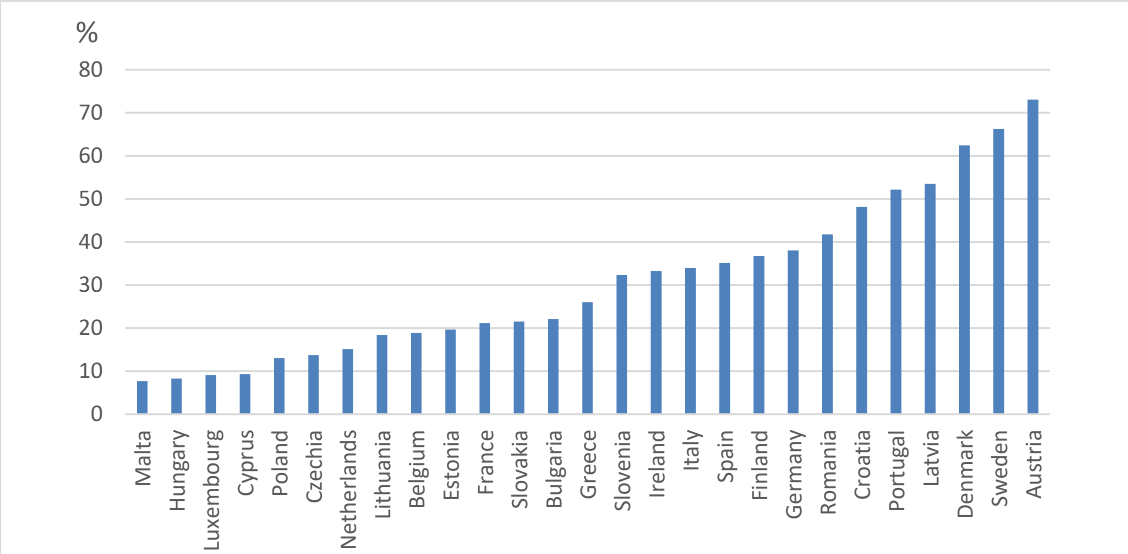
[26] European Commission (2019b). Evaluation of the Council Directive 2003/96/EC of 27 October 2003 Restructuring the Community framework for the taxation of energy products and electricity. SWD(2019)332final.

[27] Some examples of the sectoral exemptions are the optional exemption granted to biofuels and to energy products and electricity used for combined heat and power generation, without any precise requirement in terms of energy savings.

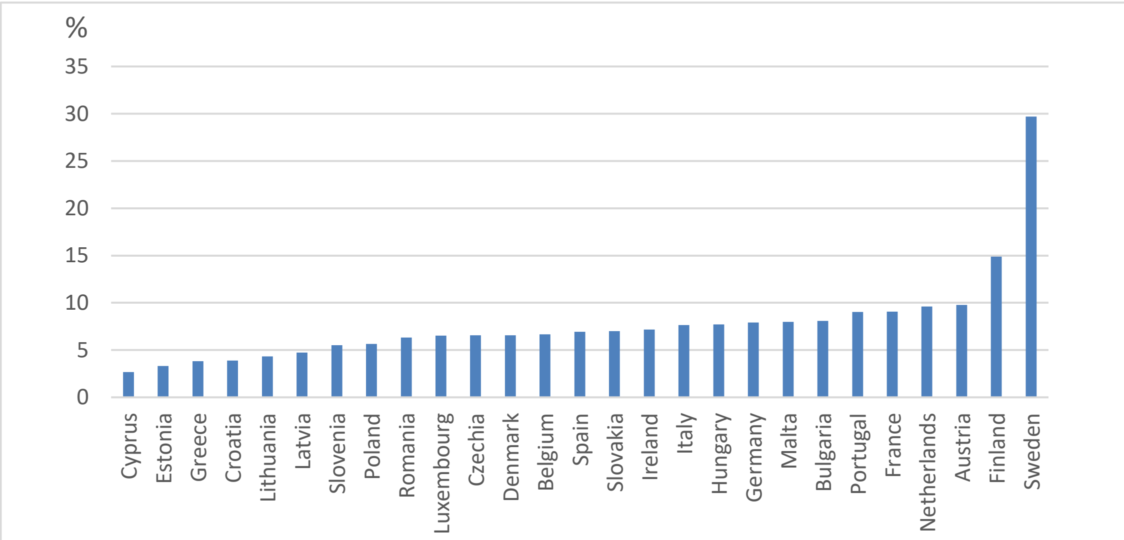
In terms of the share of renewable energy sources in transport, Sweden by far ranked first with nearly 30 %. Finland was second but had around half lower share of renewables than Sweden. Overall there were 6 Member States with less than 5 % of renewable sources in their final energy consumption in transport sector, and the rest of countries had less than 10 %.

Figure 9: Share of electricity from renewable sources in gross electricity consumption, 2018



Source: Eurostat data (code NRG_IND_REN)

Figure 10: Share of renewable energy sources in transport, 2018



Source: Eurostat data (code NRG_IND_REN)

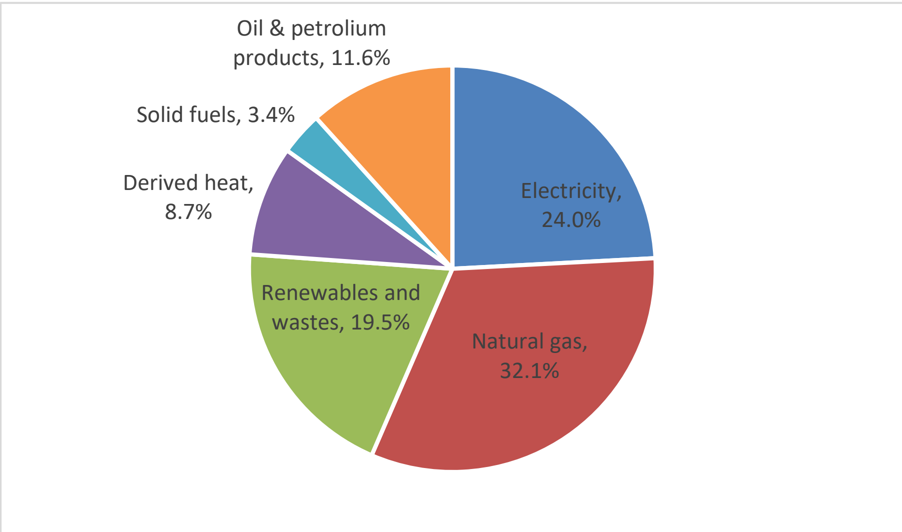
5 Current energy prices in the European Union

Energy prices in the EU depend on a range of different supply and demand conditions, including the geopolitical situation, the national energy mix, import diversification, network costs, environmental protection costs, climate conditions, and levels of excise and taxation. In this chapter we look at the household energy prices, in particular at the prices for electricity and then transport more briefly. We also discuss the cost determinants for electricity. The price and reliability of energy supplies, electricity in particular, are key elements in a country's energy supply strategy.

5.1 Household energy consumption and expenditures

In 2018, households represented 26 % of final energy consumption or 17 % of gross inland energy consumption in the EU. The residential sector overall uses different energy products. In terms of energy carrier, most of the EU final household energy consumption is covered by natural gas (32.1 %) and electricity (24.7 %) (Figure 11). Renewables account for nearly 20 %, followed by petroleum products and derived heat. A small proportion, over 3 %, is still covered by solid fuels.

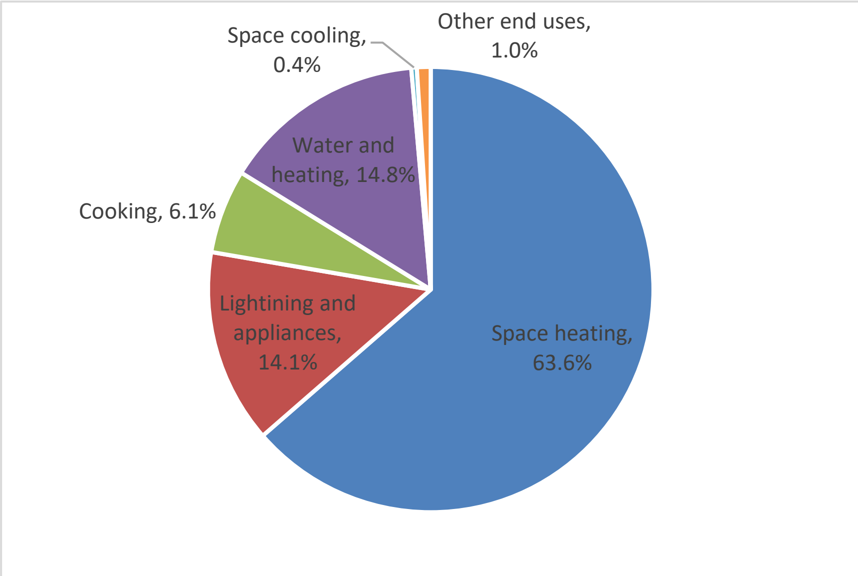
Figure 11: Final energy consumption by fuel in the residential sector, EU-27, 2018



Source: Eurostat data (code NRG_BAL_C)

The main use of energy by households is for heating their homes - 63.6 % of final energy consumption in the residential sector (Figure 12). The proportion used for water heating represented nearly 15 %, and electricity used for lighting and electrical appliances 14 % (this excludes the use of electricity for powering the main heating, cooling or cooking systems). Main cooking devices took up just over 6 % of the final energy consumption in the residential sector. The remaining share of energy was required for space cooling and other end-uses.

Figure 12: Final energy consumption in the residential sector by use, EU-27, 2018



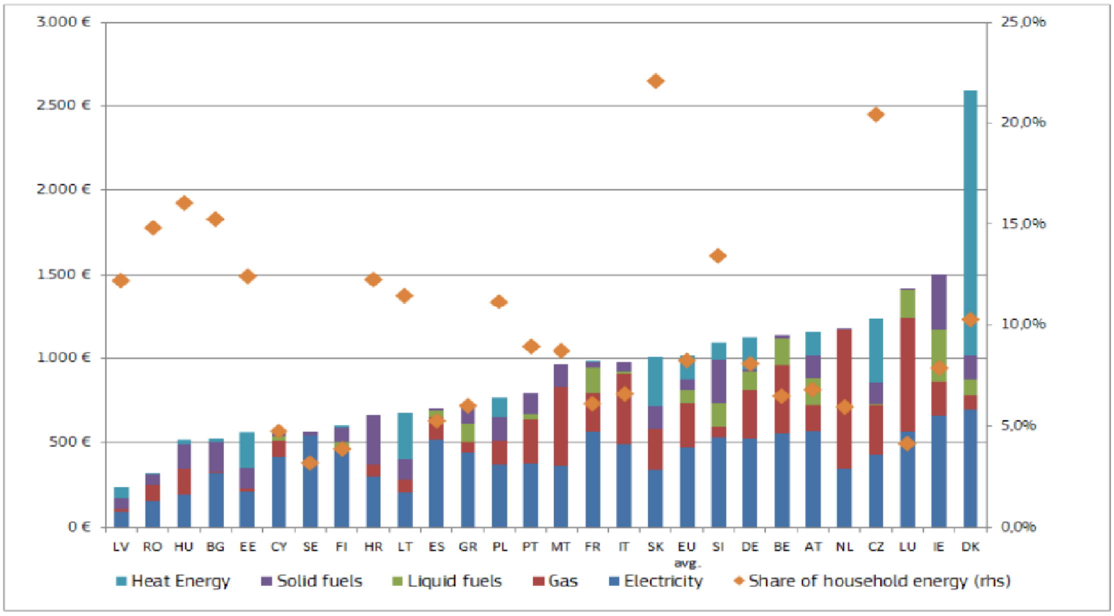
Source: Eurostat data (code NRG_BAL_C)

Energy prices have increased substantially over the last two decades mainly driven by a growth in network charges, taxes and levies (European Commission, 2019c). This development, together with the lower incomes resulting from the economic crisis that began in 2008 has burdened many households' ability to pay their energy bills. Although they spend more in absolute terms, higher income households use a smaller proportion of their income on energy than poorer households do.

In 2018, the poorest European households (the lowest 10 % income bracket) spent 8.3 % of their expenditure on energy. Lower-middle (third decile) and middle income (fifth decile) households spent 7.4 % and 6.7 %, respectively, of their expenditure on energy (European Commission, 2020c).

By region, northern and western European middle-income households spent 3-8 % while central and eastern Europeans with the same income level spent 10-15 %. By country, the poorest households spent from slightly more than 20 % in Slovakia and Czechia to less than 5 % in Luxembourg, Finland and Sweden (Figure 13). In absolute terms, the EU poorest households spent on average a total amount of EUR 945 on energy products, which ranged across Member States from less than EUR 500 to EUR 2500. However, it is important to consider that the purchase power varies largely amongst the Member States.

Figure 13: Expenditures on household energy products for the poorest households (excl.transport) by fuel and energy share in their total expenditure, 2018



Source: DG ENER ad hoc data collection on household consumption expenditures

5.2 Electricity market design and electricity household prices

5.2.1 Cost determinants for electricity

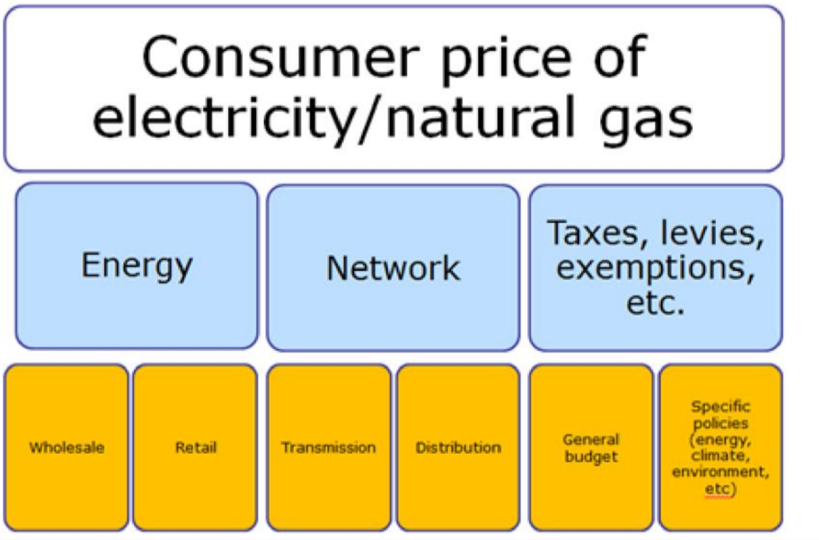
5.2.1.1 Components of the electricity bill

Household electricity prices broadly consist of three parts (Figure 14). First, the energy component depends on the wholesale electricity market which reflects the costs incurred by companies in delivering energy to the grid (such as for fuel purchase/production, shipping, processing, as well as constructing, operating and decommissioning power stations). The energy component also includes the retail costs related to the sale of energy to final consumers (European Commission, 2014).

Network costs refer to transmission and distribution system costs. These include the development, maintenance and management of electricity networks, network losses and customer service costs. Network costs also consist of certain taxes and regulatory charges imposed by municipal, regional and national governments.

Finally, taxes and levies include VAT and excise duties, and costs recovered from consumers to pay for energy and climate policies. Policy support costs are generally recovered in proportion to the amount of electricity consumed – per kWh or by a fixed charge per consumer (Schittekatte & Meeus, 2018).

Figure 14: Elements of consumer prices for electricity and gas



Source: European Commission, Energy prices and costs, 2014

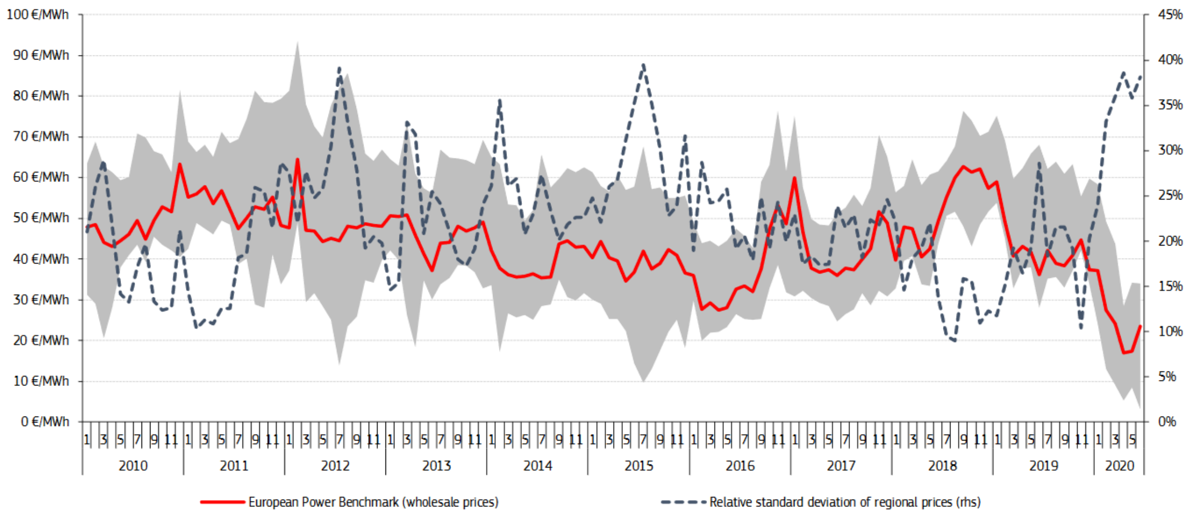
5.2.1.2 Wholesale electricity prices

Renewable energy can decrease prices in electricity spot markets - due to the so-called merit order effect that determines the power price. The merit order refers to the ranking of power stations from the cheapest to the highest bids based on their running costs. The producers offer their electricity at short-term marginal costs (i.e. fuel costs and CO_2 prices). As renewables have very low marginal costs, higher shares of renewables generally lower prices in the day-ahead spot market.

Wholesale electricity prices rose from 2016 until they reached a peak in the end of 2018 (Figure 15). Then they fell abruptly in 2019 due to the expansion of renewable generation as well as falling fuel costs. Comparing the first half of 2020 with the same period in 2019, prices fell between 30 % in some southern European regional markets and up to 70 % in some northern regions (European Commission, 2020c).

Also, there was a significant drop in the demand for electricity in 2020 due to the COVID-19's negative impact on economy. COVID-19's impact together with increasing renewable energy expansion as well as falling gas prices has drastically lowered wholesale electricity prices.

Figure 15: Wholesale electricity prices; lowest and highest regional prices and dispersion



Source: European Commission, Energy prices and costs in Europe, 2020

In addition, the guaranteed feed-in-tariff for electricity generated by renewable energy sources triggers a reduction in the demand load on electricity markets (Sensfuß et al., 2008). In turn, the reduced demand on the markets generates lower power prices. Sensfuß et al. (2008) calculated that the value of the merit-order effect of German renewable electricity increased from EUR 1 billion in 2001 to EUR 5 billion in 2006. The result is a significantly reduced renewables surcharge if this volume is subtracted from the support scheme payments that can lead to profits for consumers.

However, it is not clear if the savings created by the spot market prices from renewable electricity will translate into lower electricity prices for consumers. Pena & Rodriguez (2019) argue that a decrease in wholesale prices does not necessarily translate into lower household electricity prices. Network fees, taxes, levies and surcharges raise the electricity bills for household consumers.

5.2.1.3 Network and policy costs

The costs for energy efficiency measures, renewable energy subsidies and investments in emission reduction technologies will ultimately be borne by consumers. Policymakers have often used electricity bills to recover for example costs from renewable support schemes through non-tax levies paid by consumers (Perez-Arriaga et al., 2017). In the EU, taxes and levies make up a significant 40 % share of average electricity prices (European Commission, 2019a). In recent years, their proportion has continuously increased (Schittekatte & Meeus, 2018).

Network costs are a central part of achieving ambitious energy and climate targets. Significant investments are necessary in electricity infrastructure to accommodate the growing shares of distributed energy resources and replace the ageing infrastructure. Network investments include building and connecting new capacity, as well as replacing and refurbishing existing assets. Generators that receive a revenue stream from feed-in-tariffs can provide significant benefits in terms of energy output, but can also add costs to the electricity system.

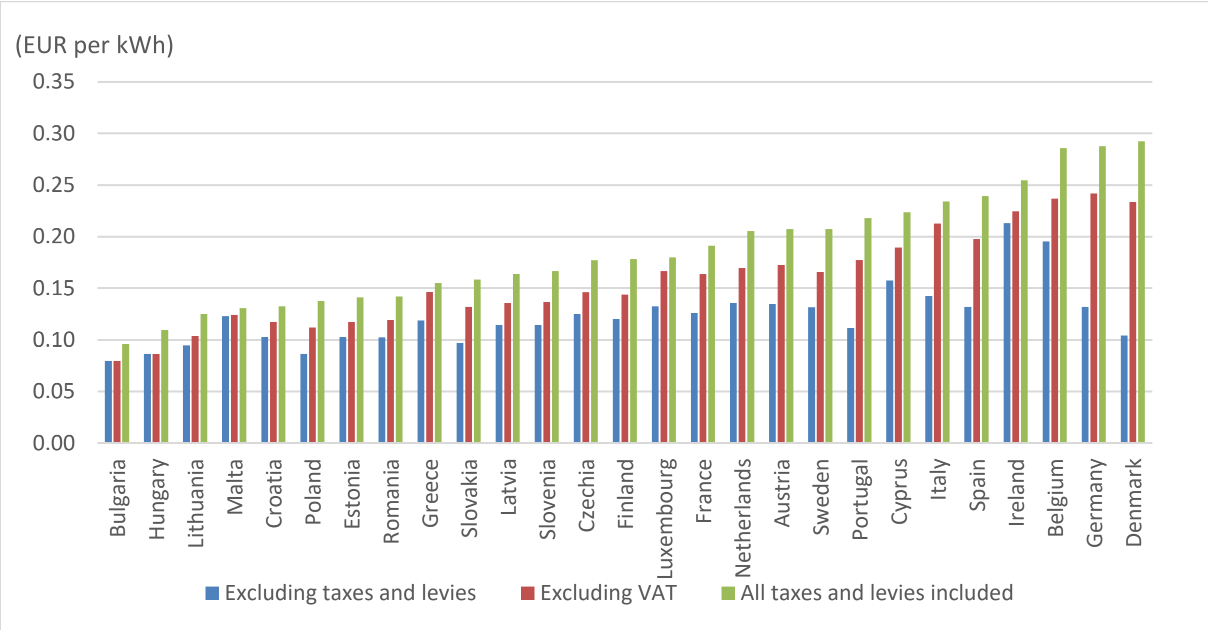
Network costs also increased due to the integration of variable renewables at low-voltage levels. Industry (for competitiveness reasons) is often exempt from or faces lower network charges, electricity taxes and levies than households (European Commission, 2019a).

Volumetric charges (e.g. charging based on energy flows per kilowatt-hour) allow customers to save money by reducing energy consumption or consuming their own energy. In traditional one-way electricity systems where customers were solely consuming electricity, volumetric charging was sufficient for network operators to recover their expenses. With the uptake of bidirectional electricity flows occurring in distribution grids, volumetric tariffs no longer reflect total network costs as they lower the revenue for network infrastructure and cross subsidise costs (Perrez & Arriaga, 2017).

5.2.2 Household electricity prices

Household electricity prices in the EU-27 were highest in Denmark (EUR 0.29 per kWh) and lowest in Bulgaria (EUR 0.10 per kWh) during the second half of 2019. The price of electricity for household consumers in Denmark was more than three times as high as the price in Bulgaria. Figure 16 indicates the household electricity prices in the second half of 2019 together with taxes and levies included and excluded.

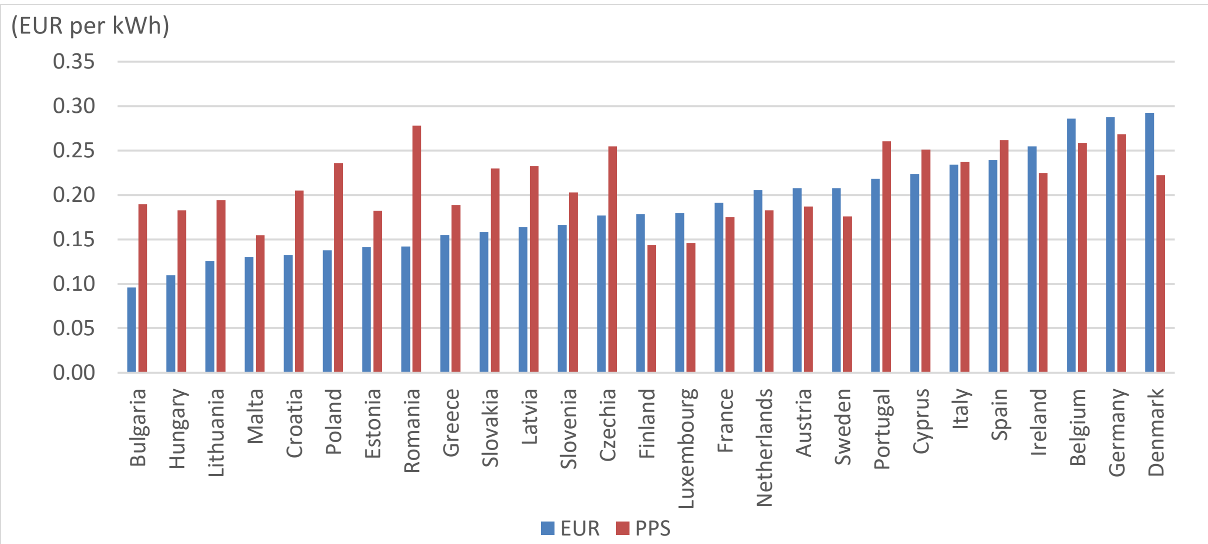
Figure 16: Electricity prices for household consumers, second half 2019



Source: Eurostat data (code NRG_PC_204)

Although figure 16 shows countries like Germany, Denmark and Belgium having by far the highest electricity prices, there are also significant differences in the amount of money available that people can spend. The Member States have different GDPs and salaries in Western and Eastern Europe can differ significantly. These characteristics needs to be accounted for when determining how cheap or expensive electricity is in a particular country. Therefore, figure 17 compares the actual electricity price (taxes and levies included) with the purchasing power standard (PPS)[28]. We now see that, in fact, considering the PPS, Romanians pay the largest share for electricity in the EU, and Finnish the smallest.

Figure 17: Electricity prices for household consumers compared to the purchasing power standard, second half 2019



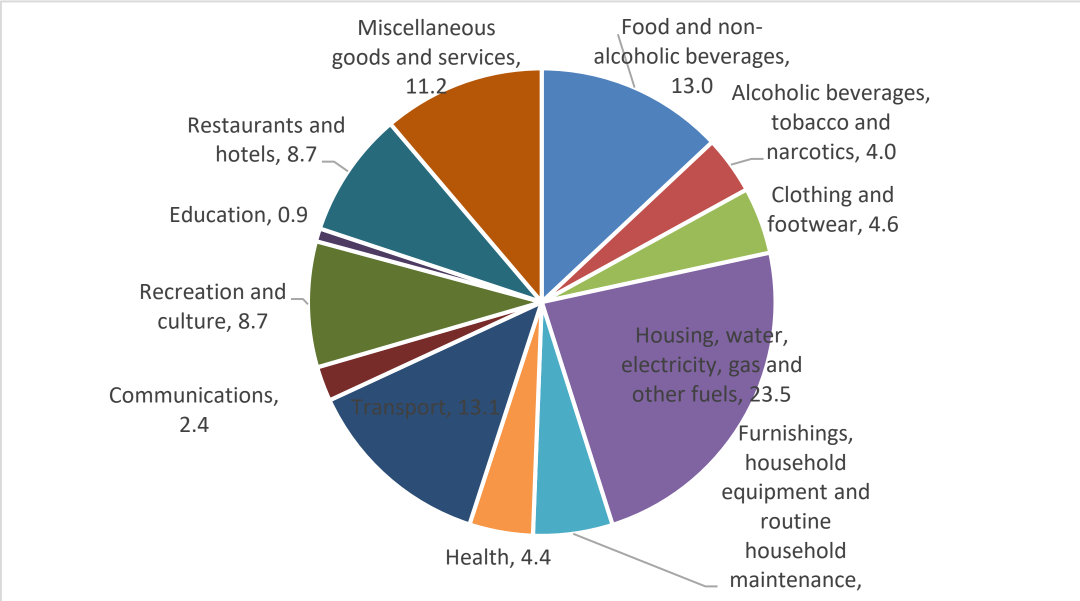
Source: Eurostat data (code NRG_PC_204)

[28] The gross domestic product per capita of the country is converted into PPS taking other factors into account.

5.3 Transport prices and external costs

Transport pricing is also a key policy tool for promoting an environment-friendly balance between transport modes and for managing transport demand. For households in the EU, transport is the second largest expenditure item after housing, water, electricity, gas and other fuels combined (Figure 18). Food and non-alcoholic beverages follow in third place (Eurostat, 2020d).

Figure 18: Household expenditure by consumption purpose, share of total, EU-27, 2019

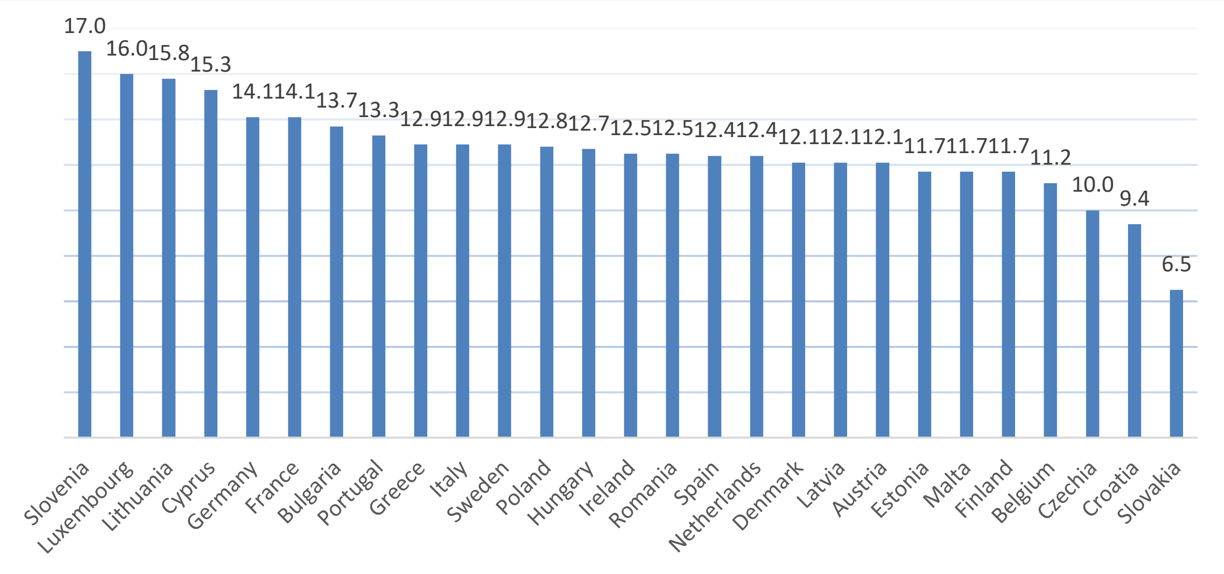


Source: Eurostat data (code nama_10_co3_p3)

In 2019, households in the EU spent 13.1 % of their total consumption expenditure on transport (this includes private and public transport). In 2018, when the total consumption on transport was 0.1 %, lower, it represented a total expenditure of over EUR 1.1 trillion, equivalent to 7.2 % of the EU's GDP or EUR 2 220 per EU inhabitant (Eurostat, 2020d).

Figure 19 shows the EU household expenditure on transport as a share of total expenditure in 2019. The share of household expenditure devoted to transport was largest in Slovenia (17 %), ahead of Luxembourg (16 %) and Lithuania (15.8 %). They were followed by Cyprus (15.3 %), Germany and France (both 14.1 %), and Bulgaria (13.7 %).

Figure 19: Household expenditure on transport, % of total expenditure, 2019



Source: Eurostat data (code nama_10_co3_p3)

Transport activities are often taxed, such as vehicle sales taxes and registration fees. For road transport, all EU Member States apply fuel taxes and vehicle taxes (such as purchase and registration taxes), while in most countries, road charges (tolls and/or vignettes) are also applied. Tolls are commonly levied on the usage of transportation assets, particularly at bottlenecks such as bridges and tunnels. Diesel and gasoline taxes, and to a lesser extent electricity taxes are also applied (European Commission, 2017). For rail transport, rail access charges are applied in all Member States.

The main external costs of transport are those linked to greenhouse gas emissions, local air pollution, congestion, capacity bottlenecks, accidents and noise. In particular, energy use and climate change have the most significant impact on transport.

The transport sector remains one of the key challenges to decarbonising the economy. GHG emissions from transport have increased every year since 2014. Estimates put them at 29 % above 1990 levels in 2018 (European Environment Agency, 2019). Achieving climate neutrality will need a 90 % reduction in transport emissions by 2050.

The total external costs of transport in the EU are estimated at EUR 987 billion (this figure includes congestion costs for road transport only) (European Commission, 2019e). In general, the most important cost category is accident costs adding up to 29 % of the total costs, followed by congestion costs (27 %). Overall, environmental costs (climate change, air pollution, noise, well-to-tank and habitat damage) make up the remaining 44 % of the total costs (European Commission, 2019e). Calculation of external costs in the EU 28 in 2016 demonstrates that motorcycles cause the highest average external costs per passenger-kilometre (pkm), which is due to relatively high noise and accident costs. The average external costs of buses are significantly lower compared to passenger cars, which can be explained by the higher occupancy rates of these vehicles. For rail transport, the average external costs for diesel trains are significantly higher than for electric trains. There are two main reasons for this – the fact that passenger diesel trains have lower load factors (number of passengers per vehicle) than electric trains, and the higher emission factor of diesel trains. Due to significantly higher climate change and air pollution costs, the average costs of diesel trains are EUR-cent 3.9 per pkm, while the costs of electric trains only amount to EUR-cent 2.6 per pkm (European Commission, 2019e).

6 The impact of energy taxation on vulnerable consumers

The impact of energy taxation on people's income and expenditure shows a great variation, in particularly when comparing the richest and poorest in society. From the perspective of household disposable incomes, energy and climate policies may affect low-income households disproportionately. For those households it is important to consider how to alleviate and/or compensate for such impacts.

The way energy taxation schemes function can also influence people's attitudes towards the energy transition as a whole. Although taxes on polluting fuels encourage a shift to low-carbon alternatives, poor households need to be protected from paying a greater share of their resources than wealthier ones. Any tax increase on polluting energy has to be offset by decreases elsewhere to cushion the social impact. The energy taxes and network costs take up a considerable part of the energy bill, and poor households cannot always afford to pay their energy bills. Therefore, this group of people faces energy poverty and social exclusion. The Energy Poverty Observatory estimates that more than 50 million households in the EU are experiencing energy poverty.[29] Distribution of collected tax revenues used for specific causes could help eliminate certain aspects of energy poverty. Re-investing the energy taxation revenue by transferring it back to poor households can boost the progressivity of the tax system.

6.1 Impact of carbon pricing

Carbon prices, implemented either through taxes or tradable permit schemes, can raise the price for fuel and energy use (Vandyck & Regemorter, 2014). Carbon taxes act in a similar way as electricity or road fuel taxes that do not tax emissions by increasing the price for consumers. As lower-income households spend a large part of their income on energy, carbon taxes can have distributional effects on low-income households (Vandyck & Regemorter, 2014). Higher-income households rely more on transport services such as aviation, meaning that a carbon price in this sector might be less regressive (Hirth & Ueckerdt, 2013).

6.1.1 Electricity

Electricity is an indispensable basis for our modern societies. People rely on electricity to cook, heat and cool their homes and run energy-intensive appliances. The amount of electricity used by households for basic every day activities is not significantly influenced by fluctuating electricity prices. Meanwhile, the EU's energy system will need to get increasingly decarbonised in order to meet the EU's 2050 climate neutrality goal. A carbon tax incorporating the external costs associated with greenhouse gas emissions from energy used is a preferred tool to regulating negative effects (Advani et al., 2013). This is likely to complement the growing trend in retail energy prices that have mostly been driven by taxes and levies, and network charges (European Commission, 2019a).

When analysing the distributional effects of rising energy prices for households in Germany, Reaños & Wölfing (2018) find that low-income households are more affected than wealthier ones. Flues & Thomas (2015) agree that taxes on electricity are regressive, giving the reason that households have fewer alternatives for electricity consumption than for heating or transport. Lower-income households tend to have older, more energy-consuming electrical appliances and buy fewer energy-efficient ones (Flues & Thomas, 2015). In Denmark, Wier et al. (2005) find that of all household energy commodities, electricity was the most heavily taxed, followed by oil and gas. CO_2 taxes imposed on energy consumption in households do, in fact, tend to be regressive, and therefore have undesirable distributional effects. Although low-income households paid less taxes, this accounted for a greater share of their income at 0.8 % in comparison to 0.3 % for the high-income families (Wier et al., 2005).

6.1.2 Heating

There are various heating practices for households. Some use individual or collective heating with fuels like natural gas, oil, solid fuels and electricity. Reaños & Wölfing (2018) find that, contrary to public debates, increases in heating prices are more regressive than those in electricity. By contrast, Flues & Thomas (2015) derive slightly less regressive effects of heating fuel taxes. They state as reason the possibility for lower-income households to save on heating costs since they might live in smaller dwellings that represent a smaller area to heat. Similar effects can be seen in Belgium where household energy prices fell by 15.1 % between 2013 and 2015 due to the falling prices of natural gas and oil for heating (Delbeke & Meyer, 2017). Despite lower incomes, households in the Brussels region were at lower risk of energy poverty than in the

[29] https://www.energypoverty.eu/about/what-energy-poverty

Walloon region as most residents live in apartments that requires less heating than a house (Delbeke & Meyer, 2017). Wier et al. (2005) argued that rural households in Denmark suffer from higher CO_2 tax burden as they have high energy consumption due to heating needs.

6.1.3 Transport

Transport conditions as well as mobility behaviours of lower-income population groups differ significantly from their higher-income counterparts in almost every country in the world (Mattioli et al., 2018). There is also a close connection between transport affordability and social exclusion as inability to meet the cost of transport can prevent people from accessing education, work, shopping or other basic necessities (Litman, 2013). According to Gwilliam (2002), affordability and inclusiveness of public transport services should be traded off against that of sufficient revenue for good quality services, and can only happen through financial subsidies from the state. Controlling public transport fares, ostensibly to help the poor, may adversely affect service quality unless supported by subsidy.

Transport-related taxes such as on fuels and vehicles carry the potential to mitigate carbon emissions, reduce congestion and improve local urban environment, and therefore are an important instrument for climate policy. They can be either less regressive or progressive depending on the country (Kosonen, 2012). Kosonen (2012) finds that taxes on transport fuels alone are, at the EU average level, sufficiently progressive to counteract the regressivity of other types of energy taxes. Taxes on electricity and heating tend to be regressive in most countries, while taxes on transport fuel and vehicles are not necessarily so. In fact, they seem to be sufficiently progressive in most European countries that they offset the regressivity of other energy taxes. Sterner (2012) by reporting on examples of over 20 countries also claims that fuel taxation is a progressive policy particularly in low income countries. As there might be some minimal regressivity in high-income countries, they can correct for it by cutting back on other taxes that adversely affect more financially vulnerable citizens, or by spending more money on services for the poor. In poor countries, poor people spend a small share on fuel for transport and they cover some costs from fuel taxes through food transport or public transport. Sterner (2012) concludes that overall the more the income of the country decreases, the more progressive the gasoline taxes become.

6.2 Impact of the EU's Emissions Trading Scheme

A cap-and-trade programme such as the EU’s ETS can raise public concerns concerning its potential regressive distributional impacts on society. Depending on its design, the system can lead to higher prices for energy and energy-intensive goods that would eventually impose a higher burden on low- and moderate-income households in relation to their income (Dinan, 2009).

In the power sector, the EU ETS raised concerns about increases in the electricity prices in particular due to the pass-through of the cost of EU allowances (Lise & Wetzelaer, 2008). The EU emissions trading increases the generation costs of power installations that emit CO_2 emissions. Firms are expected to pass on the opportunity costs whether the allowances were granted for free or were put up for sale at auctions (Sijm et al., 2006). If the marginal costs of emission allowances is fully passed on to the electricity price in competitive markets, it would increase the electricity bills for consumers. (Kara et al., 2008) found that small-scale consumers are likely to be the most affected by the electricity price rises due to the additional carbon costs.

Addressing emissions from the industrial sector via the ETS has faced similar concerns about distributional effects on consumers. Industry sectors such as cement, iron and steel, refineries, fertilisers and chemicals would pass on the carbon costs by increasing the price of their products. Benefits for industry can arise from the allocation of free allowances, the possibilities to use international credits for compliance and the cost pass-through of large shares of freely obtained allowances (De Bruyn et al., 2016).

Free allowances allocation to industrial sectors was criticised for foregoing government revenue from auctioning the pollution permits and transferring costs to European consumers (Carbon Market Watch, 2016). According to a literature review, the over-allocation of free allowances has resulted in windfall profits whereby energy-intensive and power companies that received free allowances passed the carbon costs to consumers. (Carbon Market Watch, 2016); (De Bruyn et al., 2016); (IEA, 2020); (Sijm et al., 2006).

De Bruyn et al. (2016) estimated the additional profits from passing through the carbon costs under the EU ETS profits for the 15 most carbon-intensive sectors[30] amounted to over 15 billion euro between 2008 and

[30] Excluding electricity, heat and aviation

2014. Carbon Market Watch (2016) further calculated that governments have lost at least EUR 137 billion in auctioning revenues as a result of issuing 11 billion free allowances. The table below shows the estimated minimum and maximum variant for the cost-pass through rates for the 15 sectors analysed by (De Bruyn et al., 2016) in 19 European countries.

Table 2: Estimated cost-pass through rates from various sectors

Sector	Minimum	Maximum	Average
Extraction of crude petroleum and gas	40 %	100 %	70 %
Manufacture of coke oven products	55 %	100 %	75 %
Refineries	40 %	100 %	70 %
Industrial gases	0 %	0 %	0 %
Inorganic chemicals	10 %	37 %	24 %
Petrochemicals	15 %	100 %	50 %
Fertilizers	10 %	100 %	50 %
Manufacture of plastics	42 %	100 %	70 %
Flat glass	0 %	80 %	40 %
Hollow glass	30 %	80 %	55 %
Other glass	24 %	80 %	50 %
Manufacturing of bricks	30 %	80 %	40 %
Cement	20 %	58 %	39 %
Lime	0 %	80 %	40 %
Iron and Steel	55 %	100 %	75 %

Source: De Bruyn et al., 2016

6.3 The use of energy tax revenues

As mentioned previously, in 2018, environmental tax revenue in the EU totalled EUR 324.6 billion and the largest part of it – 77 % - was collected from energy taxes alone (Eurostat, 2020b). This raises the question of how these revenues are recycled back to the economy. The final distributional impact of the energy taxation also depends crucially on how the tax revenues are used. There are, in fact, different options for the use of tax revenue. Energy tax revenue can potentially be used by a government to increase its expenditure on environmental protection or efficient management of natural resources. Environmental advocates often believe that revenues should be used to support further efforts at cutting greenhouse gas emissions (Esch, 2013), while others are worried about the poor and want to make sure some revenues are used to offset their burdens (Stone, 2015).

According to Vollebergh (2012), energy taxes are typically not earmarked for specific use, and thus seen as a part of governmental income. Governments then decide how they want to allocate the collected revenue which can contribute to a budget surplus or alleviate a budget deficit, provide room for discretionary increases in government expenditures, or discretionary reductions in other taxes (OECD, 2001). Some countries earmark certain taxes for specific use (for example, fuel taxes are often earmarked for road building). Earmarking revenues may also improve the political acceptability of taxes because of the dedicated nature of expenditures, a proportion of which is returned to tax payers in the form of subsidies or public investments (OECD, 2001).

When discussing carbon tax revenues, Marron & Morris (2016), emphasize the following goals that carbon tax revenues should achieve: offset the new burdens that a carbon tax places on consumers, producers, communities, and the broader economy; support further efforts to reduce greenhouse gas emissions; ameliorate the harms of climate disruption; and fund unrelated public priorities.

The different uses of revenue also have different implications for income groups (Caron et al., 2018). When revenue is devoted to social programs (such as food assistance or social security), the results are most beneficial to lower income households than in either the case where all net revenue is used for tax relief or social programs or half is used for the investment tax credit (Rausch & Reilly, 2012). Vandyck & Van Regemorter (2014) analysed aggregate and distributional effects of increased excise levies on oil in Belgium, and drew a few important conclusions. Their research finds that using additional tax revenue to increase welfare benefits results in gains for lower income households. A reduction in wage and return to capital makes high income households worse off in this scenario. Also, when the revenue is recycled through lower labour taxes, the environmental tax reform is slightly regressive.

A recent Commission report on employment and social developments in Europe also argues that transferring part of the revenue from energy taxes back to households can cushion the impact on poverty and inequality (European Commission, 2020d). The energy taxation would be less regressive if governments considered re-investing tax revenue through special schemes such as renovation and/or renewable energy subsidies to reduce energy poverty among vulnerable populations. Another option is lump-sum transfers for households that would help those who otherwise were affected disproportionally by higher energy taxes (European Commission, 2020d).

The Commission's 2030 Climate Target Plan[31] also points out that the use of carbon revenues in general could lead to a reduction of labour taxation with positive effects on employment and could be used to invest in innovation and modernisation towards a green economy. The Impact Assessment accompanying the 2030 Climate Target Plan[32] informs that the estimated changes in relative prices generated by higher climate ambition would indeed affect lower income earners significantly more than the top income earners. However, the Impact Assessment analysis shows that carbon revenue at a national level would be sufficient to compensate those income groups who are affected the most. In this case, the evaluation is made assuming that revenues from carbon pricing are redistributed as a lump sum uniformly to all households, regardless of their income and expenditure. In addition, the complementary analysis by Temursho et al. (2020) on distributional impacts shows progressive effects after lump sum revenue redistribution, with on average 10% lowest-spending households being better off than before the policy reform. If the redistribution mechanism is targeted to address the needs of lower income groups rather than all households, it would be possible to use part of the carbon revenues to support sectoral restructuring, for instance via direct support for research and development, innovation and the deployment of new technologies at market scale.

The way the energy taxation revenue is used can have important consequences, especially if the taxes, and therefore, the revenues are predicted to grow in the future. The EU is expected to have a few increases in carbon price signals in the EU ETS/non-ETS sectors and the energy taxation in line with climate and air pollution objectives (European Central Bank, 2020). Ireland has passed legislation for an increase in carbon taxes for 2020 with very minor fiscal implications for the euro area as a whole and the government has stated its intention to introduce linear increases in the tax until 2030. Also, more than half of euro area countries plan to increase environmental taxes other than carbon taxes over the next two years (European Central Bank, 2020). The Netherlands is expected to have the biggest increase in such taxes, although the macroeconomic effects will be largely offset by compensatory cuts to energy taxes.

6.4 Impact of Renewables Support Schemes

This section analyses the impact of support instruments and costs of renewables schemes by giving examples of the German feed-in-tariff and net metering schemes for renewables.

[31] European Commission (2020b). Communication on the 2030 Climate Target Plan COM (2020) 562 final

[32] European Commission (2020a). Impact Assesment accompanying the 2030 Climate Target Plan. COM (2020) 562 final

6.4.1 German Feed-in-Tariff

Renewable generation started to grow in Germany driven by a feed-in-tariff implemented since 1991. Since 2000, the Renewable Energy Sources Act (EEG) encouraged the generation of renewable electricity. The revision of the act in 2014 included the transition to an auction system for most technologies. In 2017, the EEG explicitly[33] acknowledged the role of citizen-owned renewable energy facilities (Argyropoulos et al., 2016). At the same time, the share of renewable energy in electricity consumption rose from around 6 % in 2000 to around 36 % in 2017. By 2025, the target is to reach a 40-45 % share of renewables (BMWi).[34]

Energy consumers pay for the additional cost of the EEG surcharge for each kWh consumed.[35] According to the EEG, network operators buy electricity generated by renewable producers at a guaranteed feed-in-tariff. The EEG surcharge corresponds to the difference between the guaranteed remuneration for the renewable plant operator and the revenue from selling the electricity on the wholesale market. The transmission network operator will pass the resulting EEG surcharge as a cost to the electricity consumers.[36]

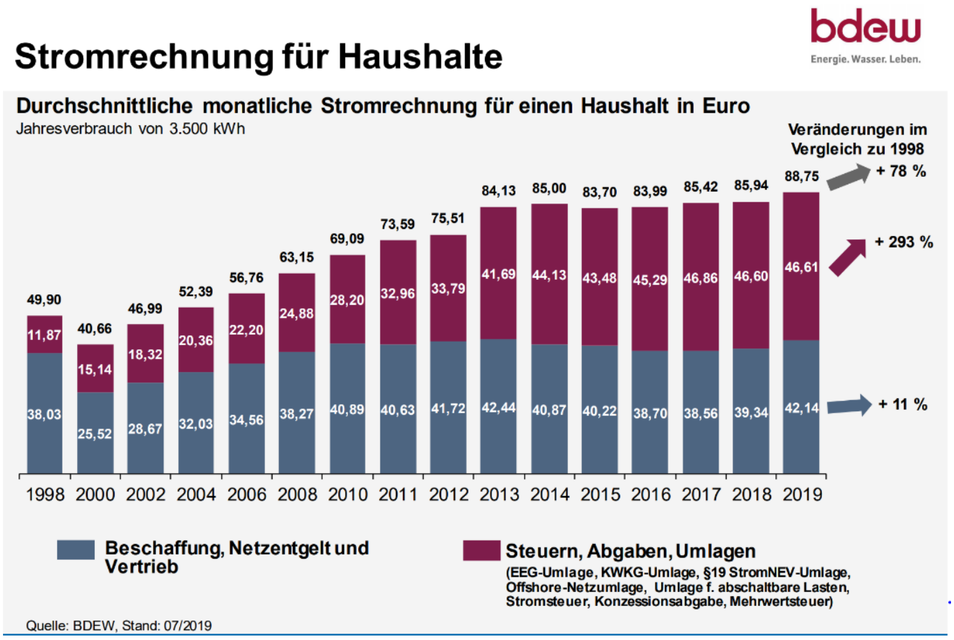
As some energy intensive industries are partially exempted from the payment of the EEG surcharge, households have to bear a disproportionate share of the costs burden (Winter & Schlesewsky, 2019). Until 2014, the surcharge for households was 6.24 ct/kWh, much higher than for large consumers standing at 0.05 ct/kWh (Cludius, 2015). Moreover, as large consumers benefit from lower wholesale prices due to renewables reduction effects, the amount they pay for the EEG surcharge is likely to be offset.

Winter & Schlesewsky (2019) find that the EEG surcharge leads to regressive distributional effects among consumer groups. It was calculated that the lowest income quintile had to spend more than 6 % of their income on electricity, while the highest income quintile had to pay only less than 1.7 % of their income. While high-income households only have to pay 0.5 % of their incomes for the EEG levy, low-income households have to pay around 2.2 % of their income (Winter & Schlesewsky, 2019). In addition to paying less for the EEG surcharge, higher-income households also benefit from the feed-in-tariff payments for producing electricity with their own solar panels.

In 2019, the monthly electricity bill for an average German household was EUR 88.7, or 78 % higher than in 1998.[37] The reason for this increase is partly due to the growth in the EEG, up from 0.08 ct/kWh in 1998 to 6.4 ct/kWh in 2019. Overall, the components of taxes, levies and surcharges in the electricity bills increased by 293 %[38] (Figure 20).

[33] https://www.cleanenergywire.org/factsheets/what-german-households-pay-power
[34] https://www.bmwi.de/Redaktion/EN/Dossier/renewable-energy.html
[35] https://www.futurepolicy.org/climate-stability/renewable-energies/the-german-feed-in-tariff/
[36] https://www.bmwi.de/Redaktion/EN/Artikel/Energy/electircity-price-components-state-imposed.html
[37] https://www.bdew.de/media/documents/20190723_BDEW_Entwicklung_Preisbestandteile_Strom.pdf
[38] https://www.cleanenergywire.org/factsheets/what-german-households-pay-power

Figure 20: Household electricity bill in Germany, 2019



Source: BDEW

6.4.2 Net metering

The growth of distributed generation in conjunction with feed-in-tariffs spurred the development of self-consumption. Further, falling costs of solar power and battery energy storage make it increasingly attractive for people to invest in on-site power generation (Solar Power Europe, 2019).

Net metering is a practice that allows owners of distributed generation who generate more electricity than they consume to receive compensation for the electricity they feed back into the grid. The compensation scheme offsets electricity consumed against the production for a certain period (Bird et al., 2013). The payment of energy allows for ‘running the meter backwards’ when the rooftop solar installation is generating more electricity than the system is using (Bird et al., 2013). Electricity retailers are usually required to purchase the excess electricity from the distributed generation owners.

Benefits of net-metering include reduced costs of customers’ final electricity bills (Eid et al., 2014). It also helps to incentivize the market and foster the deployment of distributed generation.

The side effects of net metering that concern utilities and distributors also affect consumers. Owners of distributed generation are usually paid at the full retail price when they sell the extra power generation to the grid. The retail rate includes not only the energy cost, but also the costs of transmission and distribution (Brown, 2013). This means that the avoided costs for the grid infrastructure are shifted to those customers without solar installations through higher utility rates. The reason is that the distributors will raise the costs for the other consumers in order to recover their lost revenues for maintaining the grid.

Thus, net metering can act as a socially regressive policy instrument as it imposes additional costs on customers who do not want to buy or cannot afford PV installations or other distributed generation systems. Solutions for net metering include changing the payments for solar customers from retail to wholesale rates and raising their fixed charge for using the grid.

7 Conclusions and recommendations for a more efficient redistribution

The EU has increasingly favoured fiscal instruments such as environmental taxes because they provide flexible and cost-effective means for reinforcing the polluter-pays principle and for reaching objectives of the European Green Deal. However, as energy taxation raises the price citizens have to pay for their energy, the poor are at risk to be relatively more burdened by energy price increases than the wealthy.

The most common forms of environmental taxes, and the ones that are the most fiscally important, are those on energy and transport. There is a huge debate in the literature about the progressivity of such taxes, and while some researchers confirm the common belief of them tending to be regressive, others claim that this depends on other factors, such as taxed commodity (taxes on electricity and heating tend to be regressive in most countries, while taxes on transport fuel and vehicles are less regressive), country's overall level of economic development (in low income countries fuel taxation policy is more progressive) and how the collected revenue is used. Also, the progressivity factor might depend on the methodology used by researchers, for example measuring citizens' annual expenditure or annual earnings might bring different results (Pizer & Sexton, 2017).

Energy taxes are a cost-effective policy to address energy externalities but they can raise legitimate distributional concerns in some cases that may or may not be easily rectified. Overall, while energy taxation is essential for reaching climate neutrality targets, regressive energy taxes are controversial and can make it difficult to carry out environmental tax reforms. Regressive taxes also lower citizens' acceptance of the energy transition, contribute to issues such as energy poverty and possibly even social exclusion. Therefore, it is important to ensure that the revenue collected from energy taxes helps to reduce the distributional problems in the EU. A well-balanced portfolio of measures can largely reduce the unwanted distributional effects of climate policies and ensure that the transition to a climate-neutral economy leaves no one behind.

From a social perspective, one of the best ways to redistribute the tax revenue is re-investing it through social schemes like means-tested renovation subsidies that can reduce the energy poverty among the vulnerable populations in Member States. In terms of lump sum tax recycling schemes, they might not be the best option achieving an equitable climate policy as they redistribute the revenue to households without taking into account their income level. Redistributive policies could be designed to target low-income households more directly.

Also, governments can use the revenues from EU ETS allowances auctioning to further invest in actions to reduce distributional impacts on customers. These can include ways to offset customer cost increases from carbon costs by providing compensation for low-income households (IEA, 2020). Such measures will complement existing mechanisms by Member States to recycle the revenues from the EU ETS into climate and energy measures.

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List of abbreviations and definitions

EE	Energy efficiency
EEG	Renewable Energy Sources Act
ETD	Energy Taxation Directive
ETS	Emissions Trading Scheme
EU	European Union
GDP	Gross domestic product
GHG	Greenhouse gas emissions
IEA	International Energy Agency
JRC-GEM-E3	Joint Research Centre's General Equilibrium Model for Economy-Energy-Environment
Pkm	Passenger-kilometre
RES	Renewable energy sources

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