4. Europe's energy crisis: a stress test for both the European Green Deal and the European Social Model

Béla
Galgóczi

Mehtap
Akgüç

Topics

Introduction 101
Greenhouse gas emissions in Europe and the world 102
The fossil energy crisis 106
A new landscape of clean energy investment 110
Response measures to the energy crisis 114
Conclusions with a ‘beyond growth’ outlook 117

> “Striking a balance between climate and social objectives in mids of a cost of living crisis is a Herculean task
>
> **Béla Galgóczi and Mehtap Akgüç**

Introduction

The ‘cost of living crisis’ triggered by runaway fossil fuel energy prices is a watershed moment for Europe. Russia’s invasion of Ukraine has created a new geopolitical constellation, highlighting Europe’s vulnerability as a result of an insufficiently ambitious energy transition. Europe’s long-standing fossil fuel dependence has been exacerbated by naive reliance on Russian oil and gas imports, and the EU has woken up to the current situation to realise that speeding up the energy transition is the only solution. While there is no doubt about this for the medium and long term, the short-term effects of this new energy crisis are more complex and ambiguous. Switching energy systems cannot happen overnight, but short-term fossil fuel supply needs to be secured and the social effects of soaring energy prices must be addressed. As some of these measures risk jeopardising European Green Deal objectives (Hook and Hume 2022), a delicate balance needs to be struck. *Benchmarking Working Europe 2021* (Galgóczi and Akgüç 2021) offered a detailed overview of the complexity of multidimensional inequalities in the context of the climate-environment-social nexus. The main dimensions stretch from responsibility for causing climate change to exposure and vulnerability (as regards both climate change and pollution) and adaptive capacity, as well as employment and the distributional effects of mitigation policies, such as differential accessibility and affordability of low-carbon technology. We showed how these dimensions are linked to inequalities in income, wealth, spatial characteristics, housing and employment, reflecting also on age, gender, skills and racial (ethnic) characteristics. It was concluded that, without a robust social dimension, we face a triple injustice: those least responsible for causing climate change and most vulnerable to its effects are likely to be more affected by the necessary mitigation policies (in terms of employment and distributional effects) and can least afford low-carbon technologies to bring an end to fossil fuel reliance.

One year on, what we observe is that the current energy crisis is further amplifying these inequalities. Trends (as we show in this chapter) indicate that the effects of higher energy costs are harshest for lower-income vulnerable groups, while richer households may even increase their consumption and carbon footprint (as fast-growing civil aviation and SUV sales show, for example (IEA 2022b)). The most disturbing trend for 2022 seems to be that the main factor limiting the further increase of global greenhouse gas (GHG) emissions is slower growth of output and energy use with dramatic effects for the poor.

Winter 2023 has been a key stress test for both the European Social Model and the European Green Deal. Europe is trying to perform a balancing act of maintaining its climate ambitions, while at the same time addressing the social emergency posed by the cost-of-living crisis. Speeding up the green transition while addressing the triple injustice, where those with the lowest carbon footprint suffer most from the effects of energy price increases and can least afford low-carbon technologies, is a formidable task.

This chapter will show the latest trends in greenhouse gas emissions during the past few years, marked by multiple crises, with Section 1 looking at global, European and sectoral levels. Section 2 discusses the effects of the fossil energy crisis that has triggered a cost-of-living crisis in Europe and the world, showing extreme price changes and demonstrating how households are likely to be affected. Section 3 will map the emerging landscape of energy transition investment, with the past few years showing a shift from renewable energy investment towards clean mobility investment, while creating new inequalities. Section 4 will briefly discuss national and EU level responses to the energy crisis. Section 5 concludes with some thoughts about degrowth.

Greenhouse gas emissions in Europe and the world

Global CO_2 emissions

Global CO_2 emissions from energy combustion and industrial processes[1] rebounded in 2021 and are expected to reach their highest ever annual level, according to the International Energy Agency (IEA 2022b: 3). In 2021 energy-related global CO_2 emissions reached a historic peak of 36.3 gigatonnes (Gt), a 6% increase on 2020. This rebound has more than offset the 5.2% decrease due to the effects of the Covid-19 pandemic in 2020, and results in a net increase in emissions of around 180 megatonnes (Mt) compared to the pre-pandemic level of 2019. The 2021 rebound was also stronger than the 2010 resurgence that followed the global financial crisis (IEA 2022b). The 6% increase in CO_2 emissions in 2021 was in line with the 5.9% growth in global economic output and marks the strongest coupling of CO_2 emissions with GDP growth since 2010. Figure 4.1 shows the trends in CO_2 emissions for advanced economies over the past 20 years.

> By 2021, the EU had managed to reduce its energy-related emissions by 20.5% from 2000 levels

By 2021, the EU had managed to reduce its energy-related emissions by 20.5% from 2000 levels, as had the US, while for Japan the reduction was just 9%.

For 2022, despite earlier concerns about the effects of more coal burning in the context of the current energy crisis, global CO_2 emissions from fossil fuel combustion are expected to grow by just under 1%, a fraction of their increase in 2021 (IEA 2022a).

The latest IEA data from around the world show that these CO_2 emissions are on course to increase by nearly 300 Mt in 2022 to 33.8 Gt, in contrast to their increase of more than 2 Gt in 2021. The increase is driven by power generation and by the aviation sector, as air travel rebounds from pandemic lows.

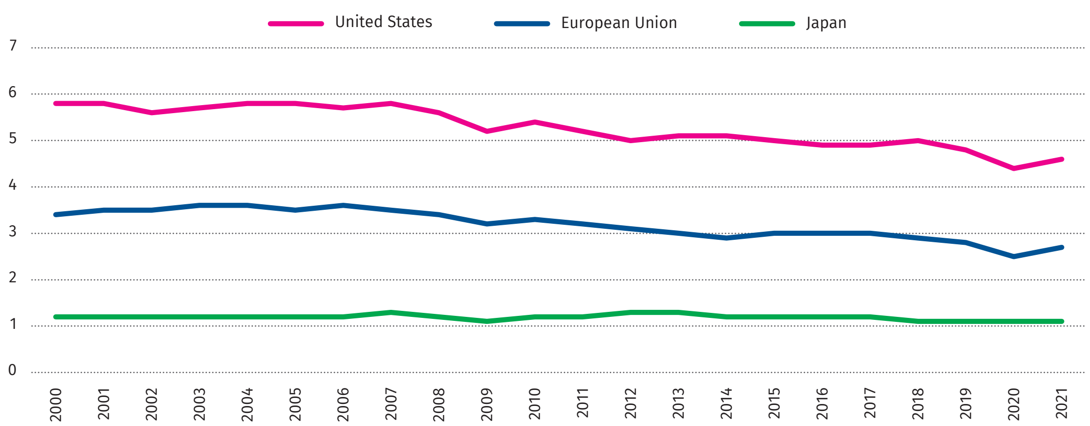
This projected rise in global CO_2 emissions for 2022 would be much larger – close to 1 billion tonnes – without major deployments of renewable energy technologies and electric vehicles (EVs) around the world. The second decisive factor in global energy trends, pushing emissions downwards to a similar extent, is the projected slower economic growth due to the impact of the war in Ukraine on the world economy.

The combined result is that the CO_2 intensity of the world's energy supply is set to improve slightly in 2022, resuming a pre-pandemic multi-year trend of improvement.

According to an IEA projection for 2022, the EU's CO_2 emissions are on course to decline, despite an increase in coal emissions (IEA 2022c). The rise in European coal use is expected to be temporary, with new renewables projects forecast to add around 50 gigawatts of capacity in 2023. These additions would generate more

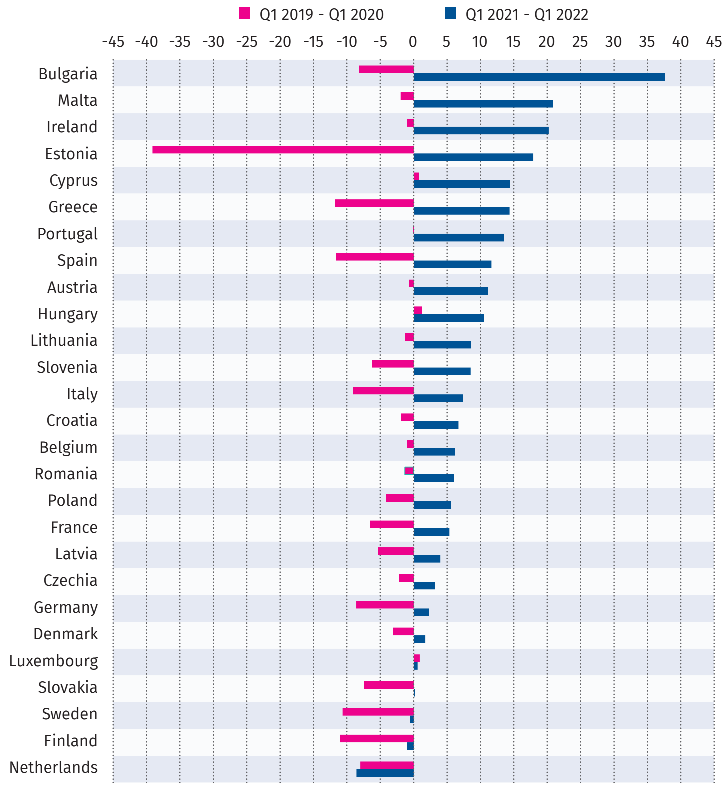
1. The IEA uses the term 'energy-related emissions' for CO_2 emissions from energy combustion and industrial processes.

Figure 4.1 **Energy-related CO_2 emissions in major developed economies (Gt)**



Source: IEA (2022b).

Figure 4.2 **Change in greenhouse gas emissions by Member State (Q1 2019-Q1 2022, in %)**



Source: Eurostat (2022).

electricity than the expected increase in coal-fired power generation in the EU in 2022.

The positive message of the IEA 2022 Energy Outlook is that, even if 2022 brings a further increase in global emissions, this is significant improvement on earlier expectations. While the record deployment of renewables (as one driver of the moderation) is indeed good news, the net positive effect from slower growth due to the war in Ukraine on global emissions is not. If the world 'needs' a cost-of-living crisis to avoid another jump in emissions (with lower growth bringing less fossil energy use), this clearly demonstrates the limited achievements of climate policy efforts. This is bad news from a climate policy viewpoint, but even worse from a social one. Further details from the IEA report also show that aviation has become an important driving force for emissions increase, and, while a record uptake of electric vehicle sales had a significant impact on road transport emission improvements, the similarly record sales of powerful and expensive SUV cars have cancelled out any such improvement. Both trends indicate that the carbon footprint of the rich is less affected by the global slowdown. The apparent outcome is that, while the 'cost-of-living crisis' may bring some incremental improvement in emissions, it aggravates inequalities with devastating social effects. We also saw this pattern in the financial crisis, as well as in the pandemic.

Emissions in Europe

Total greenhouse gas emissions in the first quarter of 2022 increased in almost all EU Member States when compared with the same quarter of 2021, as a by-product of recovery from the Covid-19 pandemic, as Figure 4.2 shows (Eurostat 2022a). The Netherlands (-9%), Finland (-1%) and Sweden (-0.4%) were the Member States that registered a decrease in emissions in the year up to the end of the first quarter of 2022. Apart from Slovakia and Luxembourg (no change), all others and the EU27 as a whole recorded rising GHG emissions, with Bulgaria (+38%), Malta (+21%) and Ireland (+20%) topping the list.

Sectoral emissions

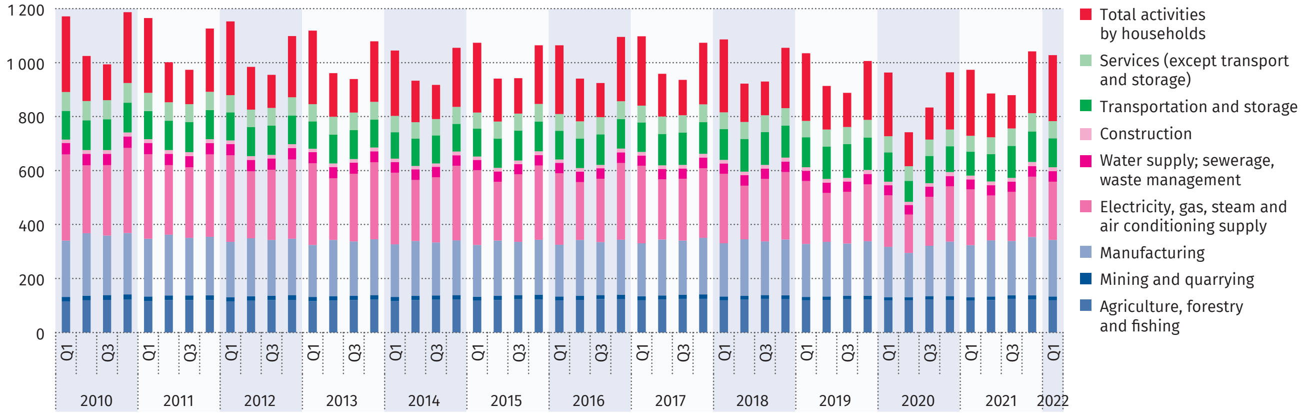
In the first quarter of 2022, among economic sectors, total activities by households[2] had the highest share in greenhouse gas emissions (24%), followed by electricity and gas supply (21%) and manufacturing (20%), while agriculture and transportation accounted for 12% and 10% respectively, as shown by Figure 4.3. Greenhouse gas emissions increased in all sectors compared with the same period of 2021, except for households, which remained at the same level (245 million tonnes of CO_2 eq.). The highest increases were recorded in transportation and storage (+21%), mining (+15%) and construction (+11%).

Emissions by gender

Based on a detailed analysis of consumption patterns in Sweden, a study by Carlsson Kanyama et al. (2021) found that the carbon footprint of single men is significantly higher than for single women. Figure 4.4 shows that, based on consumption patterns, Swedish men have on average, 17% higher annual emissions than women, and the differences are greatest in emissions related to holidays (24%) and transport (45%). For men, these two items make up nearly 60% of their annual carbon footprint. While the case of one Member State is certainly not representative of the whole of Europe, this example from Sweden indicates that, even in an

2. Eurostat uses the term 'total activities of households' as a separate category along Nomenclature of Economic Activities (NACE) sectors.

Figure 4.3 **Greenhouse gas emissions by economic activity, EU27, Q1 2010-Q1 2022 (million tonnes CO_2-eq.)**



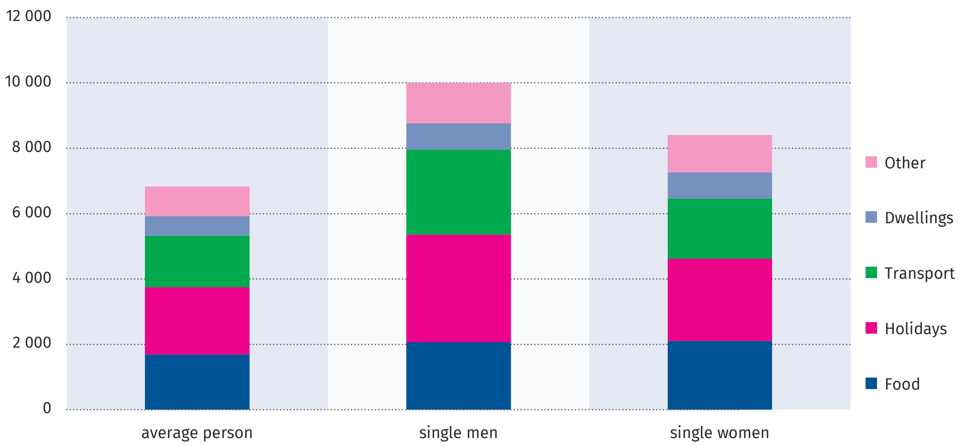
Source: Eurostat (2022) env_ac_aigg_q.

advanced economy that has the second-best gender equality index in the EU (UN n.d.), there is still a significant gender imbalance in terms of climate impact, which also demonstrates the importance of transport-related emissions.

Emissions and working hours

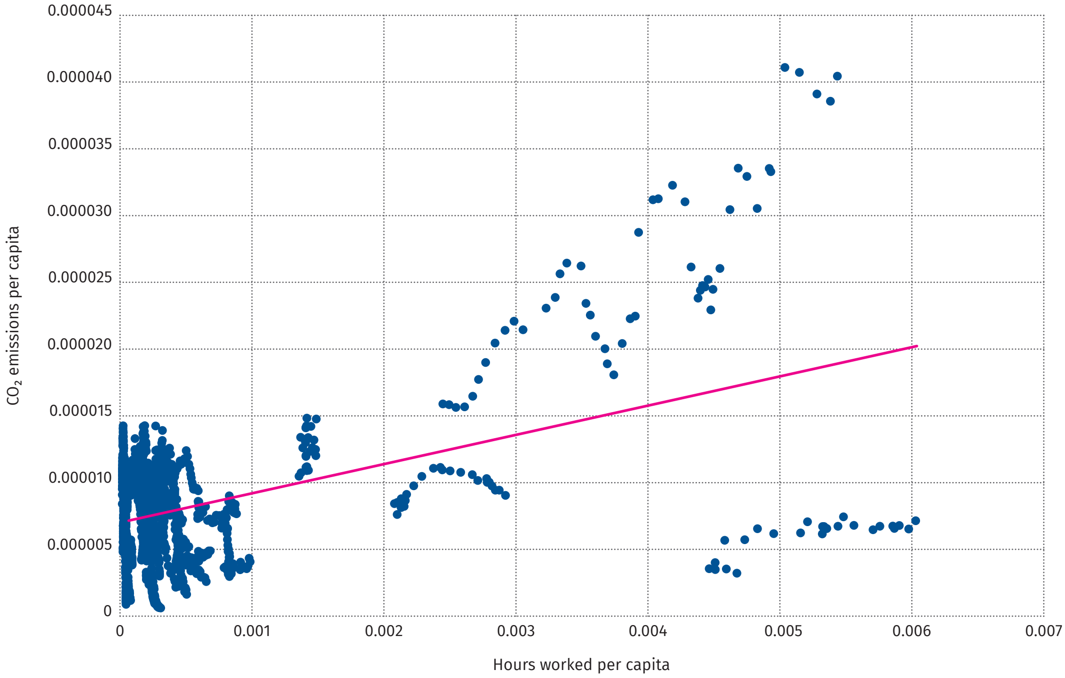
While emissions historically show fluctuations as a response to macro-level shocks (e.g. the financial crisis of 2008 or the recent pandemic), an emerging literature points to the potential link between emissions and working hours. On the one hand, the number of hours worked is related to productivity, and thereby to economic growth. On the other hand, economic growth is associated with environmental pressures, among which emissions is one of the principal impacts (Hayden and Shandra 2009; Knight et al. 2013). Given these relationships, hours worked (through their contribution to productivity) are implicitly related to the scale of the economy, which results in environmental impacts because of the coupling of economic growth with resource use and related carbon emissions. Based on this conceptual framework, Figure 4.5 displays the relation between CO_2 emissions and annual hours worked per capita across 30 European countries (EU27 plus Norway, Switzerland and the UK). Using data covering six decades, this indeed suggests a positive association between annual hours worked per capita and CO_2 emissions. One interpretation of this graph would be that one way to reduce emissions is to reduce the number of hours worked, which would limit economic growth, keeping environmental pressures under control.

Figure 4.4 **Annual GHG emissions by gender according to main spending items in Sweden (kg/person)**



Source: Authors' own elaboration based on Carlsson Kanyama et al. (2021).

Figure 4.5 **CO_2 emissions (in megatonnes) and annual hours worked**



Source: Own calculations based on emissions data from the Global Carbon Network (1950-2019) and data on hours worked from The Conference Board (1950-2021).

The fossil energy crisis

While energy prices had already started to increase in the second half of 2021 due to the higher energy demand of post-pandemic recovery, the energy price shock came as an effect of Russia's attack on Ukraine and the resulting cutting of fossil energy supplies from Russia. Europe has also failed to build up its energy resilience during the past few decades. While in 2011 the EU was still the world leader in renewable energy investment, from 2013 onwards investment collapsed to around half of its 2011 level (see Section 4). The resulting fossil fuel dependence was exacerbated by naive reliance on Russian oil and gas imports, fed also by unjustified trust in the stabilising effect of trade relations.

Energy markets and price setting

While it is clear that the future lies in renewable sources of energy generation, even if the process will now be sped up (after years of stagnation), the sudden collapse of fossil energy supply cannot be replaced in the short and medium term. Alternative sources for fossil energy imports are being feverishly explored, and, as a result, wholesale prices are spiralling with huge fluctuations. It is reasonable to ask to what extent the price of energy provision for basic societal needs (such as heating and mobility) should be left to the playing field of free markets. In the spirit of the Energy Union (European Commission 2015), electricity generators and electricity suppliers operate in a liberalised market environment. Generators compete on the wholesale electricity market to sell electricity to large industrial consumers, and suppliers compete in the retail electricity market to sell electricity to the final consumer.

Under normal circumstances, markets seemed to perform reasonably well, and Europe was lulled into a naive reliance on cheap Russian fossil energy. What we see on energy markets now are spiralling prices and huge swings. The benchmark for wholesale natural gas prices in the EU is set at a virtual trading point (Title Transfer Facility, known as TTF) in the Netherlands with some 80% of EU gas trading being covered. In December 2021, the month-ahead price for one MWh of gas was 62.5 euros, rising to 227 euros on 7 March 2022, peaking by the end of August at 339.2 euros and staying just under 130 euros in the month of November 2022 (Statista 2022). Electricity prices followed the same pattern. It is mostly the functioning of Europe's electricity markets that has come into focus in policy debates in the context of the current crisis. The main issue is how gas prices affect the electricity price. There are two factors playing a key role: the share of gas generation in the European electricity mix and the price-setting mechanism.

In 2020, renewable energy generation achieved its highest ever proportion of the European electricity mix, owing to a combination of increased capacity and low demand. This allowed coal-fired generation to be reduced to a historic low across the EU, substantially cutting greenhouse gas (GHG) emissions. Gas-fired generation also fell. From 2021, electricity and gas demand recovered, and the contribution of renewables and nuclear decreased. There were three reasons for this: wind generation was low because there was less wind, but also because deployment was slower than planned; hydroelectric power also fell due to drought and low water levels across Europe; and the latter were also the main reason for lower nuclear power use, due to lack of water for cooling. This has pushed gas-fired power plants back to the forefront of the electricity generation mix across Europe.

Besides the share of gas in electricity, it is the price-setting mechanism that is in question. Power exchange markets are operated by an intermediary, to which generators and consumers submit their bids. The term 'merit order' describes the sequence in which power plants are designated to deliver power, based on the lowest marginal costs, with the aim of economically optimising the electricity supply by designating plants that constantly supply cheap power to generate electricity first. If demand exceeds supply, the price goes up. The system therefore favours electricity generation technologies with low marginal costs, such as solar energy or wind power. If they produce less electricity than is needed to meet demand, additional energy sources are activated. In a market such as this, peak-load power stations, which are predominantly fired with fossil fuels such as coal and gas, are the last to go on-line in the event of supply shortages. They then match the high demand for electricity with very high prices.

The main reason for high electricity prices is the imbalance between demand and supply.

While electricity demand has been high in the wake of the pandemic, on the supply side cheap renewables shrank, pushing the share of fossil fuels up in the electricity mix. Then came the war in Ukraine, causing a major crunch in the gas supply.

Despite its high price now, natural gas will remain critical to supply security, at least over the next decade (IEA 2022c). For both cost and environmental reasons, its role needs to return to that of feeding peaking plants (as was the case in 2020) rather than being the price-setting mainstay of the electricity system (as in 2021 and 2022).

It must also be added that these are not the prices paid by households or businesses. Depending on the model used by a national market, pricing may vary at each individual distribution level, as each Member State sets its own taxes, levies and surcharges. In Germany, for example, taxes, duties and surcharges (in particular the renewable energy or EEG surcharge) accounted for 51% of household bills, while grid charges added another 25%. This means that less than a quarter of the price can be influenced by producers and utilities reducing production costs or administrative expenses – or buying electricity on the exchange on favourable terms. On the other hand, this also means that Member States have significant leeway in influencing actual retail energy prices paid by consumers.

Energy price developments

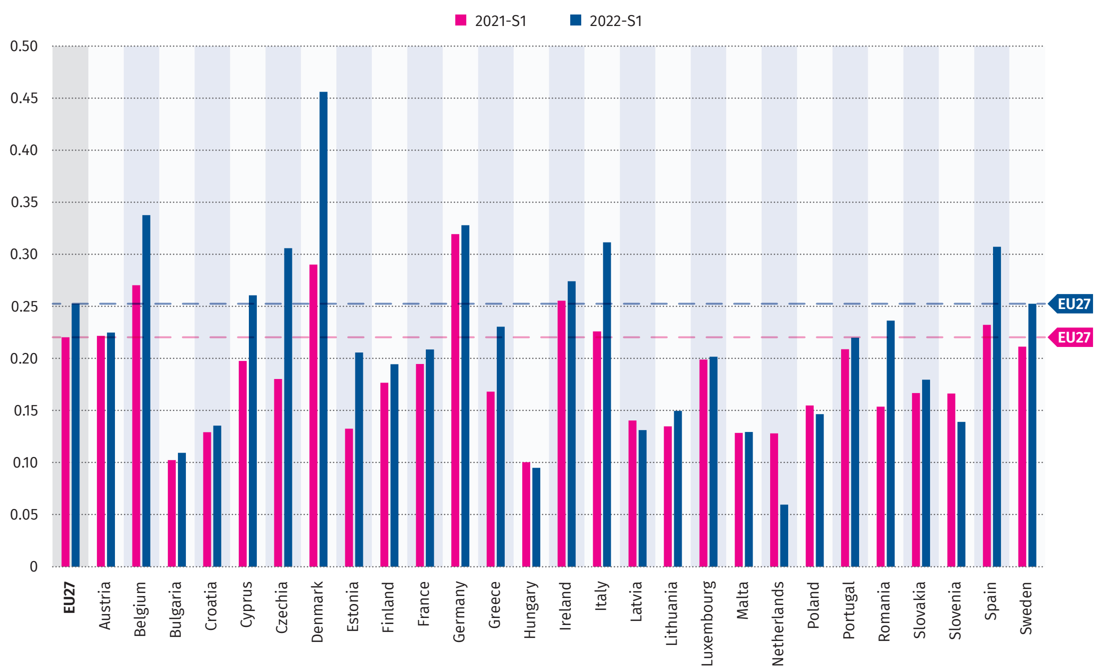
Compared to the first half of 2021, the proportion of taxes and levies in the final electricity and gas bills charged to households in the EU in the first half of 2022 decreased significantly, as Member States put in place governmental allowances and subsidies to mitigate high energy costs. Compared with the first half of 2021, the share of taxes in the electricity bill dropped sharply from 39% to 24% and in the gas bill from 36% to 27% (Eurostat 2022b).

In spite of such correction measures, in the first half of 2022 average household electricity prices in the EU increased sharply compared with the same period in 2021.

Actual levels of electricity prices for households show a great variety across the EU (Eurostat 2022b), as Figure 4.6 demonstrates.

Electricity prices in the first half of 2022 were highest in Denmark (€0.4559 per kWh), Belgium (€0.3377 per kWh), Germany (€0.3279 per kWh) and Italy (€0.3115 per kWh), while the lowest were registered in the Netherlands (€0.0595 per kWh), Hungary (€0.0948 per kWh) and Bulgaria (€0.1093 per kWh). A kilowatt-hour for Danish household consumers cost 80.5% more than the EU average price, whereas households in the Netherlands paid 76.4% less than the EU average. This difference is mainly driven by

Figure 4.6 **Electricity prices for household consumers (first half of 2021 and first half of 2022 in EUR/KWh)**



Source: Eurostat.

There is a lack of transparency in energy pricing

subsidies given to household consumers in the Netherlands.

Figure 4.6 also illustrates the change in electricity prices for household consumers, including all taxes and VAT, from the first half of 2021 to the first half of 2022. In this period, total prices increased in all but five EU Member States. The biggest increase is observed in Czechia (61.8%), followed by Latvia (59.4%) and Denmark (57.3%). The Netherlands (-53.6%) and Slovenia (-16.4%) were the two EU countries recording the largest decreases, due to measures taken to alleviate electricity costs. It should be noted that there is no transparency in prices and price developments: nobody knows the actual price of a unit of electricity or gas at a given place and time and how much a consumer is actually supposed to pay. What was the average gas price when national gas reserves were filled, what supplier contracts are in effect and how are individual consumers affected? There is uncertainty and a lack of transparency on a massive scale. An illustration for this is provided for the period from September 2020 to September 2022 by Eurostat figures on the harmonised energy price index (combining electricity, gas and fuel prices) for individual Member States, as shown by Figure 4.7. For the EU as a whole, the price index is 173% (which has no practical relevance), Malta had no change at all, and the price index for the Netherlands is 358%.

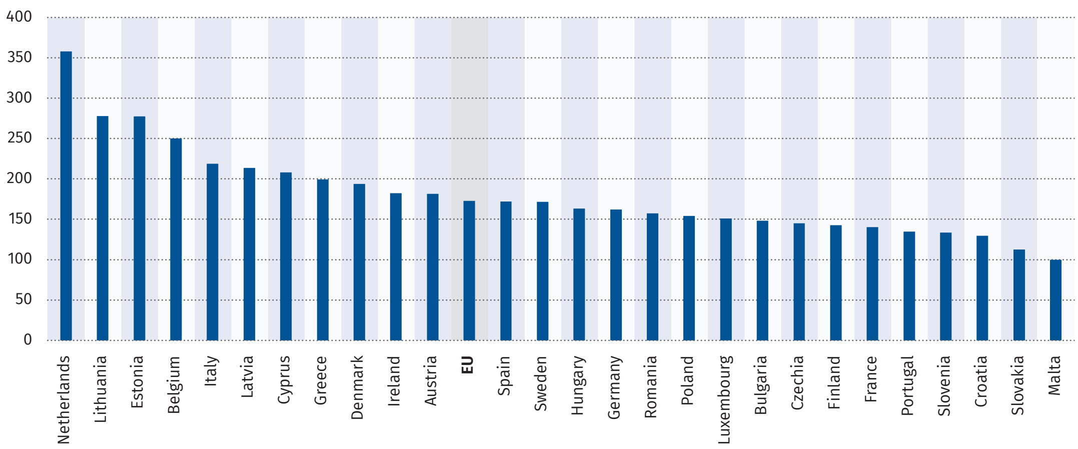
Effect on households

An IMF working paper (Celasum et al. 2022) looked at how household spending by different income groups in selected countries was affected by higher energy prices as of May 2022. Differences were significant between Member States both as regards the extent of the price effect and how differently the poorest 20% were affected, compared to the richest 20%. Estonia has seen both the biggest increase and the biggest gap between the richest (13%) and poorest quintiles (25%). For Italy, the richest 20% saw a price effect of 6% of household income, while the poorest 20% saw an 11% increase; for Belgium, the figures are 7% and 10% respectively. Both France and Germany are expected to show a minor difference in the price effect of energy prices on the lowest and highest income groups, at least according to IMF estimates from August, based on May 2022 data (Celasun et al. 2022).

The Institute for European Environmental Policy has calculated the share of energy-related household expenditure by EU-wide income deciles and area of residence. Even before the big increase in energy prices, up to 11% of household expenditure was energy-related, as Figure 4.8 shows. The population in the three lowest income deciles was the most exposed, while the population in the tenth decile was the least. If we assume an average doubling of energy-related expenditures, this might have a dramatic effect on those who already had high shares before the price hike.

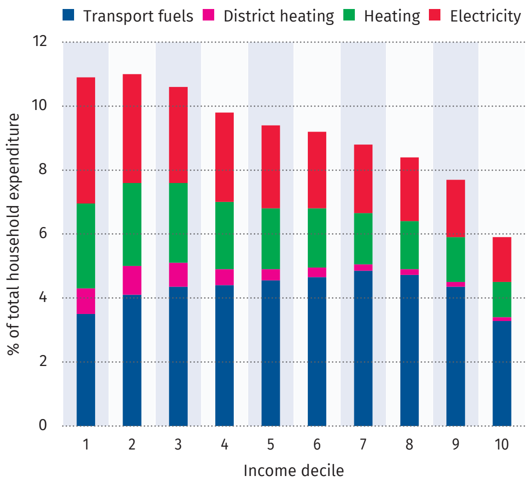
Energy poverty was already significant before the dramatic price increases, as Figure 4.9 shows for 2021. For the EU27, 6.9% of the total population, 30.8 million people, could not afford to keep their home adequately heated even before energy prices started to soar. For those at risk of poverty, 16.4% were unable to keep their home sufficiently warm. Differences across Member States were significant: while Estonia, Sweden and Finland were hardly affected,

Figure 4.7 **Harmonised energy price index (electricity, gas, fuels) in EU Member States, September 2022 (September 2020=100.0)**



Source: Destatis (2022).

Figure 4.8 **Household spending on energy by income decile, 2021**

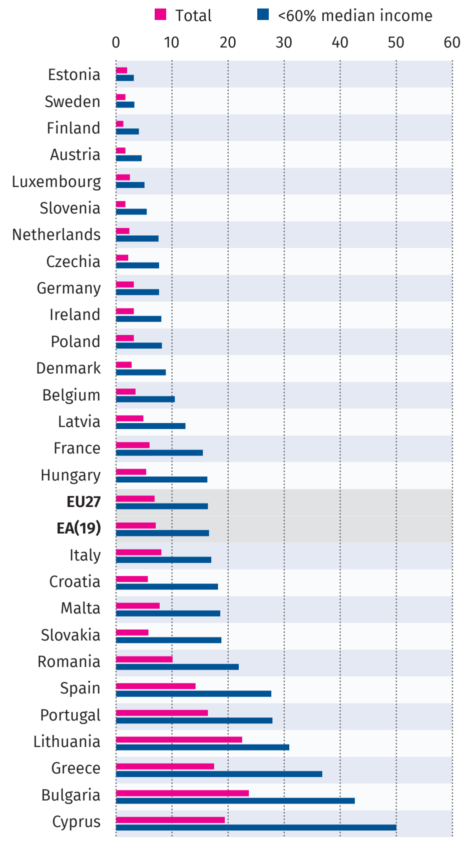


Source: IEEP (2022).

By the end of 2022, 60 million Europeans might be affected by energy poverty

the situation in Greece, Bulgaria and Cyprus was truly alarming, with up to 50% of poorer households affected by energy poverty. Allianz Research (2022) has calculated that the number of households in energy poverty in the EU27 had increased by more than 50% as at June 2022. While exact figures were not presented, this would mean that, by mid-2022, more than 45 million people in the EU were living in energy poverty. In the year up to mid-2022, arrears on utility bills in Germany, for example, rose from 2.4% to 4.0%. Using regression analysis, based on the relationship between household energy prices, gross disposable income and energy poverty indicators from 2010 to 2018, Allianz estimates that the share of the population facing energy poverty is expected to double by the end of 2022 compared with 2021. This forecast would mean having more than 60 million people in the EU facing energy poverty.

Figure 4.9 **Energy poverty – share of population unable to keep home warm (%, 2021)**



Source: Eurostat (sdg_07_60).

A new landscape of clean energy investment

Until 2014, investment in clean energy was virtually synonymous with investment in renewable energy, as the energy transition was focused on the power sector. Investment in electromobility was a negligible part of global energy transition investment. This picture has changed dramatically in the past five years, and we will show that this has major consequences for inequality. By 2021-22, investment in electromobility had become the driving force of the energy transition.

In 2021, global investment in the low-carbon energy transition totalled 755 billion US dollars, up from 595 billion US dollars in 2020, as Table 4.1 shows. This figure includes investment in projects, such as renewables, storage, charging infrastructure, hydrogen production, nuclear, recycling and carbon capture and storage (CCS) projects, as well as end-user purchases of low-carbon energy devices, such as small-scale solar systems, heat pumps and zero-emission vehicles. As regards broad economic sectors, the largest sector in 2021 was still renewable energy (366 billion US dollars) with an increase of 6.5% over 2020. The most dramatic change, however, took place in the electrified transport sector, which showed a 77% increase and came a close second after renewables with an investment of 273 billion US dollars.

The breakdown of total energy transition investment in 2021 by main region (not shown in the table) reveals that, at 266 billion US dollars, China had the highest share (60% more than in 2020), roughly as much as the EU27 (154 billion US dollars) and the US (114 billion US dollars) combined. Further details from BloombergNEF (BNEF) data also show that it is particularly Europe where clean energy investment shifted most from renewable energy generation towards electromobility, and the latter now makes up the largest part of total energy transition investment.

Table 4.1 **Global clean energy investment by sector, 2021, bn USD, and change from 2020, %**

Technology/Sector	Total Investment in 2021 (US$)	% change from 2020
Renewable energy	365.9B	6.8%
Electrified transport	273.2B	76.7%
Electrified heat	52.7B	10.7%
Nuclear	31.5B	6.1%
Sustainable materials	19.3B	141.3%
Energy storage	7.9B	-6.0%
Carbon capture & storage	2.3B	-23.3%
Hydrogen	2.0B	33.3%
Total	**754.8B**	**26.8%**

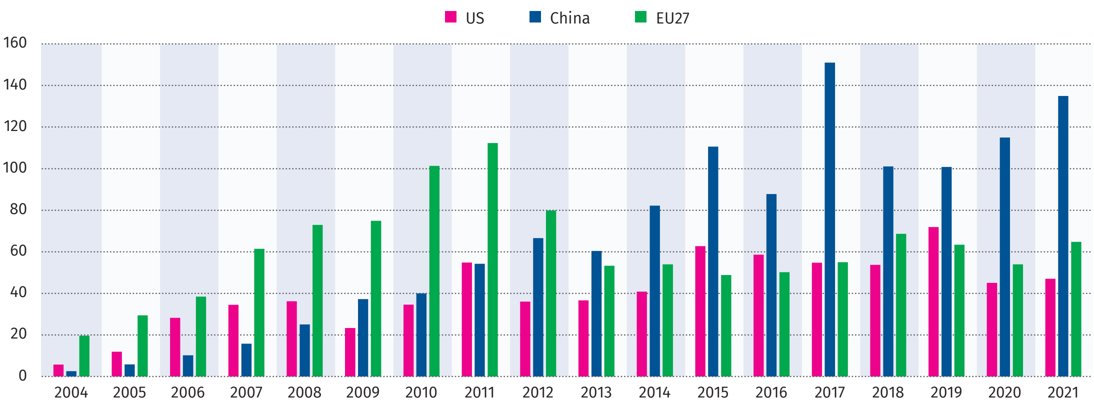
Source: BNEF (2022a).

Renewable energy generation

While in 2011 the EU was still the world leader in renewable energy investment, from 2013 onwards investment remained at around half of its 2011 level (Galgóczi 2020). This trend has not changed in the past couple of years, and EU investment in renewable energy in 2021 amounted to just about half of its 2011 peak, even if 2021 marked a 20% increase compared to 2020 and slightly surpassed the 2019 level. While the US showed a minor increase at a relatively low level, Chinese investment in renewables more than doubled in this period and, in 2021, was 20% higher than US and EU27 investment combined (Figure 4.10).

The relatively slow progress in renewables development in the EU is also shown by IEA data on renewables capacity additions and energy composition. After stagnation in 2020, renewables generation capacity improved by 20% in 2021. The share of renewable energy in the EU grew at the same time by only 0.1 percentage points, from 22.1% in 2020 to 22.2% (EEA 2022). The IEA notes that 2020 was an extraordinary year, during which consumption of non-renewables dropped considerably because of lower energy demand during the Covid-19 pandemic, thus pushing up the renewable energy sources (RES) share. In 2021, however, consumption of non-renewables experienced

Figure 4.10 **New investment in renewable energy generation in the US, China and the EU27 (USD bn)**



Source: BNEF (2022a).

a rapid rebound, although the growth of renewables remained constant.

The EU had set the goal of ensuring that 20% of its gross final energy consumption came from renewable sources by 2020, and that goal was met. Given the current trend, however, achieving the proposed 45% target set by the RePowerEU Plan (and backed by the European Parliament) for 2030 will require a doubling of investment in renewables, in line also with the need to speed up the energy transition in the new geopolitical constellation.

> Achieving the proposed 45% target set by the RePowerEU Plan for 2030 will require a doubling of investment in renewables

In the first half of 2022, global new investment in renewable energy amounted to 226 billion US dollars, recording an increase of 11% compared with the same period of 2021. This was the highest ever first half-year for investment in renewables, supported mostly by private capital funding (BNEF 2022a). China was the largest market yet again, investing 98 billion US dollars in the first half-year, up 128% compared with the same period in 2021.

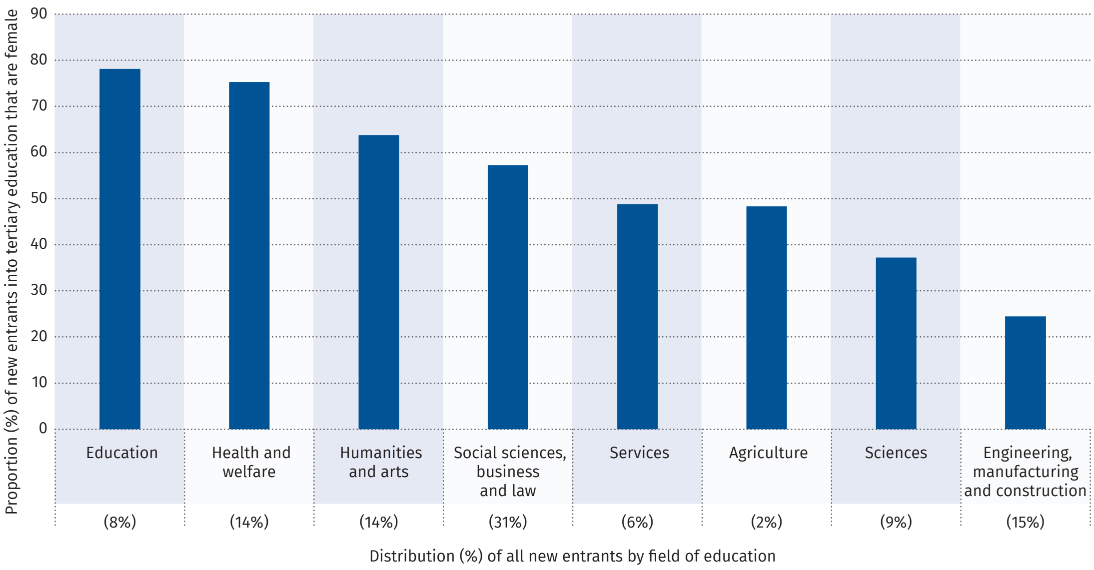
Gender gaps in the energy sector

As regards potential employment effects (both in terms of job losses and job creation opportunities), gender gaps in both employment and wages in the energy sector are quite significant. A recent report by the IEA and the OECD, using representative employer-employee data, points to significant gender gaps in the energy sector, covering five European countries in depth, namely Austria, France, Germany, Portugal and Spain (IEA 2022d). Using three-digit level ISIC and NACE classifications to define the energy sector[3] and covering roughly the period 2002-2018, the study finds that, despite efforts to reduce the imbalance, significantly fewer women work in the energy sector than men, with the gender employment gap possibly amounting to almost twice the gap in the non-energy sector. Moreover, the wages of women in the energy sector are, on average, 20% lower than for men, which is found to be even greater than the wage gap in the non-energy sector in the sample studied. The wage gaps remain robust when workers' skill composition is taken into account, including measures for ability, education and potential experience. After detailed decomposition analysis and given the existing gaps, the report finds that women are more likely than men to quit jobs in the energy sector for jobs in another sector.

One of the root causes of these gender gaps and outcomes in the energy sector is related to the low number of women with STEM (science, technology, engineering and mathematics) degrees. According to OECD (2017), constituting less than 20 per cent of entrants into computer science programmes and around 18 per cent of entrants into engineering programmes, women are severely underrepresented in STEM

3. The following three-digit industry (ISIC/NACE) codes are used to define the energy sector jobs: 051 Mining of hard coal, 052 Mining of lignite, 061 Extraction of crude petroleum, 062 Extraction of natural gas, 072 Mining of non-ferrous metal ores, 091 Support activities for petroleum and natural gas extraction, 191 Manufacture of coke oven products, 192 Manufacture of refined petroleum products, 351 Electric power generation, transmission and distribution, 352 Manufacture of gas; distribution of gaseous fuels through mains, 353 Steam and air conditioning supply, 473 Retail sale of automotive fuel in specialised stores, 493 Transport via pipeline (IEA 2022d).

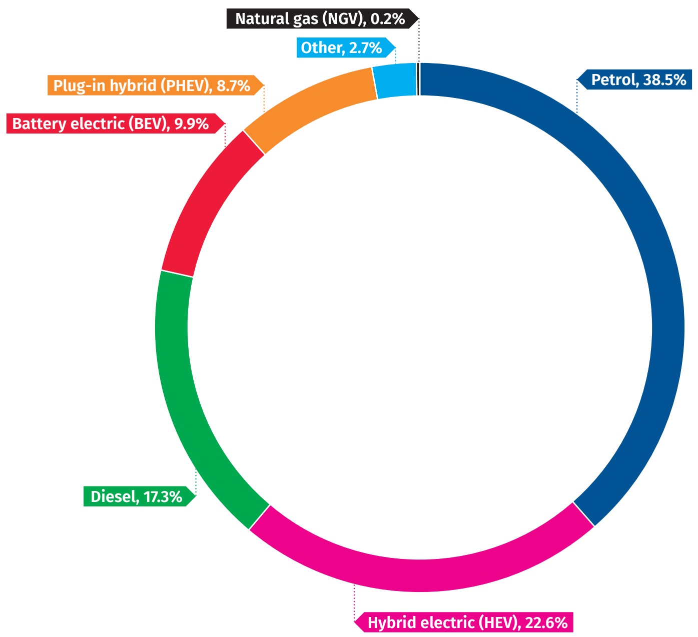
Figure 4.11 **Women are underrepresented in STEM fields in tertiary education**



Source: OECD (2017).

fields (Figure 4.11). Competences in STEM fields are prerequisite to pioneer breakthrough innovation to fight climate emergency as well as boost renewable and clean energy technologies towards a zero-carbon future. Encouraging women to pursue STEM careers, ensuring family-friendly working conditions and working hours across all sectors but particularly in the energy sector jobs to make these jobs attractive to women, and removing any barriers for women to populate green jobs is a must to ensure a gender-balanced green and energy transition.

Figure 4.12 **New car sales by fuel type in the EU (2022 2Q)**



Source: ACEA (2022).

While renewables will clearly be an expanding sector with a great job creation potential, the gender gap that we currently see in the broad energy sector should not be the pattern in a new energy landscape.

Clean mobility and inequality

As mentioned above, in the last couple of years dynamism in energy transition investments was focused to the electrification of road transport, while renewable investments were more subdued. This was particularly the case for Europe.

According to ACEA (2022), in the second quarter of 2022, sales of battery electric vehicles[4] continued to expand in the EU, accounting for 9.9% of total passenger car registrations. Plug-in hybrid cars accounted for 8.7% of market share, up from 8.4% in the second quarter of 2021, despite a decline in the number of units sold, as shown by figure 4.12.

In terms of units, petrol sales plunged by 22.2% across the EU, counting 909,703 cars sold. Diesel

4. Battery electric vehicles (BEVs) have an electric engine only and are powered by a rechargeable battery; hybrid electric vehicles (HEVs) have both an electric engine and a combustion engine but do not have a battery; plug-in hybrid electric vehicles (PHEVs) have both engines and a battery. All three types are often referred to as electric vehicles (EVs), but only BEVs are fully electric. In electric mode, HEVs and PHEVs also have very limited autonomy and are seen as an interim stage in vehicle electrification.

The unbalanced nature of the mobility transition is striking

vehicles saw an even steeper fall (-27.7%), totalling 409 174 units (ACEA 2022).

During the second quarter of 2022, registrations of battery electric vehicles (BEVs) in the EU grew by 11.1%, amounting to 233 413 cars sold. The trend in BEV sales was very uneven across Member States. Spain and France contributed to the positive performance of BEVs, posting double-digit gains (+22.0% and +18.6% respectively). Italy, on the other hand, posted a substantial fall (19.6%), while Germany witnessed slight negative growth (-0.5%).

East-West divisions were enormous, as 96% of fully electric vehicles were sold in the 14 Member States (EU Members before 2004), and, at only 4%, 17 700 vehicles were sold in Member States from Central and Eastern Europe (although they saw a very vigorous increase).

Table 4.2 **Battery electric vehicle sales in the EU, first half of 2022, and change compared to first half of 2021 (%)**

Area	Units sold	Change, %
EU27	457 600	28.4
EU14	439 800	26.4
EU13	17 700	111.0

Source: ACEA 2022.

Electric cars are increasingly unaffordable as cars become bigger, heavier and more expensive

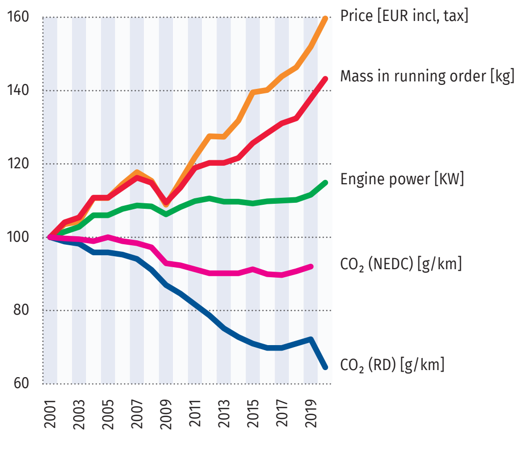
Seen from a global perspective, the unbalanced nature of the mobility transition is striking. Global passenger EV sales keep on climbing: in 2022, they are expected to reach a record 10.6 million, an increase of over 60% compared with 2021 (BNEF 2022b). China has been the main driver of the momentum, with one in five passenger cars sold in the second quarter of this year being battery electric. Electric car sales in China are forecast to hit 6 million in 2022, to make up 60% of global sales. China is important as a trend-setter in electric mobility – it is a major market for EU manufacturers and a serious competitor; see more details in Lüthje (2021).

Electric car sales (BEVs and PHEVs) have also boomed in Europe in recent years, totalling 920 000 vehicles sold in the first half of 2022 (BNEF 2022b), and the US market has also been expanding fast. China and Europe accounted for 84% of EV sales in this period, and, with the US, these three regions made up 95% of worldwide sales. This also shows that the majority of the world's population is excluded from this development (BNEF 2022c).

A further aspect that underlines this inequality is that cars are becoming bigger, faster, heavier and more expensive. Electromobility is not only unaffordable for the majority of the population, but it is also becoming increasingly unaffordable. In part due to the EU regulation on car emission standards that allows higher CO_2 emissions for larger cars (weight-adjusted CO_2 standards), new cars sold in Europe in the past decade were becoming heavier, more powerful and more expensive, as Figure 4.13 shows (see more in Pardi, 2022).

There are two main reasons why unaffordability of electric vehicles is a serious problem. Firstly, it might create a two-class mobility system, as only those who can afford the high entry costs can benefit from individual mobility, with public transport becoming the default option for the less well-off. This is all the more worrying as investments in public transport infrastructure have been neglected for decades (Greenpeace 2022), with fragmented European transport networks, in particular in rail transport (Sippel et al. 2018). Secondly, under these conditions, a vehicle fleet change in the EU that assumes the replacement of tens of millions of polluting cars with electric ones within a limited period of time does not seem to be achievable.

Figure 4.13 **The average new car sold in Europe (price, mass, engine power and CO_2 emissions), 2001-2020**



Source: Pardi (2022).

Response measures to the energy crisis

Struggling to strike a balance between climate and social objectives

EU level

Following Russia's invasion of Ukraine, in March 2022 the European Commission published a new communication called 'REPowerEU' (European Commission 2022) setting out new actions to ramp up the production of green energy, diversify supplies and reduce demand focused primarily on gas. The Plan was officially launched in May 2022 with more details on how to reach the declared objectives. The 2030 targets for energy efficiency were raised from 9% to 13%, and the share of renewable energy from 40% to 45%. It also sets out recommendations to speed up permitting procedures for new wind and solar projects. In terms of diversification of energy imports, it proposes to set up an EU Energy Platform with a voluntary operational joint purchasing mechanism as a next step. Upgrading and adapting Europe's energy infrastructure in line with changing patterns of transport energy needs, while ensuring that infrastructure is ready for the uptake of hydrogen and ammonia, will come at considerable cost. The Commission's proposal seeks to tackle this with 300 billion euros made available from untapped loans of the Recovery and Resilience Facility (225 billion euros), topped up with additional funding coming from the auctioning of reserved ETS (Emissions Trading Scheme) allowances, and provision for the transfer of up to 12.5% of Member States' Cohesion Funds.

A further communication was released on 23 March 2022 to present the benefits and drawbacks of concrete exceptional short-term measures to address the effects of price spikes. These measures include both income support and temporary state aid to help counter price effects on households and industry, but also action on retail prices through reduced taxation, a cap on electricity prices and so forth. Following on from the European Commission Guidelines on State aid for climate, environmental protection and energy, the Temporary Crisis Framework enables Member States to use the flexibility foreseen under State aid rules to support the economy in the context of Russia's invasion of Ukraine.

Although phasing out fossil fuel subsidies was included in the Glasgow Climate Pact and IMF researchers (Parry et al. 2021) pointed to their inefficiency, in the current situation direct subsidies of some sort seem to be unavoidable. These must, however, be temporary and targeted at the poor. Providing a subsidy to everyone gives the wrong message. Subsidies that can be targeted are income subsidies, while price subsidies are blunter instruments. Furthermore, to reduce energy bills and the erosion of real wages, EU and Member State interventions should also reinforce the incentives for energy efficiency and savings. The energy efficiency first principle is more relevant than ever and should be applied across all sectors and policies, with demand response measures complementing those on the supply side.

National support measures

The overall responses can be divided into two main groups: immediate and medium-term measures. The former aim to minimise the impact on end users, while the latter – most prominently represented by the REPowerEU Plan launched by the Commission in May 2022 – consist of strategic plans aiming to accelerate the transition to green energies, cut dependence on Russian fuels and diversify suppliers, and reduce demand focused primarily on gas. European Union Member States are largely responsible for their national energy policies, and EU rules allow them to take emergency measures to protect consumers from rising costs.

So far, short-term responses to the energy cost surge at national level have mostly been broad-based measures, including subsidies, tax cuts and price controls. According to a recent IMF working paper (Celasun et al. 2022), policy-makers should shift decisively away from such broad-based measures towards targeted relief policies, including income support for the most vulnerable. Targeted income support is the most socially appropriate and climate-friendly measure for mitigating the impact of high energy prices.

With regard to measures oriented specifically towards end users, each country has decided to implement a particular set of rules, depending on its specific context and market framework. In general terms, these measures consist of VAT and other tax reductions, bill discounts, price

Table 4.3 **Main categories of national measures (and their funding) to shield consumers from higher energy prices***

Country	Energy/ VAT tax cut	Retail price	Whole-sale price	Transfers to the poor	Mandate to state firms	Windfall profits tax	Support to business	State funding*	
								Bn EUR	% GDP
Austria	√			√			√	9.1	2.3
Belgium	√	√		√				4.1	0.8
Bulgaria	√	√				√	√	0.8	1.2
Czechia	√	√		√	√			5.9	2.5
Denmark				√				0.5	0.1
France	√	√		√	√	√		44.7	1.8
Germany	√			√		√	√	60.2	1.7
Greece		√		√		√	√	6.8	3.7
Italy	√			√		√	√	49.5	2.8
Lithuania		√		√				2.0	3.6
Netherlands	√			√				6.2	0.7
Poland	√	√		√				7.6	1.3
Romania	√	√		√		√		3.8	1.6
Spain	√	√	√	√		√		27.3	2.3

* Funding between September 2021 and August 2022 (based on calculations by Bruegel).
Source: Sgaravatti et al. (2022), Celasun et al. (2022), Eurelectric (2022).

Most spending is dedicated to sustainable mobility, energy efficiency and renewable energy

caps and different forms of bonuses or funds for vulnerable households, as well as clawbacks, revenue deductions and bailouts for companies. Only Spain and Portugal have enacted measures touching on the redesign of the power market and its decoupling from gas. The 2022 March European Council decided to allow both Spain and Portugal to implement specific price decoupling measures, taking into account the 'Iberian singularity'. These are the only national measures that affect wholesale prices; all others focus on retail prices. An overview of the national measures (briefly described below) can be found in Table 4.3.

The table shows that most Member States have used tax cuts on energy and have also introduced price reduction or control measures in the retail energy price. Similarly, most Member States have targeted measures for vulnerable (low-income) groups. Even if targeted measures exist, in most Member States these are not substantial, and they are often supplementary. This is not the place to present national policies; what can be said, on the basis of available overviews (Sgaravatti 2022; Eurelectric 2022), is that broad-based measures are dominant, and this does not benefit either climate and environmental policy or equity objectives.

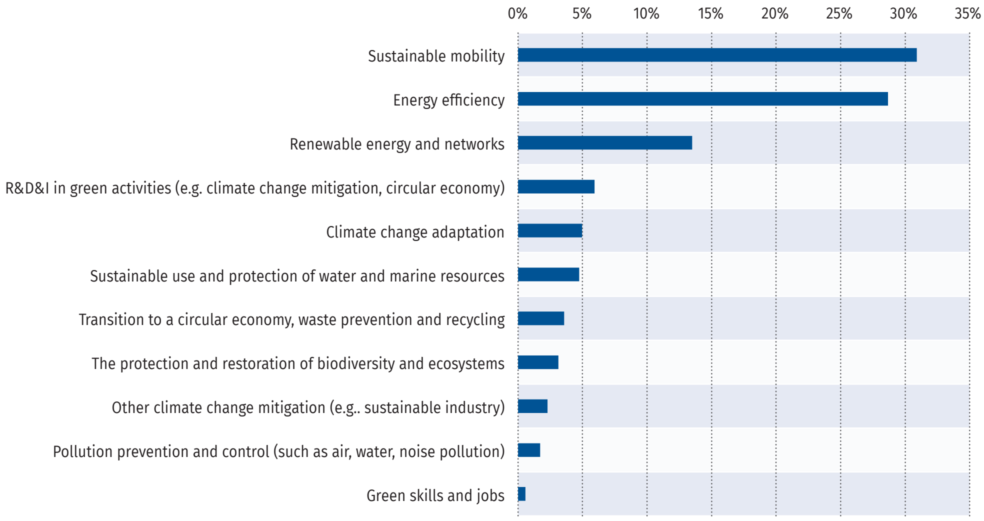
There are significant differences across Member States as to the scale of the measures. Greece spent the most on energy price relief measures when compared to its GDP, 3.7%, while Denmark spent the least with a mere 0.1%. Lithuania, Italy, Czechia and Spain followed (all over 2% of GDP), while France and Germany spent close to 2%.

It is too early to take stock of these response measures, as policies are changing month by month (e.g. Germany's 200 billion euros package was announced in October 2022, initially without a detailed list of measures). Policies also have very different time spans, from a few months up to two years, which makes comparison harder. Member States have highly varying fiscal capacity to back up such measures, posing a risk of widening disparities among Member States and raising important questions about European solidarity.

Tracking national recovery and resilience plans

Following the submission of the national recovery and resilience plans, the Commission set up an online scoreboard to document and track progress on the implementation of measures to contribute to the green transition, environmental sustainability and preservation of biodiversity, as proposed in the national plans. According to the scoreboard, a total of 923 measures have been proposed by all Member States, and 91.4 billion euros in grants and

Figure 4.14 **Breakdown of expenditure supporting the green transition per policy area**



Source: European Commission (n. d.)

45.2 billion euros in loans have been disbursed to Member States so far. The following Figure 4.14 displays a breakdown of expenditure supporting the green transition per policy area, ranging from sustainable mobility and energy efficiency to climate change adaptation and green skills and jobs, as a share of the overall budget for all Member States. It suggests that the major part of spending by countries is dedicated to sustainable mobility, energy efficiency and renewable energy and networks.

Conclusions with a ‘beyond growth’ outlook

> There is a need for a profound paradigm shift in production and consumption patterns

The notion of degrowth and sustainable well-being is increasingly under discussion (Galgóczi and Pochet 2022) – at least for advanced economies – and economic reality also makes it more likely that the days of high growth are over. The trends outlined in this chapter clearly show what a world beyond growth should not look like. Current developments in the world and Europe are pointing in a different direction: instead of lower carbon footprints and lower inequality, we have seen higher emissions and growing inequality. First, we have shown that global greenhouse gas emissions have been rising at a record level, with the strongest coupling of economic growth and emissions seen in the past decade. Even 2022 trends show a further likely increase in emissions at global level. The main reason that this increase will be limited is the impact of the energy price increases and the related cost-of-living crisis with significantly lower economic growth than previously expected. Needless to say, it is the lower-income groups and poorer countries that shoulder most of the burden. COP27 failed to make a commitment to consolidate the 1.5°C warming target and the phase-out of fossil fuels, with the consequence that the Paris targets are receding.

Inequality is set for further increase both across and within countries. Europe’s energy crisis is particularly intense because of its high reliance on Russian fossil fuel imports. Europe has missed its chance to increase its energy and economic resilience in better times in a forward-looking way; now it is being forced towards greater resilience at a very high price.

Energy poverty was already significant and, in some Member States, it was alarmingly high even before the energy crisis. According to forecasts cited above, 60 million people may be affected by energy poverty by the end of 2022.

This chapter showed that certain otherwise positive developments can also contribute to a further rise in inequality. Energy transition investment has shifted towards the electrification of transport, and while investment in renewable energy generation is rising further (although Europe’s performance was rather disappointing), investment in clean mobility is soaring. The downside of this trend is only that the increased emphasis on electric mobility contributes further to inequality. Over 95% of global new electric car sales are concentrated in China, Europe and the US, which means that the majority of the world’s population is excluded. Europe has its own inequality, as 96% of electric car sales in the year up to mid-2022 were recorded in the EU14 Member States (those that were EU members before 2004). Electric cars are not only unaffordable for ordinary people, but they are also increasingly unaffordable as cars become bigger, heavier and more expensive.

The energy transition also raises concerns from the gender perspective, with significant employment and wage gaps observed in energy-intensive sectors between men and women, in besides gender differences in energy consumption and individual emission patterns.

After looking at EU and national response measures to the energy crisis, a fragmented picture reveals that these are not properly targeted, as it is the poor who are most affected by the energy price increases and, in a broader sense, by the cost-of-living crisis. This is certainly not what a just energy transition should look like. The outcome is not optimal neither for climate objectives nor for greater equity. Embarking on an economic model that could bring less resource and material use and more well-being would need a profound paradigm shift in production and consumption patterns. This would presuppose deep societal and behavioural change. We are moving in the opposite direction. Most efforts are being targeted towards preserving old patterns. In mobility, the engine is being changed in a way that is not affordable for most. Poorly targeted relief measures to cope with the energy crisis also risk reinforcing old structures, while not reducing inequality.

References

ACEA (2022) Fuel types of new cars: battery electric 9.9%, hybrid 22.6% and petrol 38.5% market share in Q2, 20 July 2022. https://www.acea.auto/fuel-pc/fuel-types-of-new-cars-battery-electric-9-9-hybrid-22-6-and-petrol-38-5-market-share-in-q2-2022/

Allianz (2022) Averting Gasmageddon and securing a just transition, 1 September 2022. https://www.allianz-trade.com/en_global/news-insights/economic-insights/averting-gasmageddon-and-securing-a-just-transition.html

BNEF (2022a) Energy transition investment trends 2022, BloombergNEF, January 2022. https://assets.bbhub.io/professional/sites/24/Energy-Transition-Investment-Trends-Exec-Summary-2022.pdf

BNEF (2022b) The road to electric car supremacy in five charts, BloombergNEF Blog, 30 August 2022. https://about.bnef.com/blog/the-road-to-electric-car-supremacy-in-five-charts/

BNEF (2022c) Zero-emission vehicles progress dashboard, BloombergNEF, 21 September 2022. https://assets.bbhub.io/professional/sites/24/BloombergNEF-ZEV-Dashboard-Sep-2022.pdf

Carlsson Kanyama A., Nässén J. and Benders R. (2021) Shifting expenditure on food, holidays, and furnishings could lower greenhouse gas emissions by almost 40%, Journal of Industrial Ecology, 25 (6), 1602-1616. https://doi.org/10.1111/jiec.13176

Celasun O., Iakova D. and Parry I. (2022) How Europe can protect the poor from surging energy prices, IMF Blog, 3 August 2022. https://www.imf.org/en/Blogs/Articles/2022/08/03/how-europe-can-protect-the-poor-from-surging-energy-prices

Destatis (2022) Preisentwicklung in den EU-Staaten 2022, Statistisches Bundesamt. https://www.destatis.de/Europa/DE/Thema/Wirtschaft-Finanzen/Inflation.html

EEA (2022) Share of energy consumption from renewable sources in Europe, European Environment Agency, 26 October 2022. https://www.eea.europa.eu/ims/share-of-energy-consumption-from

Eurelectric (2022) Rising power prices. https://www.eurelectric.org/media/5732/overview-of-national-situations.pdf

European Commission (n. d.) RRF Scoreboard. https://ec.europa.eu/economy_finance/recovery-and-resilience-scoreboard/index.html?lang=en

European Commission (2015) Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee, the Committee of the Regions and the European Investment Bank. A framework strategy for a resilient energy union with a forward-looking climate change policy, COM(2015) 080 final, 25 February 2015. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52015DC0080

European Commission (2022) Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions. REPowerEU: Joint European action for more affordable, secure and sustainable energy, COM(2022) 108 final, 8 March 2022. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM%3A2022%3A108%3AFIN

Eurostat (2022a) EU economy greenhouse gases still below pre-COVID levels, 16 August 2022. https://ec.europa.eu/eurostat/web/products-eurostat-news/-/ddn-20220816-1

Eurostat (2022b) Electricity price statistics, Statistics explained. https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Electricity_price_statistics&oldid=575810#Electricity_prices_for_household_consumers

Galgóczi B.(2020) The path to 'zero carbon' in a post-Covid-19 world, in Countouris N. and Jagodziński R. (eds.) Benchmarking Working Europe 2020, ETUI, 75-94.

Galgóczi B. and Akgüç M. (2021) The inequality pyramid of climate change and mitigation, in Countouris N., Jagodziński R. and Theodoropoulou S. (eds.) Benchmarking Working Europe 2021, ETUI, 109-131.

Galgóczi B. and Pochet P. (2022) Welfare states confronted by the challenges of climate change: a short review of the issues and possible impacts, Transfer, 28 (3), 307-316. https://doi.org/10.1177/10242589221132781

Greenpeace (2022) Transport sector solutions, Greenpeace Central and Eastern Europe. https://greenpeace.at/uploads/2022/09/transportsectorsolutions_report_by_greenpeace_cee_2022.pdf

Hayden A. and Shandra J. M. (2009) Hours of work and the ecological footprint: An exploratory analysis, Local Environment, 14 (6),. 575-600. https://doi.org/10.1080/13549830902904185

Hook L. and Hume N. (2022) Will the Ukraine war derail the green energy transition?, Financial Times, 8 March 2022. https://www.ft.com/content/93eb06ec-ba6c-4ad2-8fae-5b66235632b2

IEA (2022a) Defying expectations, CO_2 emissions from global fossil fuel combustion are set to grow in 2022 by only a fraction of last year's big increase, News, 19 October 2022, International Energy Agency. https://www.iea.org/news/defying-expectations-co2-emissions-from-global-fossil-fuel-combustion-are-set-to-grow-in-2022-by-only-a-fraction-of-last-year-s-big-increase

IEA (2022b) Global energy review: CO_2 emissions in 2021, International Energy Agency. https://www.iea.org/reports/global-energy-review-co2-emissions-in-2021-2

IEA (2022c) World energy outlook 2022, International Energy Agency. https://www.iea.org/reports/world-energy-outlook-2022

IEA (2022d) Understanding gender gaps in wages, employment and career trajectories in the energy sector, International Energy Agency. https://www.iea.org/articles/understanding-gender-gaps-in-wages-employment-and-career-trajectories-in-the-energy-sector
IEEP (2022) Can polluter pays policies in the buildings and transport sectors be progressive?, Research report March 2022, Institute for European Environmental Policy. https://ieep.eu/publications/can-polluter-pays-policies-be-progressive
Knight K., Rosa E. A. and Schor J. B. (2013) Reducing growth to achieve environmental sustainability: The role of work hours, in Wicks-Lim J. and Pollin R. (eds.) Capitalism on trial, Edward Elgar Publishing. https://doi.org/10.4337/9781782540854.00022
Lüthje B. (2021) Going digital, going green: changing production networks in the automotive industry in China, International Journal of Automotive Technology and Management, 21 (1-2), 121-136. https://doi.org/10.1504/IJATM.2021.113355
OECD (2017) The pursuit of gender equality: An uphill battle, OECD Publishing. https://read.oecd-ilibrary.org/social-issues-migration-health/the-pursuit-of-gender-equality_9789264281318-en#page3
Pardi T. (2022) Heavier, faster and less affordable cars: The consequence of the EU's regulatory framework for car emissions, Report 2022.07, ETUI.
Parry I.W.H, Black S. and Vernon N. (2021) Still not getting energy prices right: A global and country update of fossil fuel subsidies, Working Paper WP/21/236, IMF.
Sgaravatti G., Tagliapietra S. and Zachmann G. (2021) National policies to shield consumers from rising energy prices, Bruegel Datasets, 29 November 2022. https://www.bruegel.org/dataset/national-policies-shield-consumers-rising-energy-prices
Sippel L., Nolte J., Maarfield S., Wolff D. and Roux L. (2018) Comprehensive analysis of the existing cross-border rail transport connections and missing links on the internal EU borders, Publications Office of the European Union. https://ec.europa.eu/regional_policy/sources/studies/cb_rail_connections_en.pdf
Statista (2022) Weekly Dutch TTF gas prices 2021-2023, 10 January 2023. https://www.statista.com/statistics/1267202/weekly-dutch-ttf-gas-futures/
UN (n.d.) Gender inequality index. https://hdr.undp.org/data-center/thematic-composite-indices/gender-inequality-index#/indicies/GII