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# ENERGY POVERTY, TRANSPORT POVERTY AND LIVING CONDITIONS

*AN ANALYSIS OF EU DATA  
AND SOCIOECONOMIC INDICATORS*

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## **Abstract**

A substantial share of the population across the European Union (EU) is suffering from energy and transport poverty. Tackling those requires a better understanding of the social groups and territories affected most. In this report, we utilise microdata from the EU-SILC and HBS surveys to provide a detailed assessment at high granularity. Using expenditure data and classic energy poverty indicators, we identify similarities and differences across various socio-economic and spatial categories (e.g. gender, employment status, tenure category, and degree of urbanisation). The visualised results of the analysis can help the research and policy community to shape agendas towards a fair and just transition with reduced inequalities.

# 1 Introduction

Energy poverty has become a challenge recognised across the EU as it is a widespread condition affecting millions of households in the continent <sup>(1)</sup>. The phenomenon is highly complex given that there are multiple factors allowing energy poverty to emerge. To name a few: low income, unavailability of certain forms of energy (supply side), energy costs, lack of energy-efficient households and equipment, failure of social and energy policies addressing the issue, demographics and climatic conditions. The result of this complexity is the lack of a common definition of energy poverty, and that generates statistical reporting deficiencies as definitions provide the frame within which metrics can be established.

‘Energy poverty’ or ‘fuel poverty’ are the most commonly used terms in academic debate to describe the inability to access the socially and materially adequate level of energy services <sup>(2)</sup>. Socially, with regard to the energy service levels that allow for functional participation in society, and materially with regard to the direct consequences on physical and mental health from exposure to substandard living conditions <sup>(3)</sup>. The term ‘energy justice’ is also often used in scholarly work to describe fundamental conditions in relation to energy needs and the right to secure, affordable, and sustainable energy for everyone <sup>(4)</sup>.

In European policy and research, energy poverty is commonly understood as the inability of a person or household to fulfil their needs for heating, cooling, lighting and other energy-essential services. As the condition manifests a self-evident connection between precarious social conditions (e.g. low income), the problem is often seen through the lens of social policy rather than energy policy <sup>(5)</sup>.

However, research indicates that energy poverty is driven by a multitude of factors and requires a spectrum of policy responses based on a variety of indicators as well as a deep understanding of local contexts and conditions. For example, even if economically vulnerable households face higher elasticity on energy price fluctuations, income poverty does not necessarily signal fuel poverty in every context <sup>(6)</sup>; While energy retrofitting and housing policies might have a higher impact on tackling energy poverty than direct energy subsidies <sup>(7)</sup>.

Nevertheless, these much needed and vibrant debates go beyond the scope of this report, which is to take stock and reflect upon EU data, providing a spatial and social disaggregation platform for established proxy indicators of poverty and the identification of trends.

In EU Member States (MSs), the situation is equally complicated with regards to the standardisation of the definition of energy poverty. EU legislation leaves space for MSs to develop definitions and employ their own criteria according to their own particular context. However, EU policy on energy poverty has gradually gained momentum over the last 15 years, shaping MSs policy and responses.

Since 2009, EU legislation has recognised energy poverty and vulnerability, requiring MSs to employ adequate measures (e.g. national energy action plans, social security benefits and support for energy efficiency improvements) <sup>(8)</sup>. In 2017, the European Pillar of Social Rights included energy services among the essential services every citizen should have access to (Principle 20), calling for support measures to meet minimum standards for vulnerable citizens <sup>(9)</sup>.

To support the monitoring of energy poverty, the EU Energy Poverty Observatory (EPOV) was launched in 2018 and reorganised in 2021 as the Energy Poverty Advisory Hub, offering practical policy support to European stakeholders. During its operation, EPOV selected a set of four primary indicators (arrears on utility bills, energy expenditure, the share of energy expenditure in income, and inability to keep the home adequately warm) to measure energy poverty in the EU, based on data from EU surveys.

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(1) Commission Recommendation of 14.10.2020 on energy poverty, SWD(2020) 960 final

(2) Bouzarovski, S., and S. Petrova, ‘A Global Perspective on Domestic Energy Deprivation: Overcoming the Energy Poverty-Fuel Poverty Binary’, Energy Research and Social Science, 2015

(3) Thomson, H. and Bouzarovski, S., ‘Addressing energy poverty in the European Union: state of play and action’, EU Energy Poverty Observatory, European Commission, 2018

(4) D. Hernandez, ‘Sacrifice along the energy continuum: A call for energy justice’, Environmental Justice, 8, pp. 151–156, 2015

(5) Primc, K., and R. Slabe-Erker, ‘Social Policy or Energy Policy? Time to Reconsider Energy Poverty Policies’, Energy for Sustainable Development, 2020

(6) Charlier, D., and S. Kahouli, ‘From Residential Energy Demand to Fuel Poverty: Income-Induced Non-Linearities in the Reactions of Households to Energy Price Fluctuations’, Energy Journal, 2019

(7) Charlier, D., B. Legendre, and A. Risch, ‘Fuel Poverty in Residential Housing: Providing Financial Support versus Combatting Substandard Housing’, Applied Economics, 2019

(8) Gangale, F., and A. Mengolini, ‘Energy poverty through the lens of EU research and innovation projects’, Publications Office of the European Union: Luxembourg, 2019

(9) [https://ec.europa.eu/info/strategy/priorities-2019-2024/economy-works-people/jobs-growth-and-investment/european-pillar-social-rights/european-pillar-social-rights-20-principles\\_en](https://ec.europa.eu/info/strategy/priorities-2019-2024/economy-works-people/jobs-growth-and-investment/european-pillar-social-rights/european-pillar-social-rights-20-principles_en)

The 2019 recast of the Electricity Directive was more explicit on the issue and requires MSs to ensure the protection of energy-poor or vulnerable customers through social policy or other initiatives with regards to the supply of electricity <sup>(10)</sup>. On 2020, the European Commission (EC) published a recommendation on energy poverty urging MSs to address the energy poverty situation in the bloc.

Based on these policy initiatives, a more concrete framework is now available in the EU for defining and addressing the causes and consequences of energy poverty. A direct result of this framework is the alignment of national policies. EU countries now have to assess the number of households in energy poverty in their National Energy and Climate Plans (NECPs), and set objectives for long-term renovation strategies to reduce the phenomenon.

Nevertheless, most MSs have not yet established a clear methodology to define energy poverty either qualitatively or quantitatively in their 2021–2030 NECPs, or explicit indicators to assess energy poverty levels <sup>(11)</sup>. The identification of socioeconomic and technical parameters that fuel and describe energy poverty in a specific context is highly important for the development of tailor-made and holistic policy responses. Each indicator can capture a different aspect of the phenomenon and become the prism through which energy poverty issues become more visible and comprehensible.

This report engages with this ongoing work on situational awareness and indicators setting, and summarises data deriving from EU wide surveys related to energy poverty, transport poverty, and living conditions in EU countries. It does so by providing a series of visualisations that act as indicators or proxy indicators affecting energy transition policies and the deployment of the European Green deal strategy.

The focus is on vulnerable social groups and regions that experiencing pressures, directly or indirectly, due to the energy transition. While income plays a key role in the analysis, we go beyond it to include other sociodemographic parameters such as age, gender, employment status, household types and type of household income.

The data derive from:

- The Household Budget Surveys (HBSs) which are national surveys focusing mainly on household expenditure on goods and services. They were launched in most EU Member States at the beginning of the 1960s and Eurostat has been collating and publishing these data every 5 years since 1988 <sup>(12)</sup>. The data analysed here are from the 2015 round.
- The EU Statistics on Income and Living Conditions (EU-SILC) survey which collects timely and comparable cross-sectional and longitudinal data on income, poverty, social exclusion and living conditions <sup>(13)</sup>. The legal basis of the EU-SILC project entered into force in 2004 and now covers all EU countries and several external participants.

The indicators selected for visualisation and their respective analytical domains are a result of a review process that took into account the EU common practices on indicators, the availability of complete datasets and their quality and ability to compare across territories and social groups, and finally, the need for disaggregated data in specific thematic areas as identified by policy, civil society and academic reviews.

The report consists of 4 chapters with visualisations. First, we provide a general picture of household income in the EU, acting as a reminder of the disparities across member states and income groups (Chapter 2). In Chapter 3, we utilise the latest available data from the HBS to indicate expenditures in energy and transport across countries and social groups as analysed by gender, occupation, income and population density. In Chapter 4, data from the EU-SILC survey are used to monitor energy poverty. The graphs create an understanding of the distribution of households' energy poverty across income quintiles and Member States controlling also for tenures status, dwelling type, age, gender and the employment status of households' responsible person. Chapter 5 displays data at regional level via a mapping exercise, that also examines the levels at which energy poverty is observed by the degree of urbanisation across EU. Finally, Chapter 6 summarises the key messages of the report.

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(10) Directive (EU) 2019/944 of the European Parliament and of the Council of 5 June 2019 on common rules for the internal market for electricity and amending Directive 2012/27/EU

(11) Bouzarovski, S., H. Thomson, A. Varo, and R. Guyet. Towards an inclusive energy transition in the European Union: Confronting energy poverty amidst a global crisis. Luxembourg: Publications Office of the European Union, 2020

(12) <https://ec.europa.eu/eurostat/web/microdata/household-budget-survey>

(13) <https://ec.europa.eu/eurostat/web/microdata/european-union-statistics-on-income-and-living-conditions>

## 2 EU Households' income

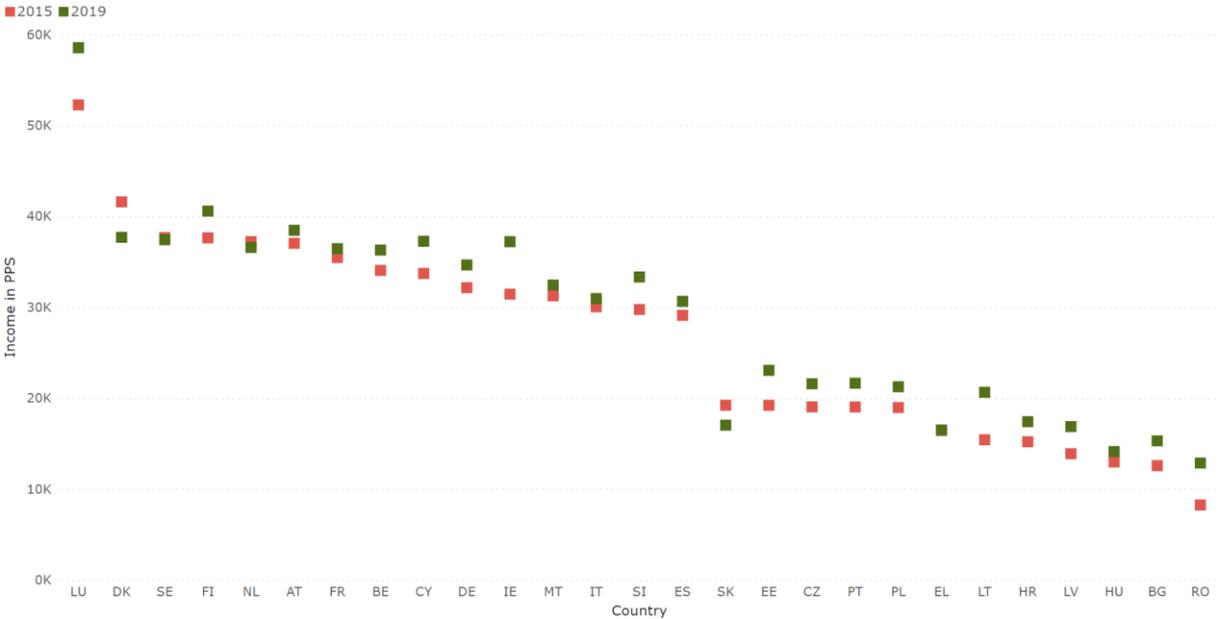
Household income is key to understanding and defining the level of poverty and exclusion among social groups. It is generally defined as the combined income of all members of a household above a specified age for a given time period. The measure of poverty in the EU is based on the disposable income using the calendar year as a reference period. Household disposable income provides a proxy of the current economic well-being, as it indicates the amounts available to spend or save. A household's disposable income is the sum of the personal income of all members after regular and standard contributions (e.g. income taxes, regular taxes on wealth, and other compulsory social insurance contributions) <sup>(14)</sup>.

Across and within countries and social groups diverse income realities exist. This section briefly presents the differences across the EU Member States on Household Disposable Income (HDI) expressed in Purchasing Power Standard (PPS). On average in the EU, the HDI increased by 4.9% between 2015 and 2019. Nevertheless, the degree of increase is significantly different across the EU while households in three countries experienced a decrease of disposable income.

The disparities become evident when separating households in income quintiles by dividing the surveyed households into five groups equally represented by 20 % of the survey's household units each. The first quintile group represents the 20% of the households with the lowest income and the fifth quintile group represents the 20% of households with the highest income.

The income disparities and a country's general level of economic development affect households' energy poverty and are important to take stock of these before analysing accessibility, reliability and affordability dimensions of energy and mobility poverty in the rest of the report.

**Figure 1.** Average household disposable income in EU countries

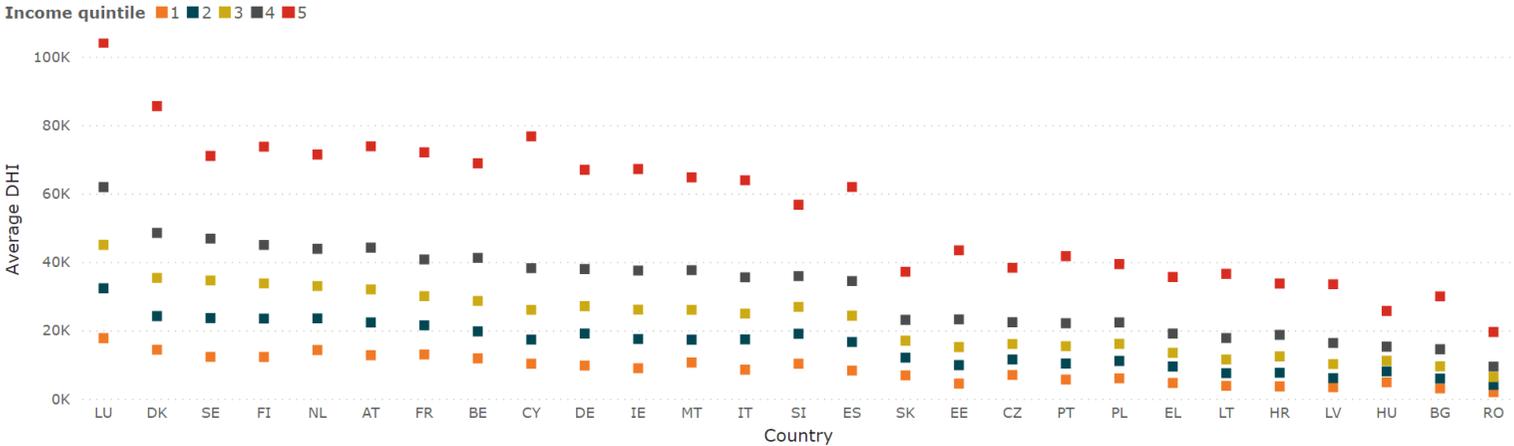


Source: JRC, based on Eurostat, EU-SILC, 2015-2019

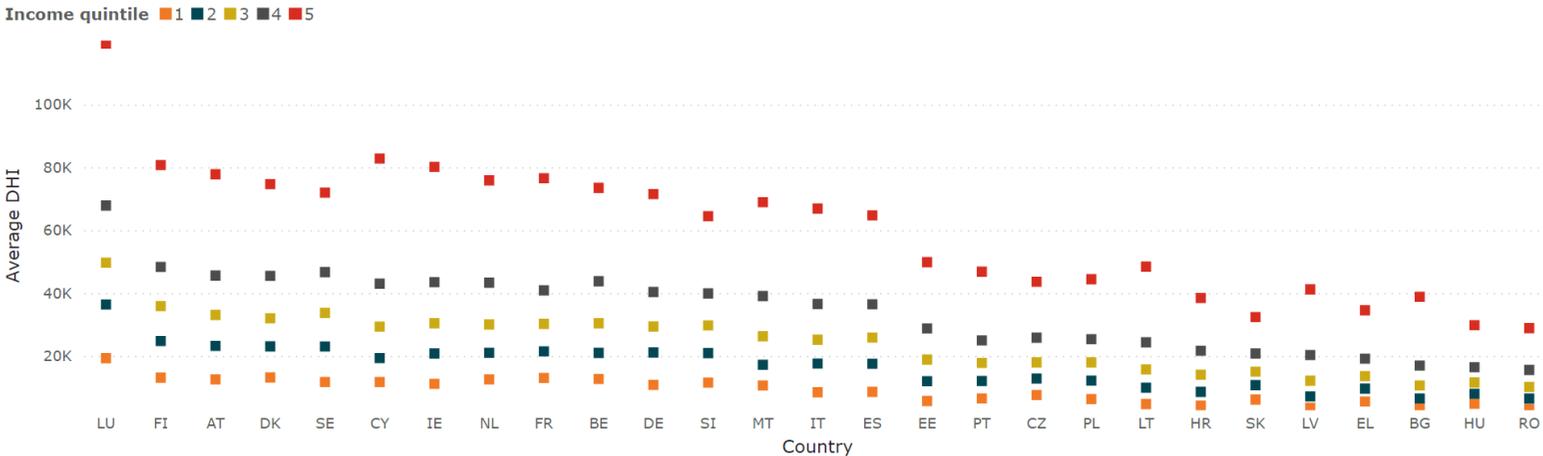
(14) [https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Glossary:Households\\_disposable\\_income](https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Glossary:Households_disposable_income)

**Figure 2.** Average disposable household income by income quintiles (2015-2019)

Average Disposable Household Income by Income Quintile in PPS (2015)



Average Disposable Household Income by Income Quintile in PPS (2019)



Source: JRC, based on Eurostat, EU-SILC, 2015-2019

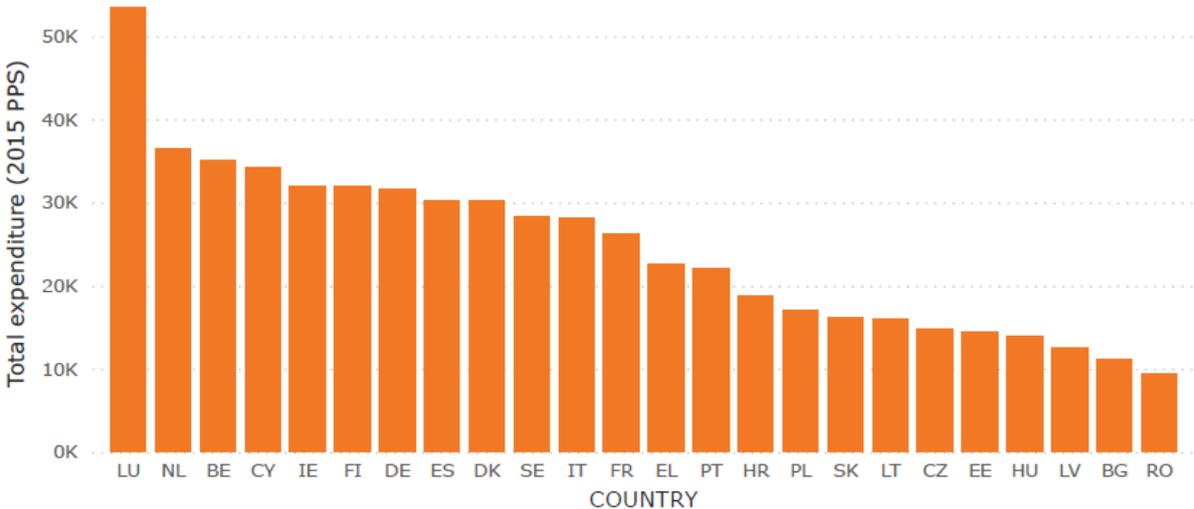
### 3 Household expenditure patterns

Indicators on household spending express the amount of final consumption expenditure made by households to meet every day needs. Surveys like Eurostat’s Household Budget Survey (HBS) collect expenditure data on energy, transport, food, clothing, housing, durable goods, health and other services of all kinds. Household expenditure is an essential variable of socioeconomic analysis as it represents around 60% of the gross domestic product in a country <sup>(15)</sup>.

On average, housing, transport, food and energy are usually the categories where households spend most of their income. However, spending patterns diverge, sometimes significantly, within and across countries and social groups. In this section, we provide data from the HBS analysing expenditure patterns on energy and transport in relation to the activity of the reference person, the household’s income quintile, the degree of urbanisation, the gender of the reference person, and the household’s type.

The latest available microdata from the HBS provide information on households’ expenditures on goods and services in Europe <sup>(16)</sup>. The mean total household expenditure is shown in Figure 3 in 2015 Purchasing Power Standard per Member State. From the 24 Member States that reported data, Luxemburg shows the highest average total household expenditure (53 500 EUR), followed by the Netherlands and Belgium. The lowest values are found in Latvia, Bulgaria and Romania (9 400 EUR).

**Figure 3.** Mean total household expenditure (in PPS2015) by country



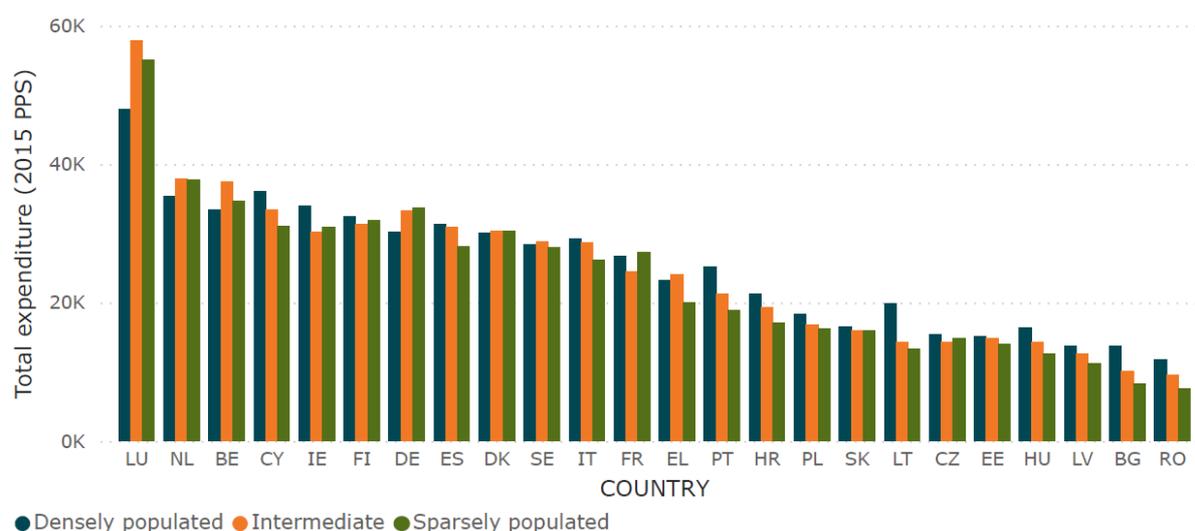
Source: JRC, based on Eurostat, HBS, 2015

Figure 4 shows the mean total household expenditure in 2015 PPS per Member State and population density. In general, the total household expenditure is lower in rural areas (sparsely populated regions). An exception to this are some of the countries with higher total expenditure, for example the Netherlands, Belgium, Germany, Denmark, and France.

(15) OECD (2022), Household spending (indicator). doi: 10.1787/b5f46047-en

(16) <https://ec.europa.eu/eurostat/web/microdata/household-budget-survey>

**Figure 4.** Mean total household expenditure (in PPS2015) by country and population density



Source: JRC, based on Eurostat, HBS, 2015

### 3.1 Expenditure shares for energy and personal transport

From HBS data, it is interesting to look at the expenditure pattern for energy and transport. Table 1 shows the COICOP consumption classes<sup>(17)</sup> that are relevant for the analysis of energy and mobility poverty.

**Table 1.** COICOP categories related to energy and transport

Name	COICOP categories	Comment
Electricity, gas and other fuels	04.5 (Electricity, gas and other fuels)	Named "energy" in the following
Heating fuels	04.5.2 (Gas) + 04.5.3 (Liquid fuels) + 04.5.4 (Solid fuels) + 04.5.5 (Heat energy)	Electricity used for heating (e.g. for heat pumps) is not accounted for
Personal transport	07.2 (Operation of personal transport equipment)	Excludes the purchase of personal transport equipment
Transport fuels	07.2.2 Fuels and lubricants	Excludes maintenance and repairs

In the following, we will look at the expenditure patterns on energy, heating fuels, personal transport and transport fuels. Section 3.1.1 will provide an overview for the European Union, while in Section 3.1.2, we will look at individual Member States. In Section 3.1.3, we will develop the contributing factors for the identified expenditure patterns.

#### 3.1.1 European Union

The total expenditure for **energy** in households clearly increases with available household income in the EU (Figure 5, left). For the highest income group, total energy expenditure is about two times higher compared to the lowest income group. The total expenditure is lowest in urban areas for all income groups. In general, it is highest in intermediately populated areas except for the highest income group where total expenditure is highest in rural areas.

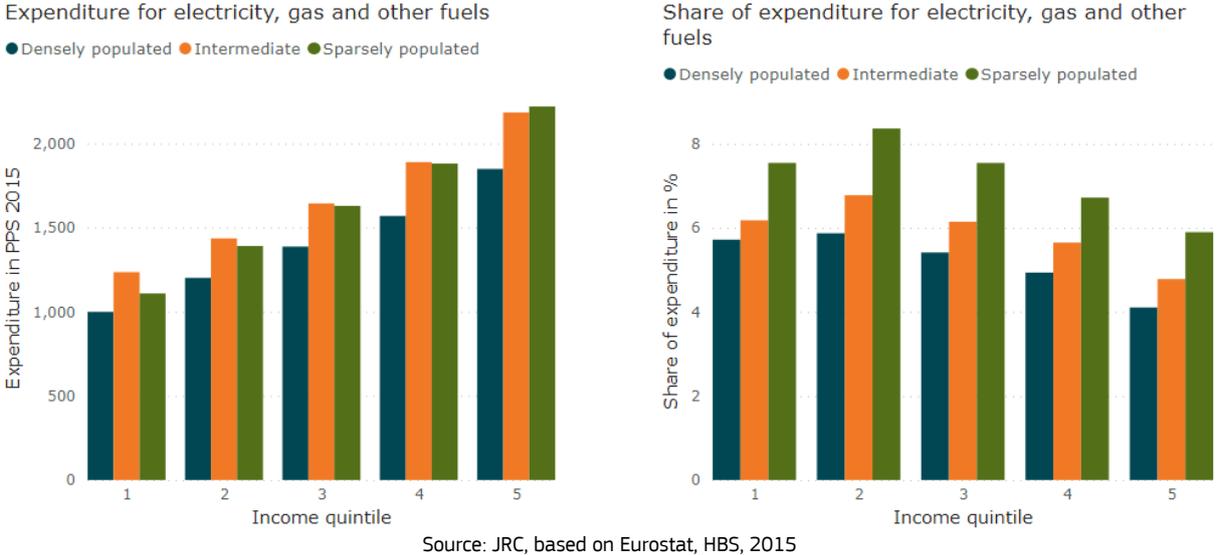
The share of households' expenditures for energy ranges between 4.1% and 8.4% depending on income group and population density. The share of households' expenditure for energy is highest for the second income quintile and lowest for the highest income households (Figure 5, right). This reflects that energy is a basic good where higher income households do not disproportionately spend more on energy. When their energy needs for e.g. heating the house to a comfortable temperature is fulfilled, they will spend their remaining

(17) The COICOP classification is available at RAMON: <https://ec.europa.eu/eurostat/ramon/>

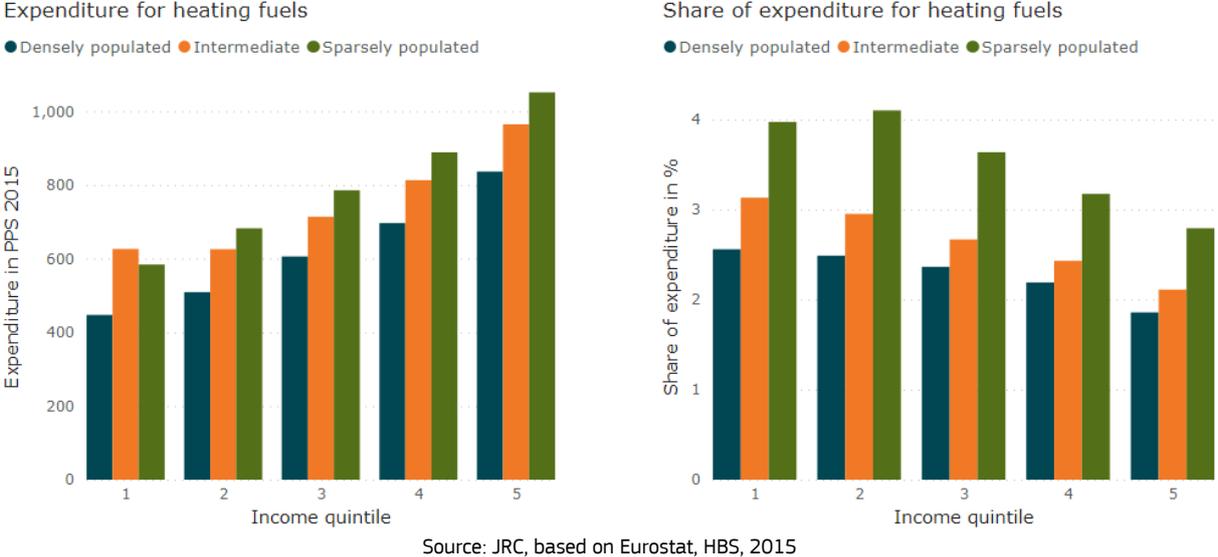
income on other consumption categories (e.g. travel, luxury goods). The share of energy expenditure is clearly lower in urban areas compared to sparsely populated regions.

The expenditure for **heating fuels** shows a similar trend as the absolute expenditure for energy and increases with income (Figure 6). In general, the lowest income households show lower expenditures and the 5<sup>th</sup> income quintile the highest expenditures. Expenditure shares are again highest for the 2<sup>nd</sup> income quintile and decrease with higher income.

**Figure 5.** Expenditure (left) and share of expenditure (right) for energy by population density and income quintile



**Figure 6.** Expenditure and share of expenditure for heating fuels by population density and income quintile



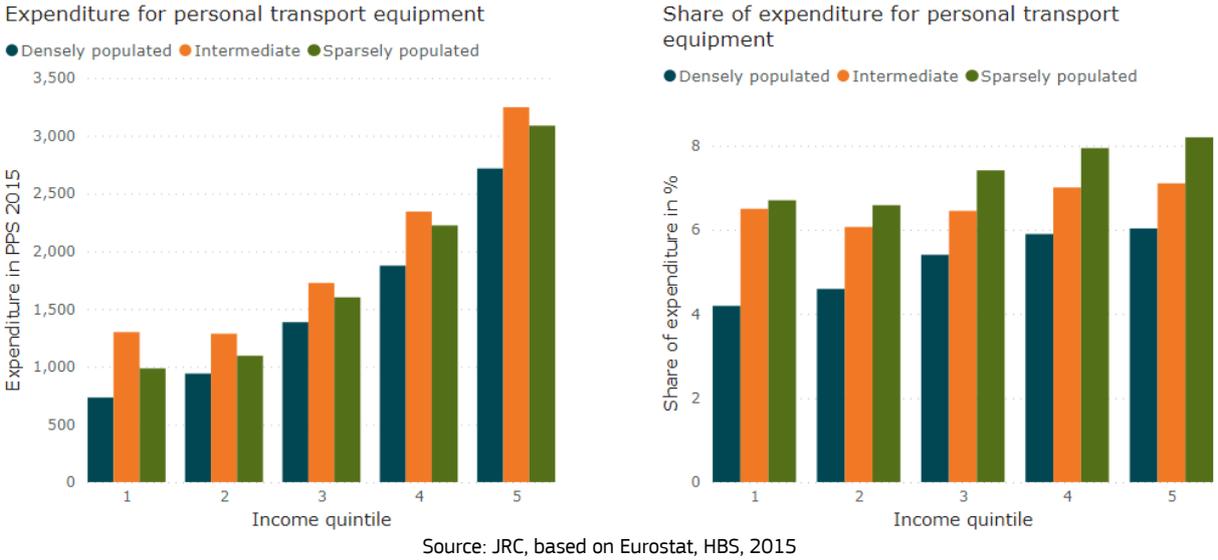
The total expenditure for the operation of **personal transport** equipment includes spare parts, fuels, lubricants, and maintenance but excludes the purchase of transport equipment such as cars, motorcycles, or bikes.

Total expenditure for personal transport in households clearly increases with available household income in the EU (Figure 7, left). For the highest income group, total energy expenditure is about three times higher compared to the lowest income group. The total expenditure is lowest in urban areas for all income groups. This clearly reflects a higher importance of public transport in urban areas compared to rural and intermediately populated areas. Usually, travel distances are also longer in rural areas. However, total

expenditures are highest in intermediately populated areas, maybe due to a larger share of commuting and more trips from intermediately populated areas to cities (e.g. for work or shopping).

The share of households' expenditures for personal transport range between 4.2% and 8.2% depending on income group and population density. The share of households' expenditure for personal transport also increases with household income (Figure 7, right). The fact that the wealthier groups of society tend to spend more on personal transport might lie in the purchase of more expensive, larger cars that consume more fuel, and more frequent use of cars (and higher annual mileage).

**Figure 7.** Expenditures for personal transport equipment by population density and income quintile

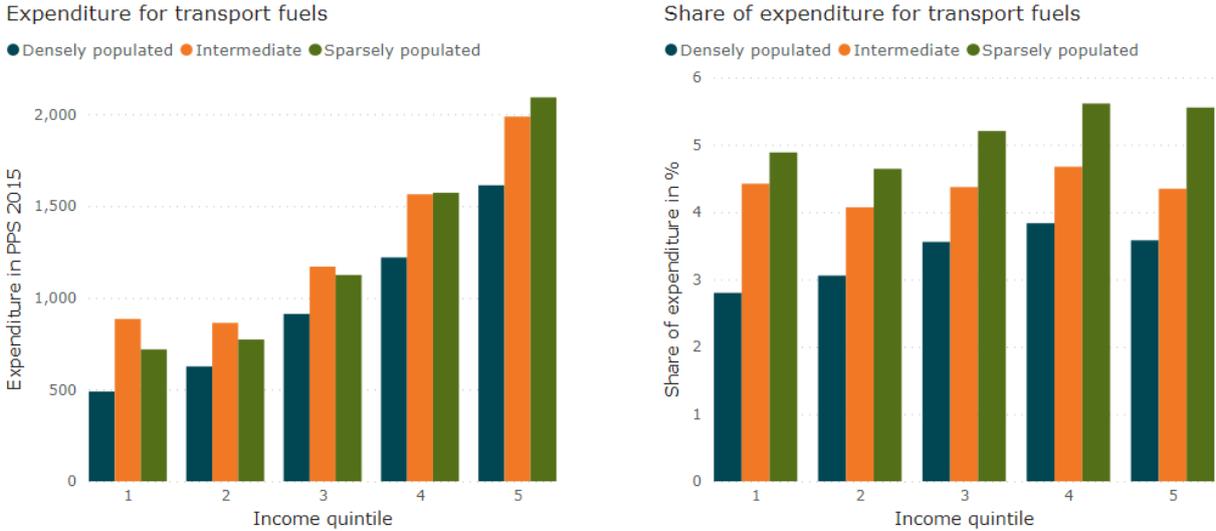


The expenditure for **transport fuels** shows a similar trend as the absolute expenditure for transport equipment. In general, the lowest income households show lower expenditures and the 5<sup>th</sup> income quintile the highest ones (Figure 8, left). Also, the share of expenditure for transport fuels increases with income quintile in general, but shows a less clear trend as transport equipment.

Total expenditure for transport fuel is highest in intermediately populated regions for the first three income quintiles while it is highest in rural areas for the 4<sup>th</sup> and 5<sup>th</sup> income quintiles. For all income groups, total expenditure for transport fuels is lowest in urban areas which might again reflect the availability of public transport in those regions.

The share of expenditure for transport fuels (Figure 8, right) does not show a clear trend. In general, the share remains relatively stable with increasing income. Clearly, the share of expenditure for transport fuels is higher in rural areas compared to urban and intermediately populated areas which indicates higher use of personal transport (car, motorcycle) in rural regions.

**Figure 8.** Expenditures for transport fuel by population density and income quintile



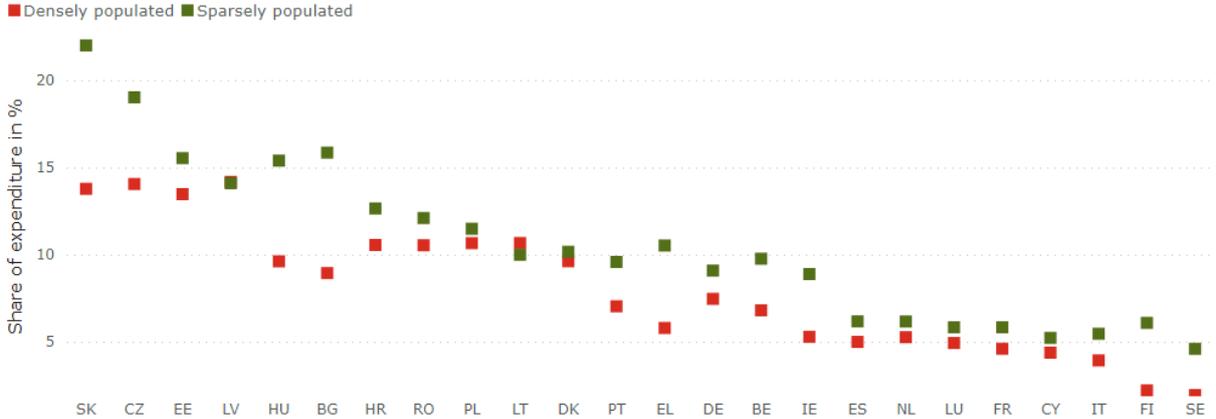
Source: JRC, based on Eurostat, HBS, 2015

**3.1.2 Analysis per Member States and population density**

In the following, we will look at the most vulnerable part of the society, the 1<sup>st</sup> income quintile only.

The share of expenditure for all energy used in the household (electricity, gas, and other fuels) for the 1<sup>st</sup> income quintile is shown in Figure 9. The share of household expenditure for energy ranges from 2% in urban areas in Sweden to 22% in rural areas in Slovakia. In all countries, the shares are higher in rural areas compared to densely populated areas. The countries with higher expenditure shares are located in Eastern Europe and the Baltics, for example, Slovakia, Czechia, Estonia, Latvia, Hungary and Bulgaria.

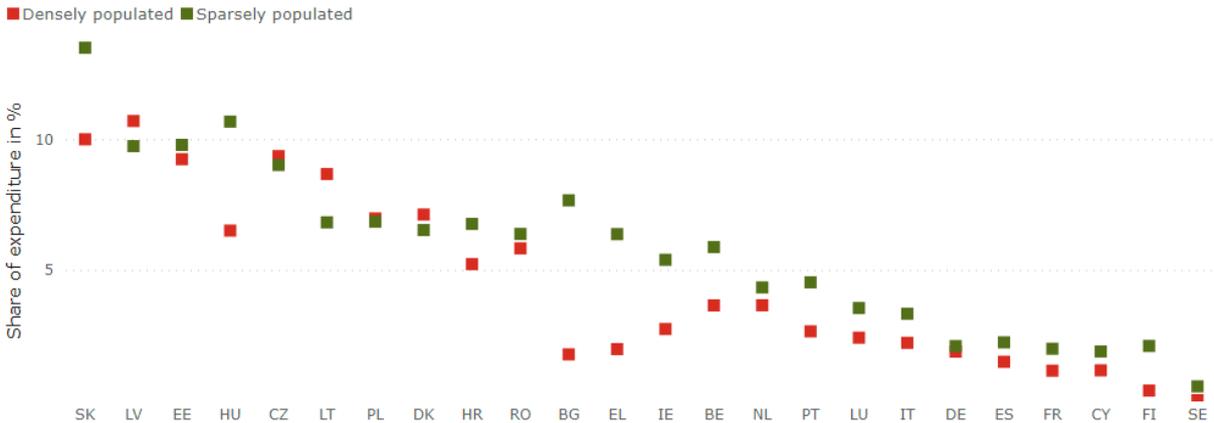
**Figure 9.** Share of expenditure for electricity, gas and other fuels by population density and country



Source: JRC, based on Eurostat, HBS, 2015

The same pattern can be seen when we only look at heating fuels, thus excluding electricity (Figure 10). This assumes that electricity is not used for heating which is not necessarily true. Big differences between urban and rural areas exist in Slovakia, Bulgaria, Greece Hungary, and Ireland.

**Figure 10.** Share of expenditure for heating fuels by population density and country

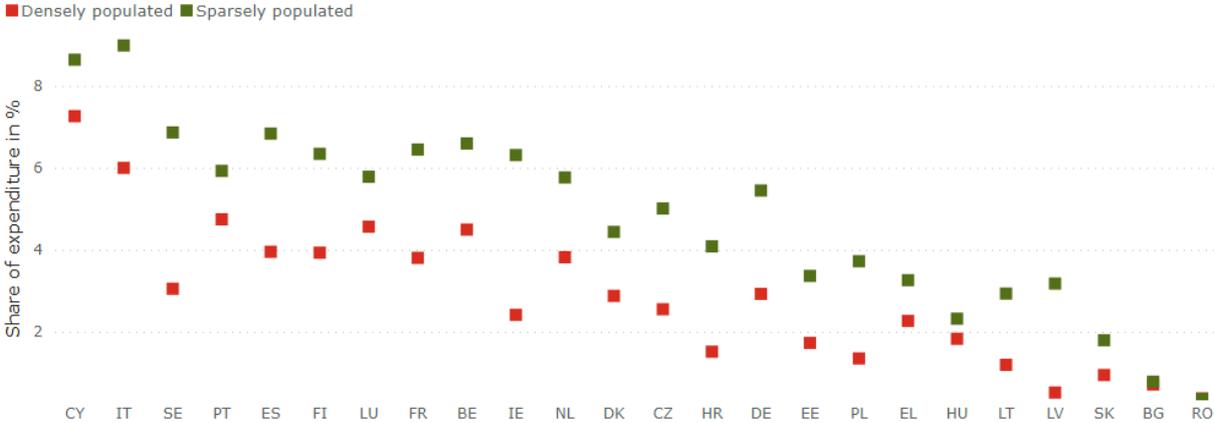


Source: JRC, based on Eurostat, HBS, 2015

Figure 11 displays the share of expenditure for personal transport for the 1<sup>st</sup> income quintile. This share ranges from 0.4% in sparsely populated regions in Romania to 9% in sparsely populated regions in Italy. The shares are higher in rural areas compared to densely populated areas in all Member States.

There is no clear geographical pattern but in general, the share of the expenditures for personal transport is lower in countries with a lower PPS (see Figure 3) which should reflect lower car ownership in those Member States. The same pattern is visible when looking at the expenditure shares for transport fuels (Figure 12). This observation could also be explained by different transport fuel taxation regimes <sup>(18)</sup>.

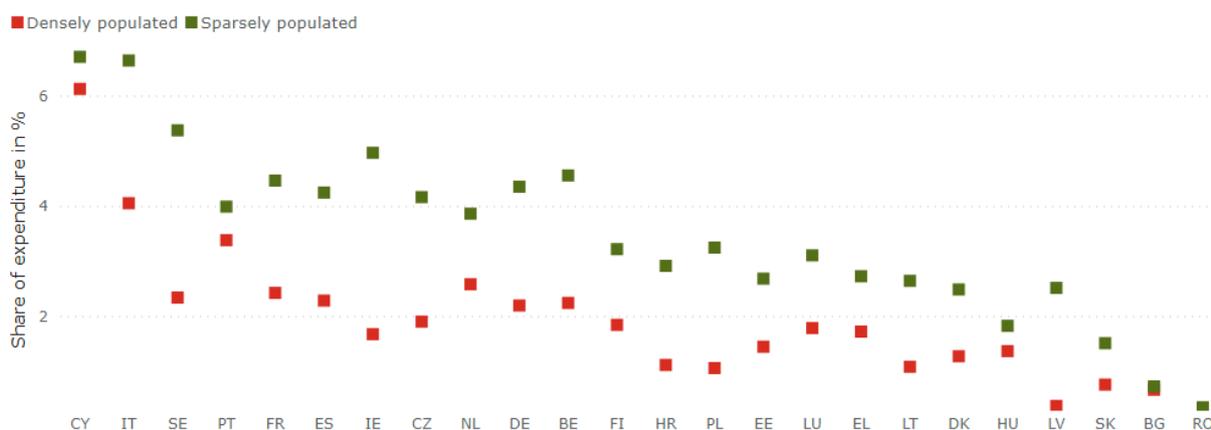
**Figure 11.** Share of expenditure for personal transport by population density and country



Source: JRC, based on Eurostat, HBS, 2015

(18) Murauskaitė-Bull, I., and A. Caramizaru, Energy Taxation and Its Societal Effects, Publications Office of the European Union, Luxembourg, 2021

**Figure 12.** Share of expenditure for transport fuels by population density and country



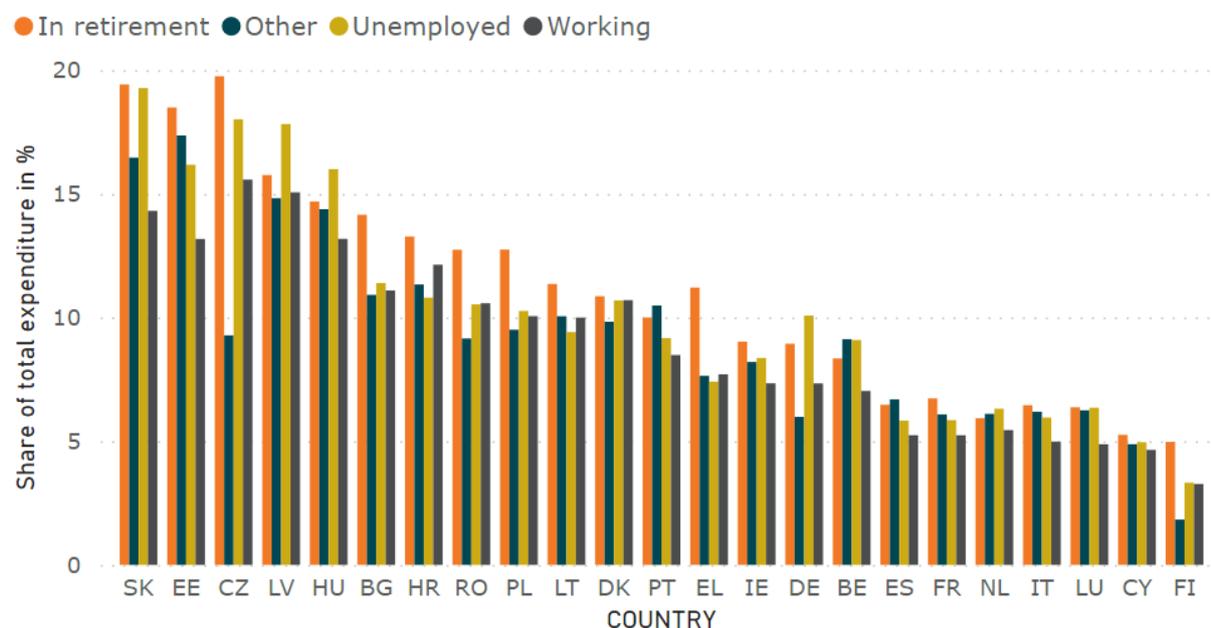
Source: JRC, based on Eurostat, HBS, 2015

### 3.1.3 Contributing factors

The Eurostat HBS does not only provide information on the household level but also further data such as the social group, occupation and employment status, income, gender and age of the reference person of the household<sup>(19)</sup>. In the following, we will analyse how far expenditure and expenditure patterns for energy and transport are linked to different social factors of the reference person and type of household.

If we look at the activity type of the reference person, clearly the retired spend a higher share of their available household budget on energy than other groups (Figure 13). Also, unemployed have a higher share. In general, households with a working reference person show the lowest share of energy-related expenditure. The differences can be remarkable in some countries, for example in Slovakia, Czechia, or Greece.

**Figure 13.** Share of expenditure for energy by activity of reference person



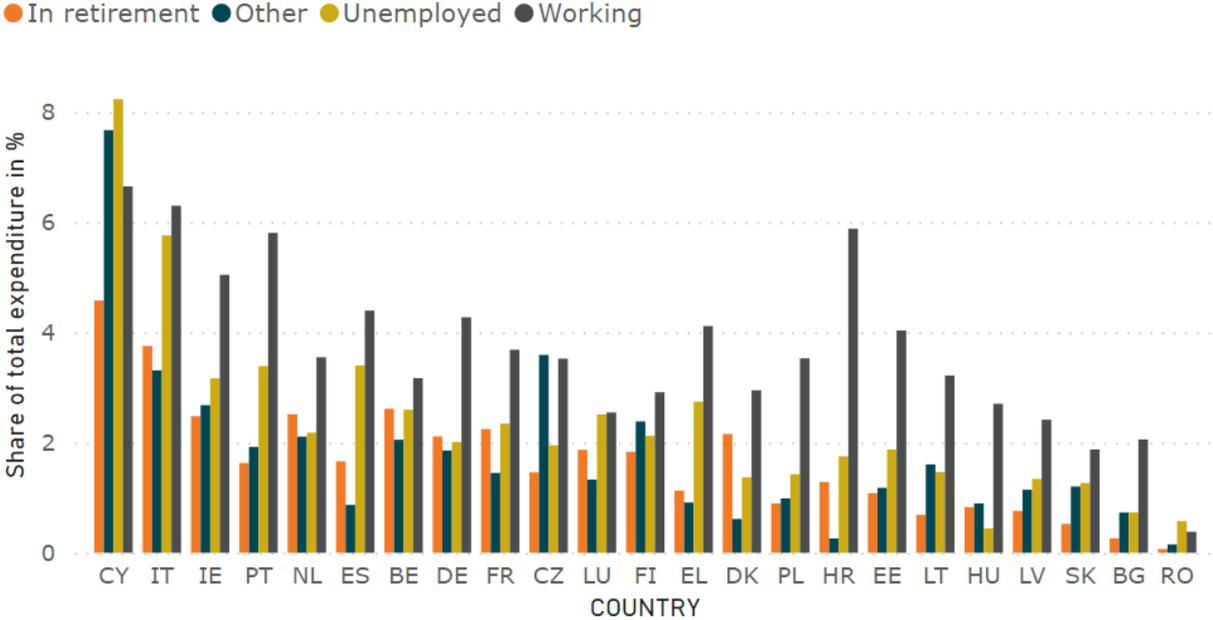
Source: JRC, based on Eurostat, HBS, 2015

If we look at the share of expenditure for personal transport, the picture is clearly the opposite: The retired have usually the lowest shares of expenditure for personal transport while working have the highest share (

(19) The household's reference person is the person aged 16 or more who most contributes to the household income.

Figure 14). This might be explained by a couple of reasons. First, a lower household budget (which we see in households with retired reference person compared to households with a working reference person) means that less is spent on personal transport, because this consumption category is not a necessity. Second, the elderly might in general have reduced mobility which means fewer and shorter trips with personal transport. And third, that the working population usually use more often the personal car to commute to and from work.

**Figure 14.** Share of expenditure for personal transport by activity of reference person

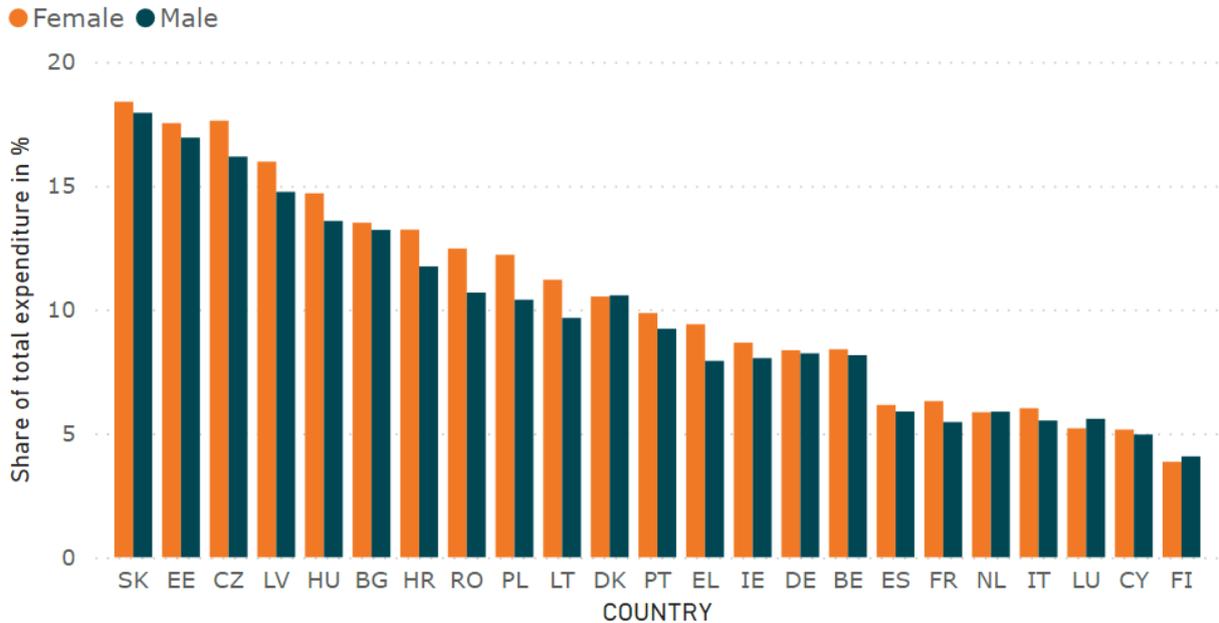


Source: JRC, based on Eurostat, HBS, 2015

Another interesting fact is presented in Figure 15. Clearly, households with a female reference person spend a higher share of their household budget on energy compared to households with a male reference person. This is true for all countries except for Luxemburg and Finland. Larger differences can be seen in Croatia, Romania, Poland, and Lithuania.

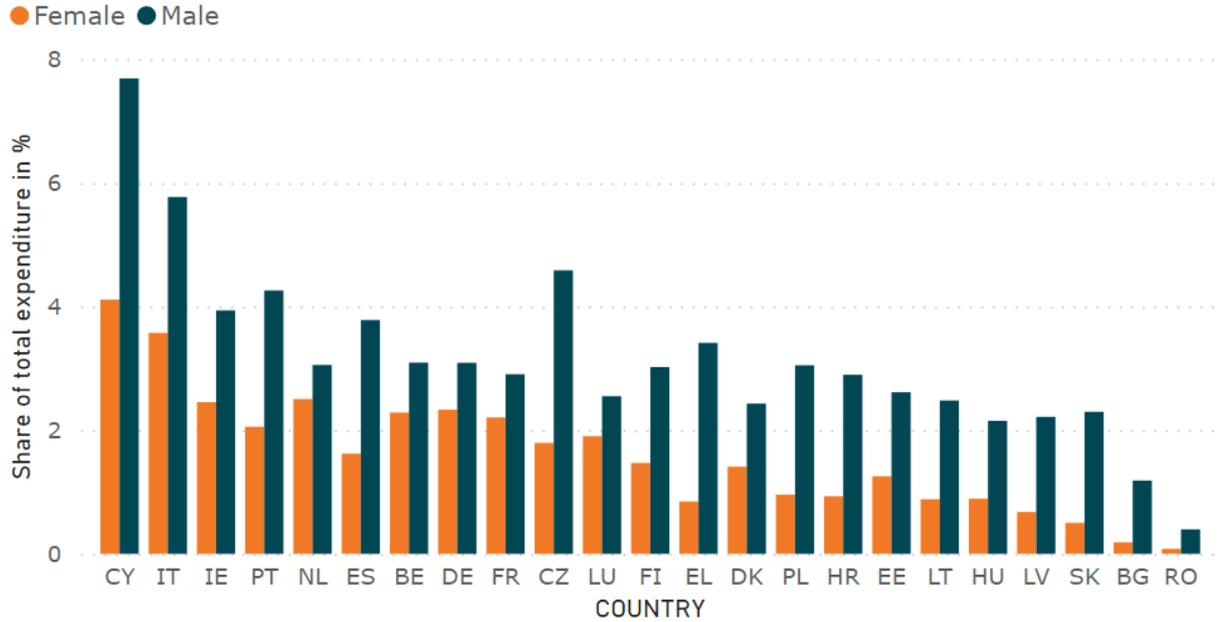
The share of expenditure for personal transport shows a drastic difference between male and female reference persons (Figure 16). Households with a female reference person show much lower shares compared to households with male reference persons. On average, households with a male reference person spend twice the share in the European Union. In some Member States, the difference can be up to a factor of 5 to 6 (Romania, Bulgaria, Slovakia).

**Figure 15.** Share of expenditure for energy by gender of reference person



Source: JRC, based on Eurostat, HBS, 2015

**Figure 16.** Share of expenditure for personal transport by gender of reference person

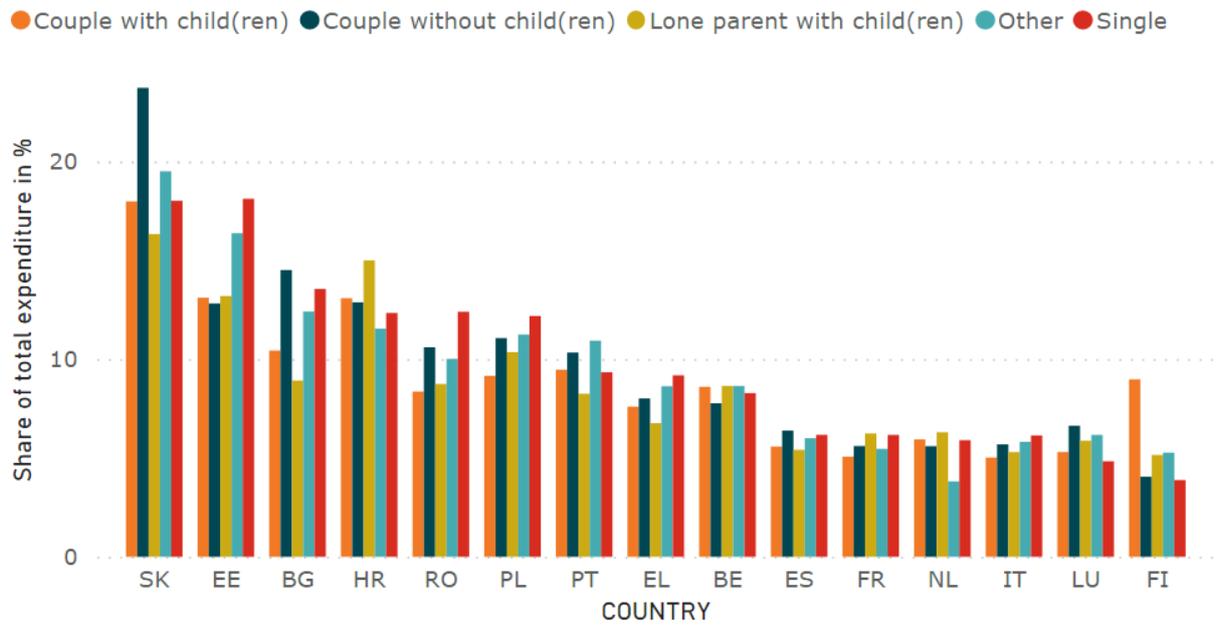


Source: JRC, based on Eurostat, HBS, 2015

When we assess the influence of the household type on expenditure patterns, we do not obtain a clear picture (Figure 17). In some countries, single households show the highest shares of expenditure for energy while in others, couples without child(ren) or lone parents with child(ren) have the highest shares. In general, couples with child(ren) have the lowest shares which could hint at a rather positive economic situation with maybe more than 1 person contribution to the household income.

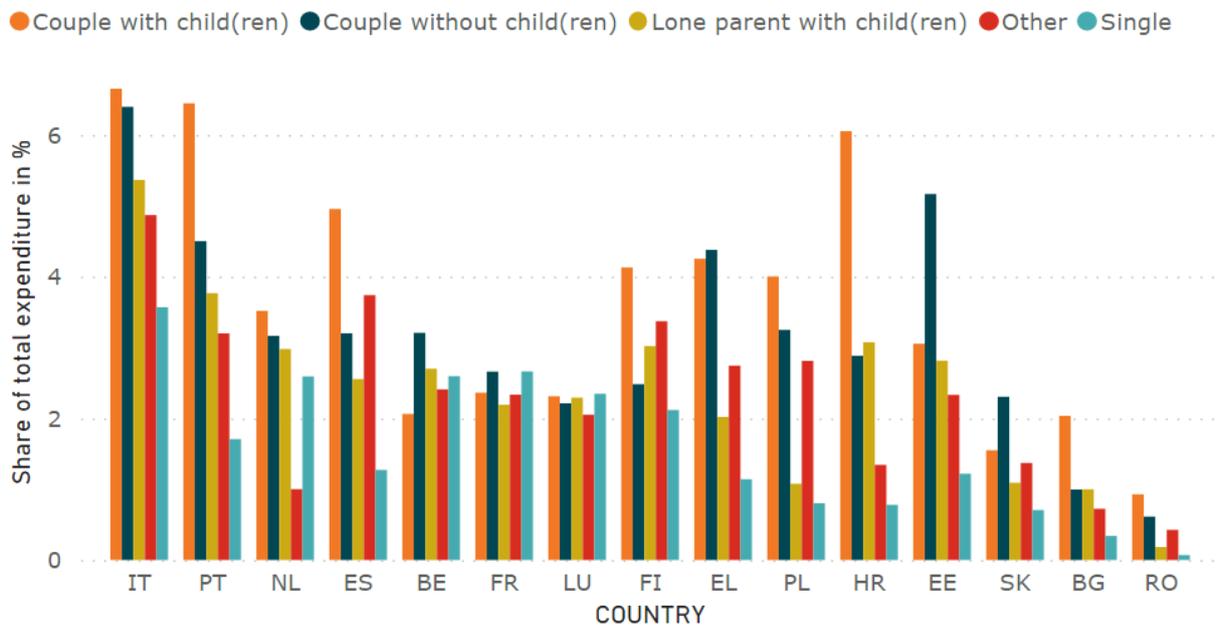
For personal transport, the results are much more varying (Figure 18). Often, couples with child(ren) have a higher share of expenditure for personal transport because, as said before, those households are often commuting to work, and have a higher mobility in general due to age. Couples without child(ren) often also have high shares in personal transport while singles usually show lowest shares.

**Figure 17.** Share of expenditure for energy by type of household



Source: JRC, based on Eurostat, HBS, 2015

**Figure 18.** Share of expenditure for personal transport by type of household



Source: JRC, based on Eurostat, HBS, 2015

An analysis in Power BI allows us to detect the key influencers that determine the expenditure patterns.<sup>20</sup> The key influencers' visualisation is using machine learning solutions provided by ML.NET to determine the most driving metrics, mainly based on linear regression.<sup>21</sup>

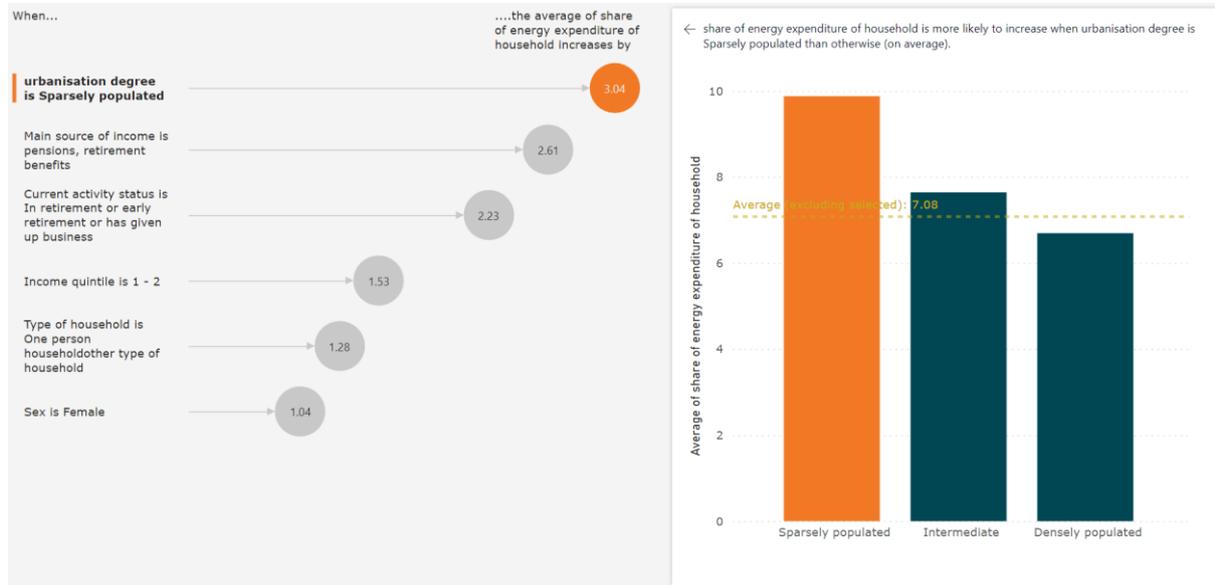
(20) <https://docs.microsoft.com/en-us/power-bi/visuals/power-bi-visualization-influencers>

(21) <https://dotnet.microsoft.com/en-us/apps/machinelearning-ai/ml-dotnet/customers/power-bi>: "Key Influencers uses ML.NET to run logistic regression for categorical metrics, using the One-hot encoding, Replace missing value, and Normalize mean variance data transformations and the L-BFGS Logistic Regression algorithm."

Clear drivers of energy expenditure in the European Union are population density, type of income, activity type, income quintile, and the type of household (Figure 19).

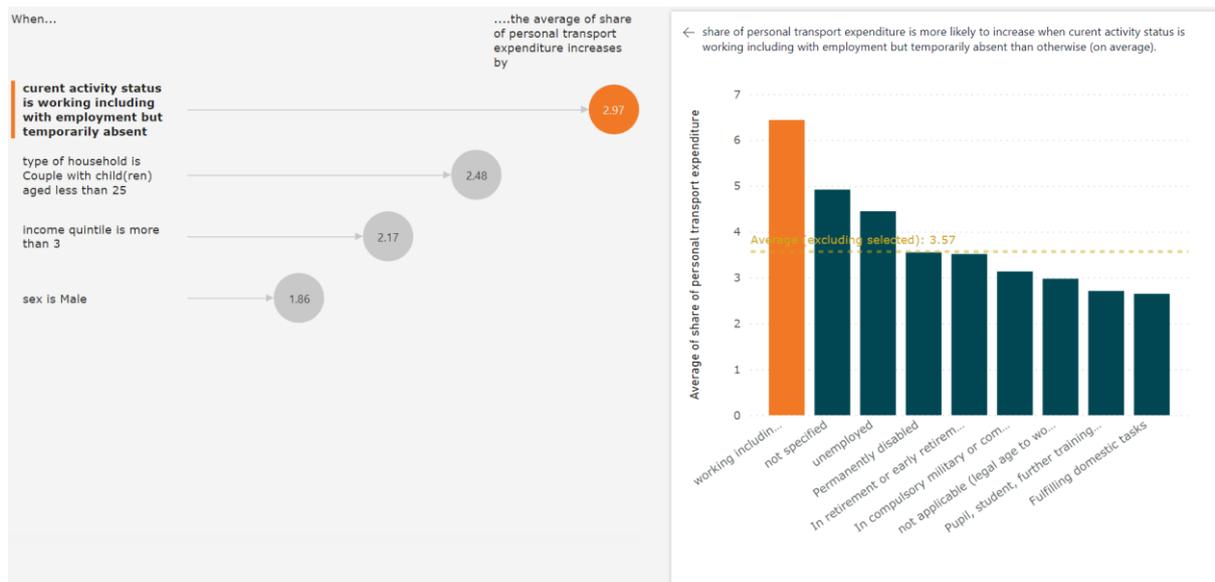
For the expenditure share for personal transport, fewer influencing factors can be seen (Figure 20). The dominating factor is the activity type of the reference person, followed by the type of household, and income quintile. The type of income does not play an important role in expenditure for personal transport.

**Figure 19.** Key influencers in share of energy expenditure of household



Source: JRC, based on Eurostat, HBS, 2015

**Figure 20.** Key influencers in share of personal transport expenditure of household



Source: JRC, based on Eurostat, HBS, 2015

## 4 Energy poverty indicators

Energy poverty results from a combination of low income, high expenditure of disposable income on energy and poor energy efficiency, especially as regards the performance of buildings as people in inefficient buildings are more exposed to weather conditions. Insufficient comfort and sanitary conditions in housing and work environments, such as inadequate indoor temperatures, deficient air quality and exposure to harmful chemicals and materials, contribute to lower productivity, health problems and higher mortality and morbidity.

Two commonly used indicators of energy poverty are the arrears on utility bills and the inability to keep home adequately warm. Arrears on utility bills result from high energy costs and/or low household income making people to fall behind on the payments of their utility bills. This indicator is used in this report to indicate households that failed to settle utility bills on time at least twice the year prior to the survey data collection. The inability to keep home adequately warm is often used interchangeably for the term "energy poverty". It reflects a situation in which a household has difficulties obtaining the necessary energy in its home to meet thermal comfort needs.

In EU-SILC surveys provide insights data for the two indicators. The format of the question is focusing on the financial ability of households to keep up with energy needs.

### Format of question on arrears on utility bills:

*In the past twelve months, has the household been in arrears, i.e., has been unable to pay the utility bills (heating, electricity, gas, water, etc.) of the main dwelling on time due to financial difficulties?*

*Possible answers: Yes, once | Yes, twice or more | No*

### Format of question on ability to keep household warm:

*Can your household afford to keep its home adequately warm?*

*Possible answers: Yes | No*

There are multiple ways to interpret the data deriving from such surveys. For example, when comparing the two indicators we observe divergence across the EU over the intensity of the phenomenon and its articulation (Figure 21) <sup>(22)</sup>. In some countries, more households may face difficulties on keeping adequate temperatures in the house than households with arrears in utility bills (e.g., Portugal or Lithuania). This may indicate the need in parallel with social support measures to focus on building stock qualities and energy efficiency improvements. Contrary in countries where thermal comfort is less of a problem than following up with bills (e.g., Croatia or Slovenia) along with vulnerable households support, an identification of the underline reasons of heating systems efficiency is needed to provide possible lessons learned.

As EU economies moved on from the multiannual recessionary cycle triggered by the 2008 financial crisis energy poverty started to reduce in most countries (Figures 22 & 23). The impact of the COVID-19 pandemic and the recent spike in energy prices is not yet captured by the available data but will be part of a report update in the near future.

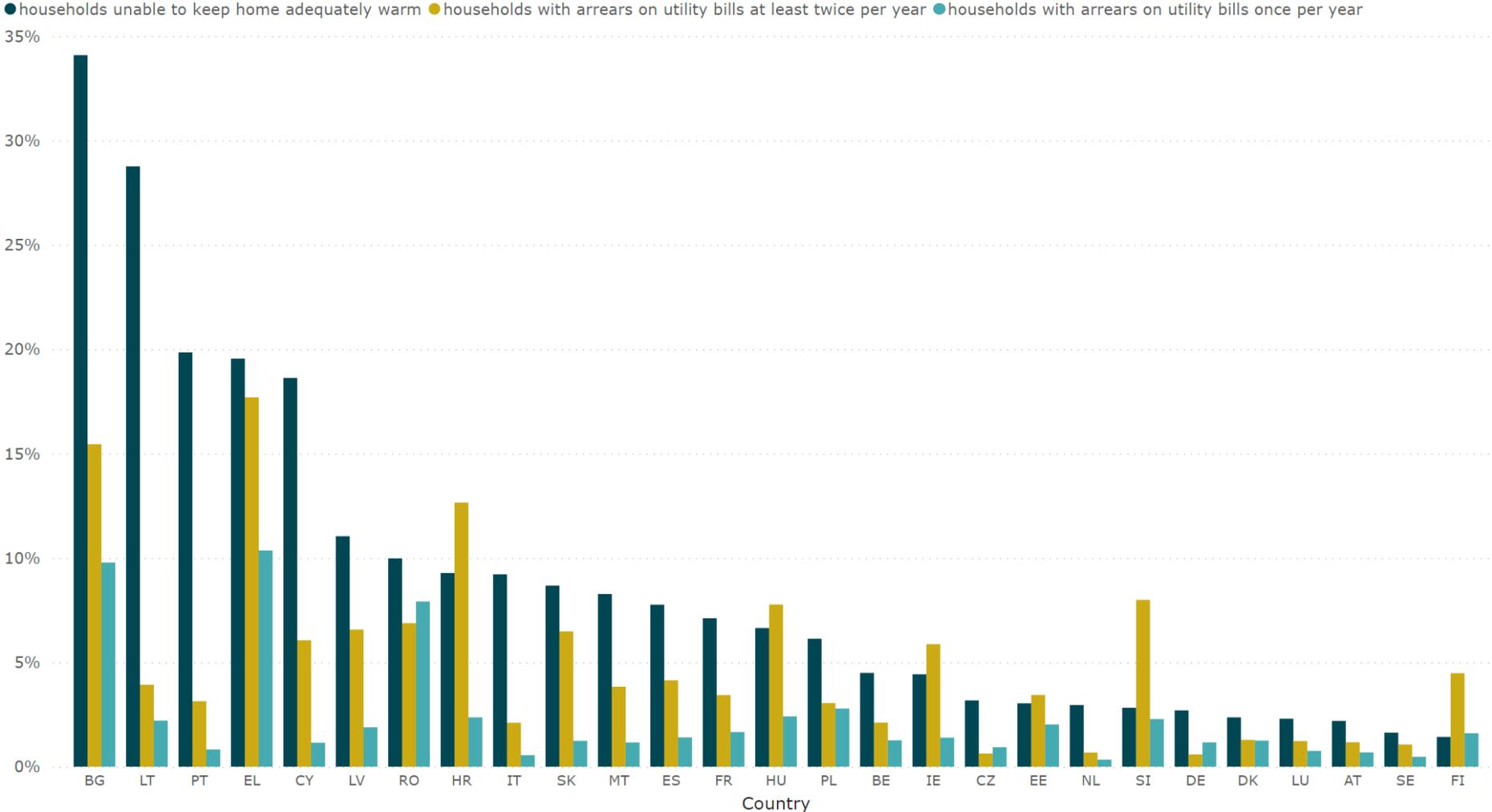
When looking to the income quintile on which the households unable to keep home adequately warm belong, we observe that largely the 2 lowest income groups are overrepresented. Across EU 64.1% of the households unable to keep home adequately warm belong to the lowest two income quintiles (Figure 24). The trend is similar with the arrears on utility bills indicator though there are more households from the upper income quintiles also report difficulties (Figure 25).

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(22) The visualisation of the data deriving from the EU-SILC surveys share the following parameters:

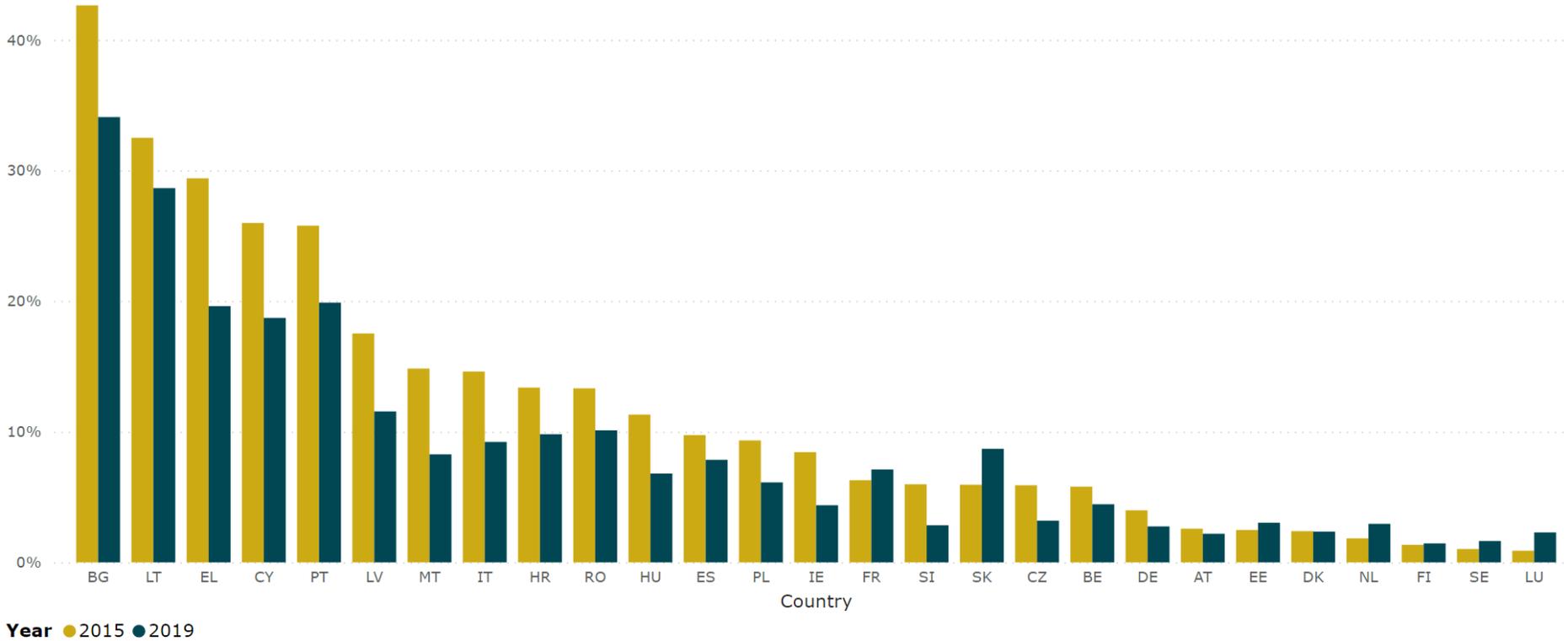
- Households that haven't answered specific fields of the survey on which the graph is referring to are excluded when calculating the total of a percentage
- Countries that do not provide data on the level of granularity a specific visual refers to are excluded from the graph
- Income indicators are calculated based on Purchasing Price Standards for the particular year and country on the related visual
- Indicators focusing on the socio-demographics of the person representing the household are calculated based on the household's responsible person. This according to the survey is the person owning or renting the accommodation. If the accommodation is provided free, the person to whom the accommodation is provided is the responsible person. If two or more persons share responsibility then the oldest is taken into account. If the person owning the accommodation is a child or if the person owning or renting the accommodation does not belong to the household, then is the person who is 'financially responsible' for the accommodation.

**Figure 21.** Energy poverty in EU countries (2019)



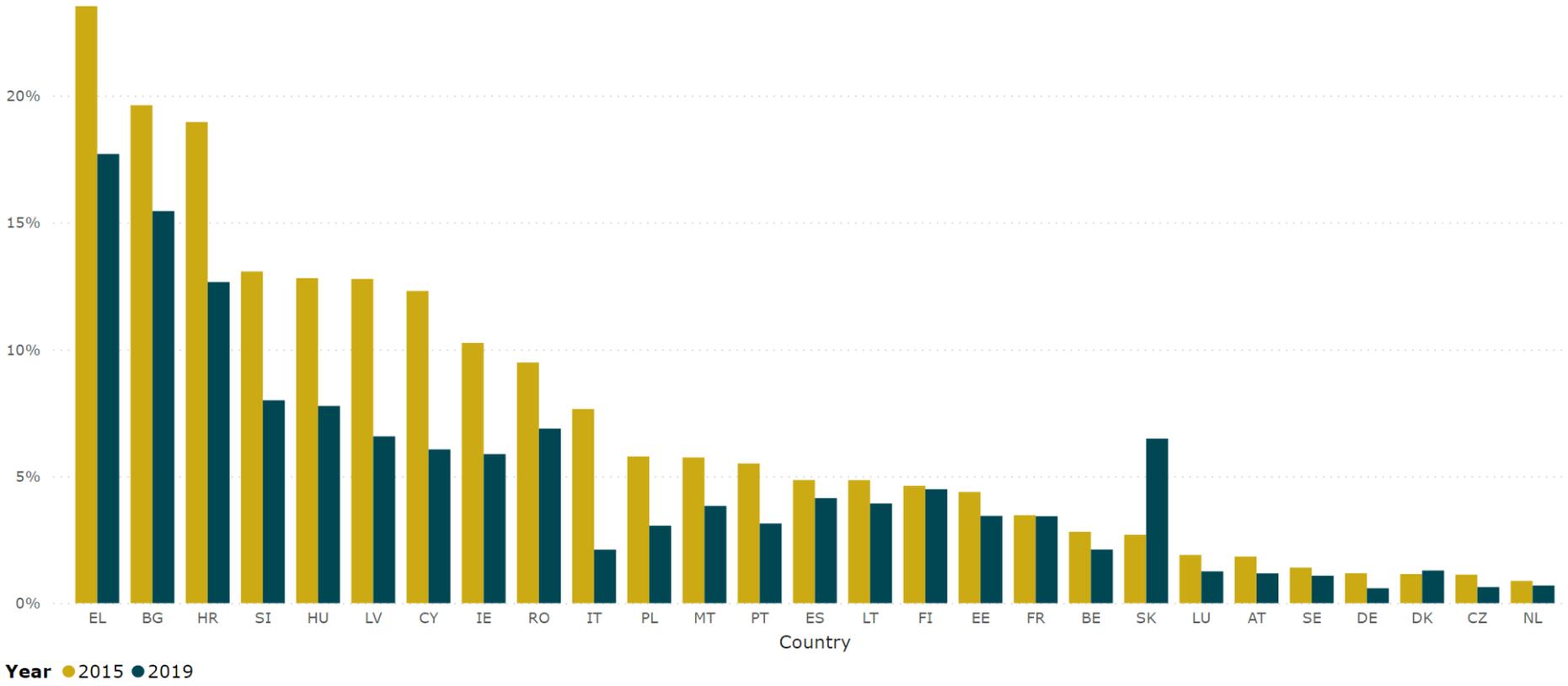
Source: JRC, based on Eurostat, EU-SILC, 2019

**Figure 22.** Percentage of households unable to keep home adequately warm across EU countries (2015-2019)



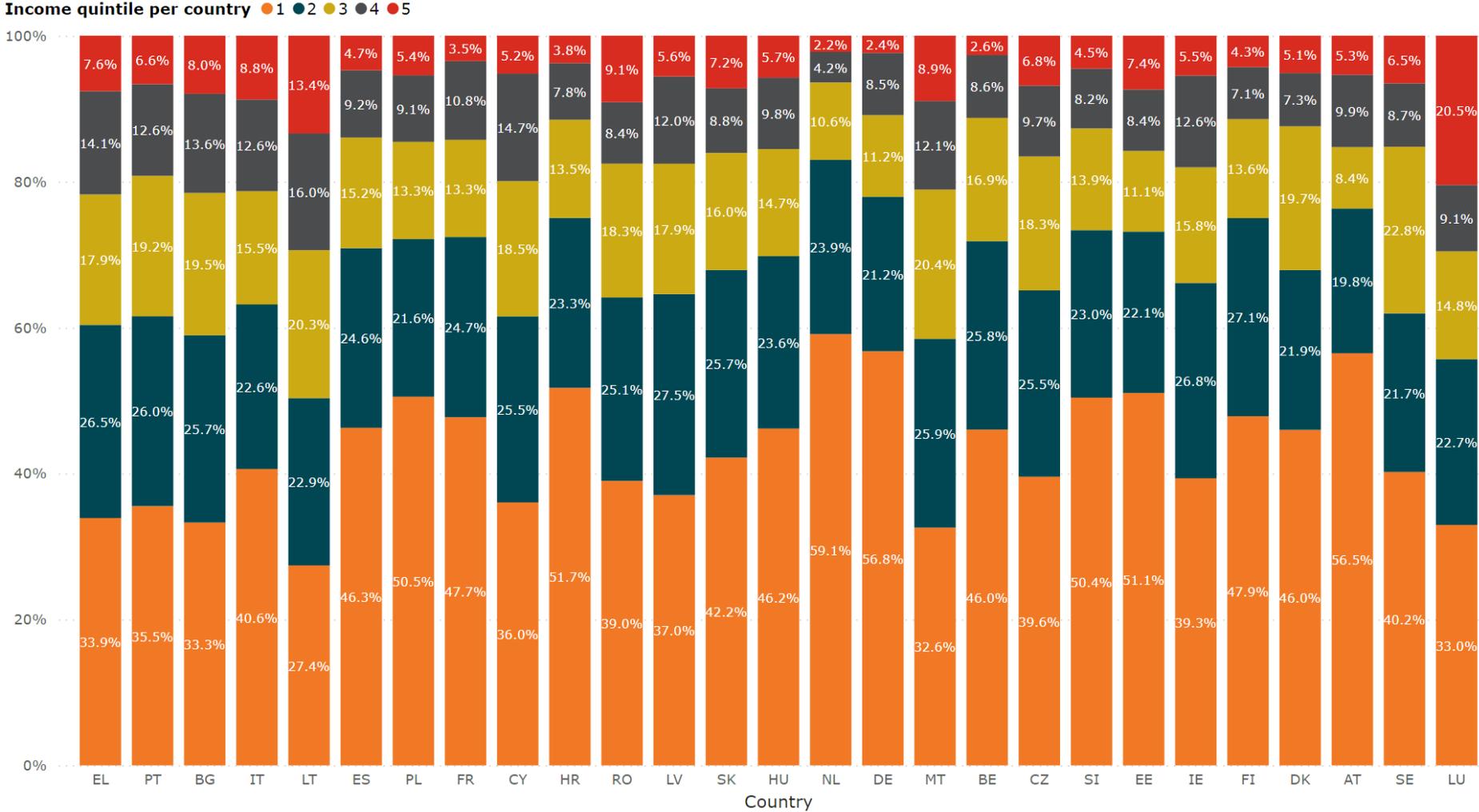
Source: JRC, based on Eurostat, EU-SILC, 2015- 2019

**Figure 23.** Percentage of households with arrears on utility bills at least twice a year across EU countries (2015-2019)



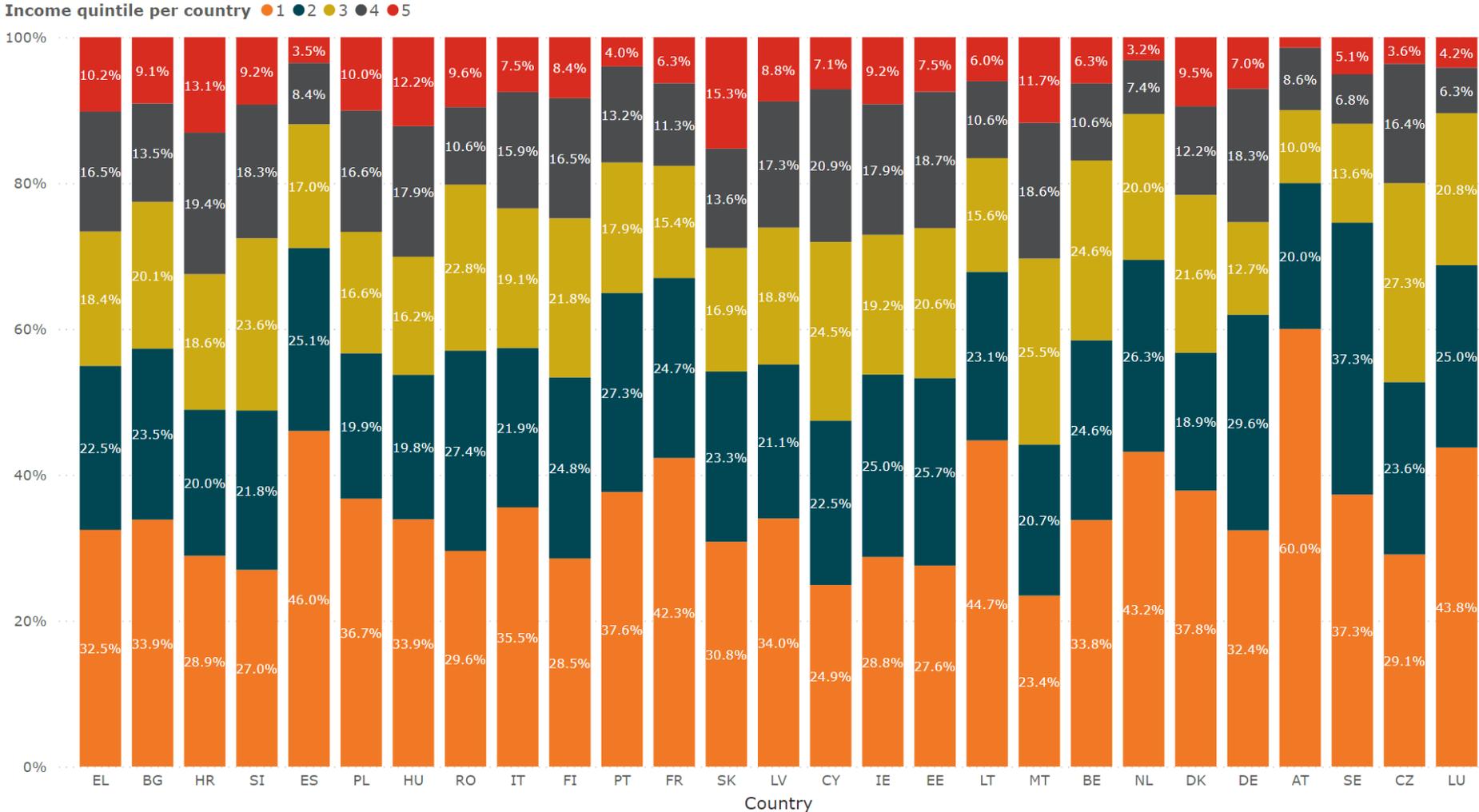
Source: JRC, based on Eurostat, EU-SILC, 2015- 2019

**Figure 24.** Distribution of households unable to keep home warm by income group across EU countries (2019)



Source: JRC, based on Eurostat, EU-SILC, 2019

**Figure 25.** Distribution of households with arrears on utility bills at least twice a year by income groups across EU countries (2019)



Source: JRC, based on Eurostat, EU-SILC, 2015- 2019

### 4.1 Tenure status and dwellings

The “drivers” or causes of energy poverty are many — energy performance of buildings, actual poverty, energy markets, social structures to name the basics. An important step for understanding the phenomenon and generate unified and straightforward policy approaches regard the identification of the very diverse terms of housing occupancy across Europe and the social groups represented in each type (various schemes of social housing, landlords, private tenants, owner-occupants with mortgage/loan or without, multi ownership apartment buildings etc.).

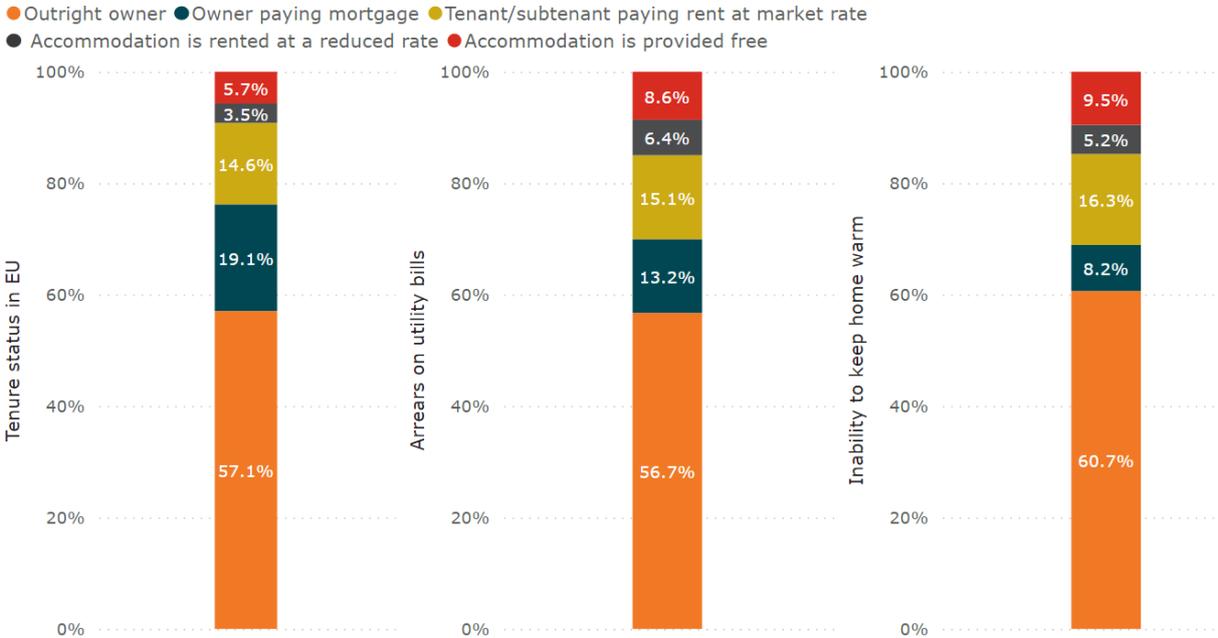
In light of the Renovation Wave Strategy <sup>(23)</sup> and the expected increase in the rate of energy renovations of buildings, this becomes even more important. Separating these groups is important as the various housing schemes and social groups have different interests and needs. For example among house owners and tenants poverty and energy poverty can exist in both social groups but the impacts of a renovation can be disproportional.

Tenure status and dwelling types are studied in this section in relation to the energy poverty indicators. In order for the visualisations at a country level (Figures 28 to 31) to be adequately decoded one needs first to have a clearer idea of the housing status (dwelling type and tenure) and how the social groups by income quintile are distributed on those.

For example, an interesting insight is that the only tenure category that is significantly under-represented in energy poverty indicators across Europe are house owners paying a mortgage (Figure 26). This can be explained from the fact that financial institutions before providing access to loans perform credit checks. Thus, the social group that has enough available resources to access the mortgage market seems to be less affected by energy poverty.

In Europe outright homeownership across income quintiles is relatively steady ranging between 55% and 59% (Figure 27). Though when it comes to owners paying mortgage or accommodation at market rates, we see a great diverge across the various income groups. Lower income households are unable to access mortgage credit while representing the vast majority of the ones paying rent at market rates. The number of households belonging to the two highest income quintiles having a mortgage is 3.5 times higher than the number of households in the two lowest quintiles. At the same time, the number of the more affluent households paying market rate rent is approximately 2.5 times lower than that of the vulnerable households.

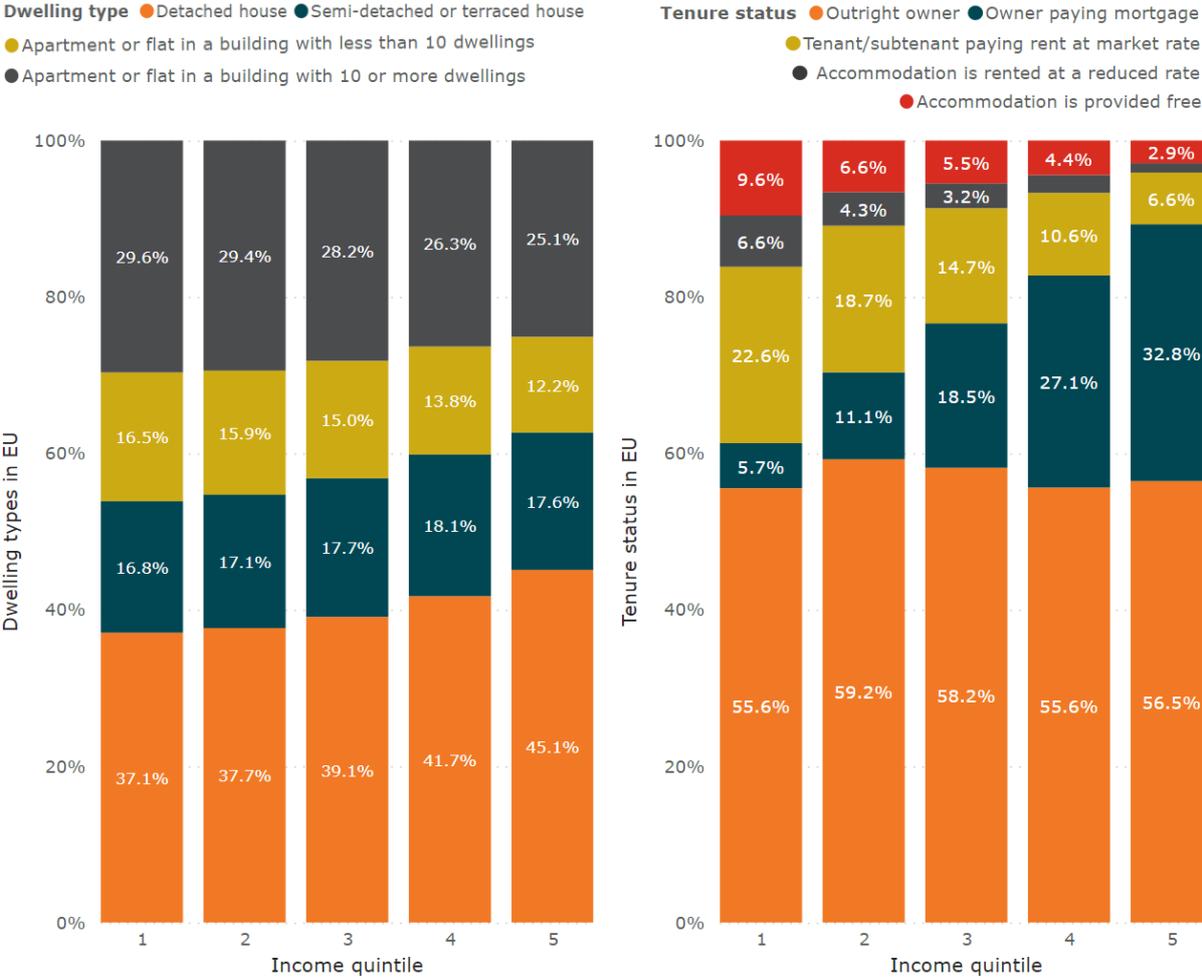
**Figure 26.** Energy poverty and tenure status in EU (2019)



Source: JRC, based on Eurostat, EU-SILC, 2019

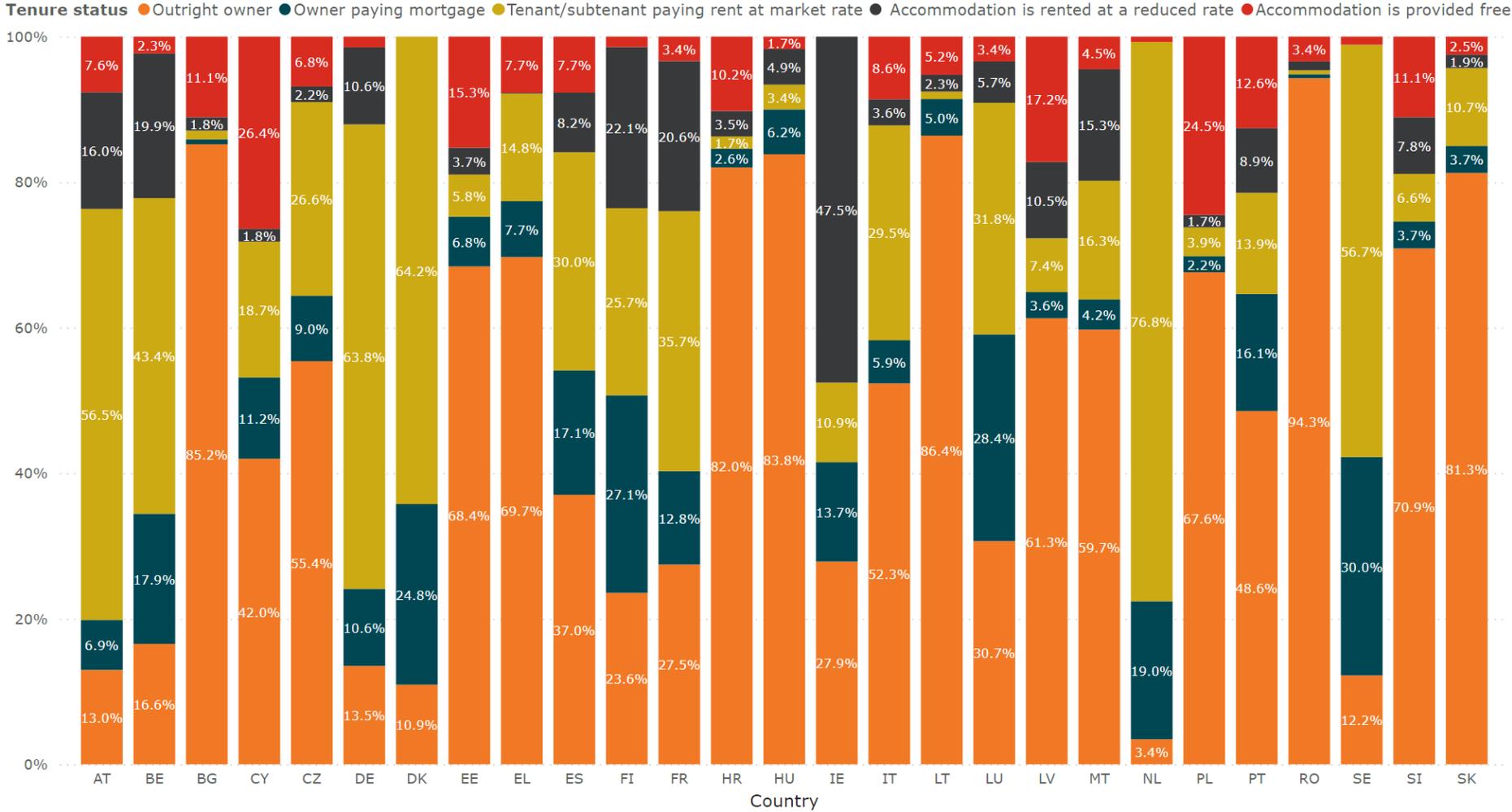
(23) COM(2020) 662 final: A Renovation Wave for Europe - greening our buildings, creating jobs, improving lives

**Figure 27.** Dwelling types and tenure status in EU by income quintiles (2019)



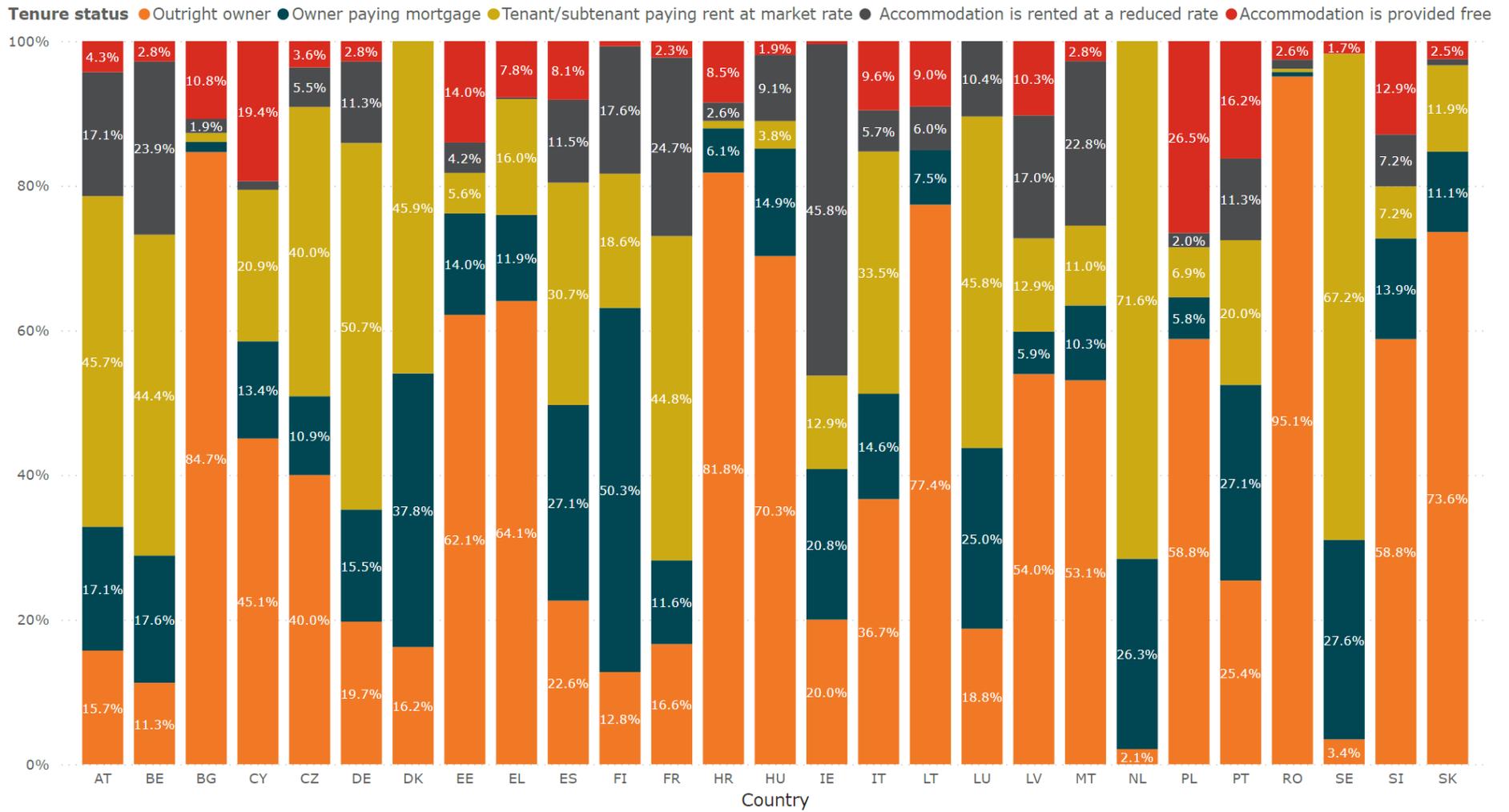
Source: JRC, based on Eurostat, EU-SILC, 2019

**Figure 28.** Households unable to keep home warm by tenure status across EU countries (2019)

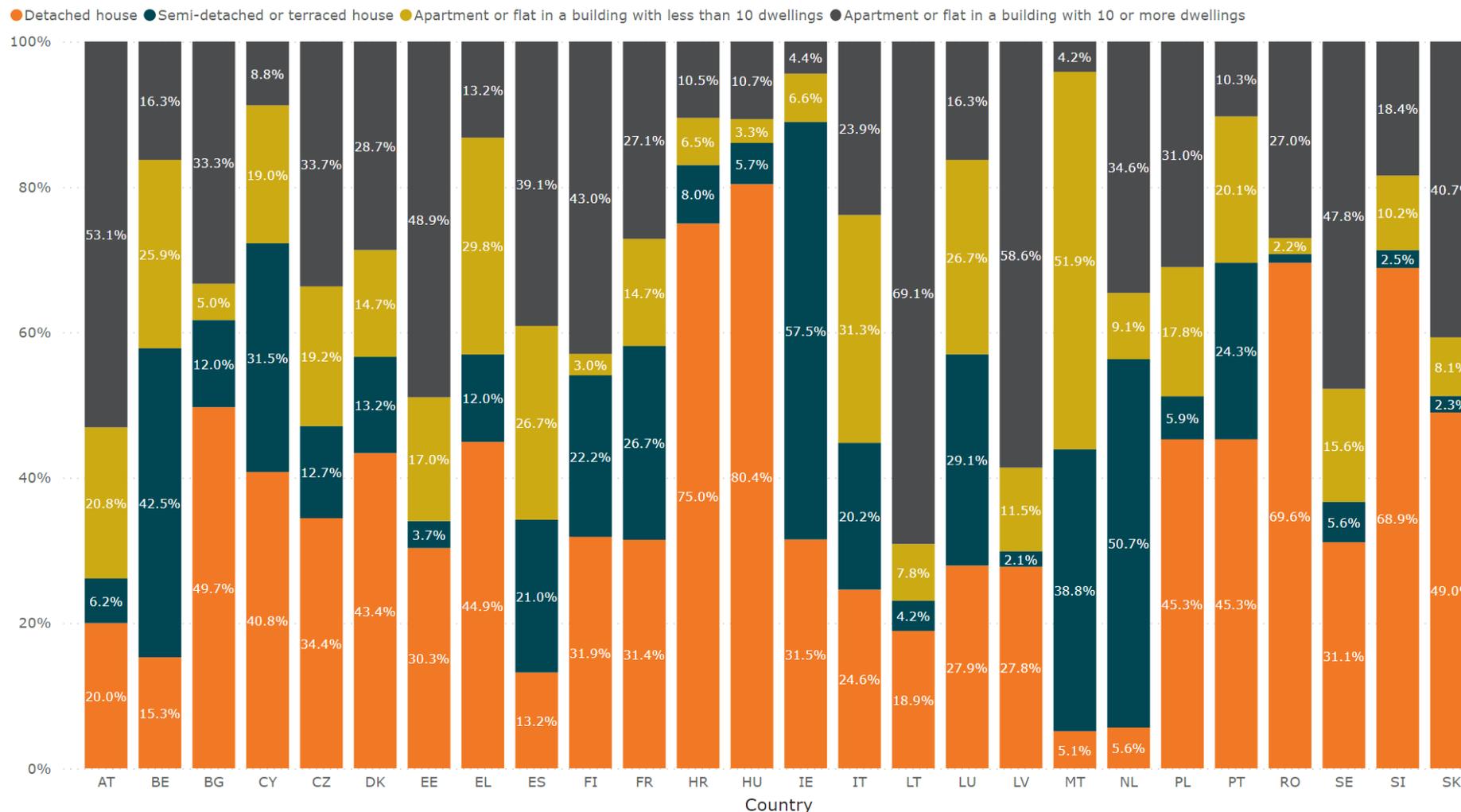


Source: JRC, based on Eurostat, EU-SILC, 2019

**Figure 29.** Households with arrears on utility bills at least twice a year by tenure status across EU countries (2019)

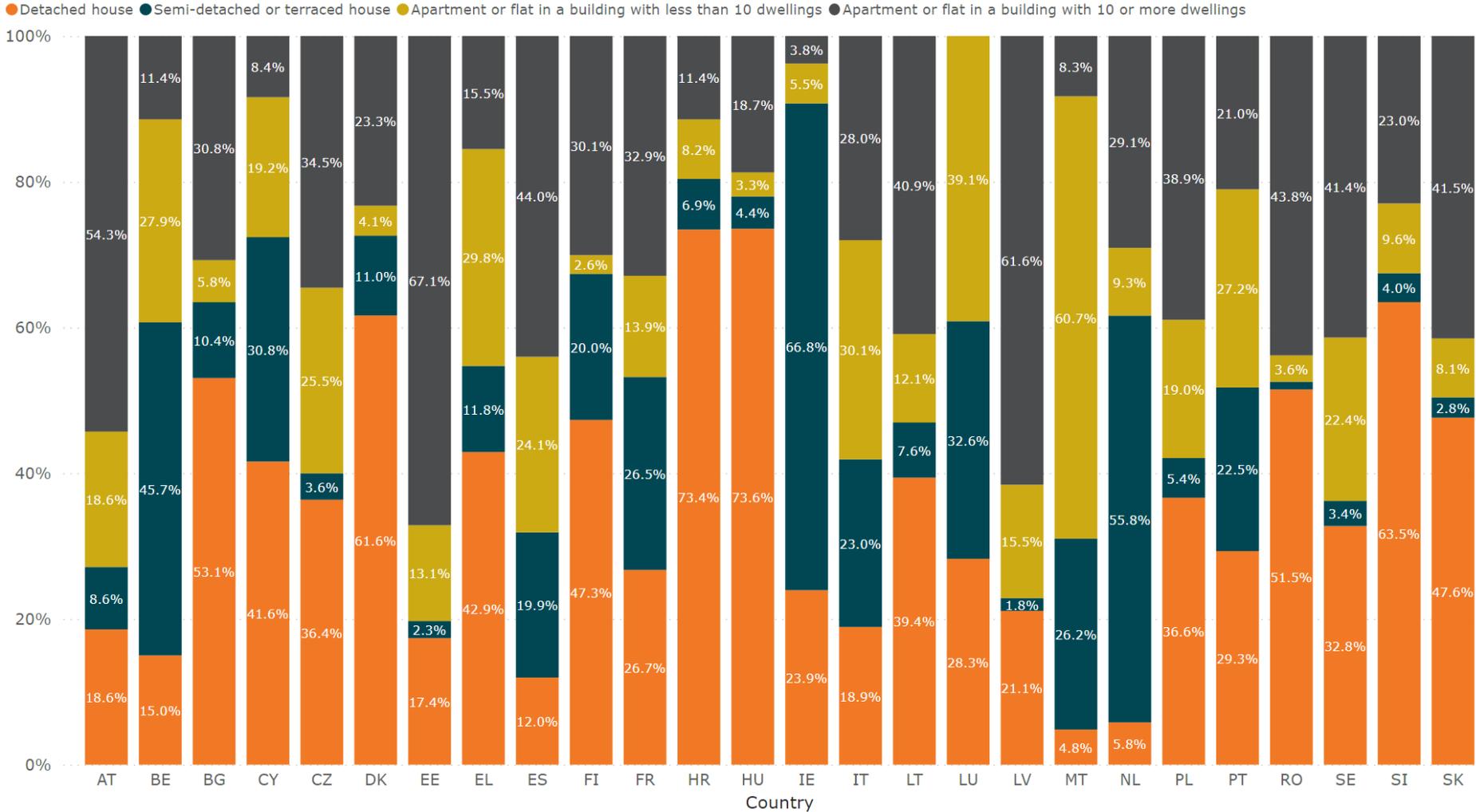


**Figure 30.** Households unable to keep home warm by dwelling type across EU countries (2019)



Source: JRC, based on Eurostat, EU-SILC, 2019

**Figure 31.** Households with arrears on utility bills at least twice a year by dwelling type across EU countries (2019)



Source: JRC, based on Eurostat, EU-SILC, 2019

## 4.2 Socio-demographics

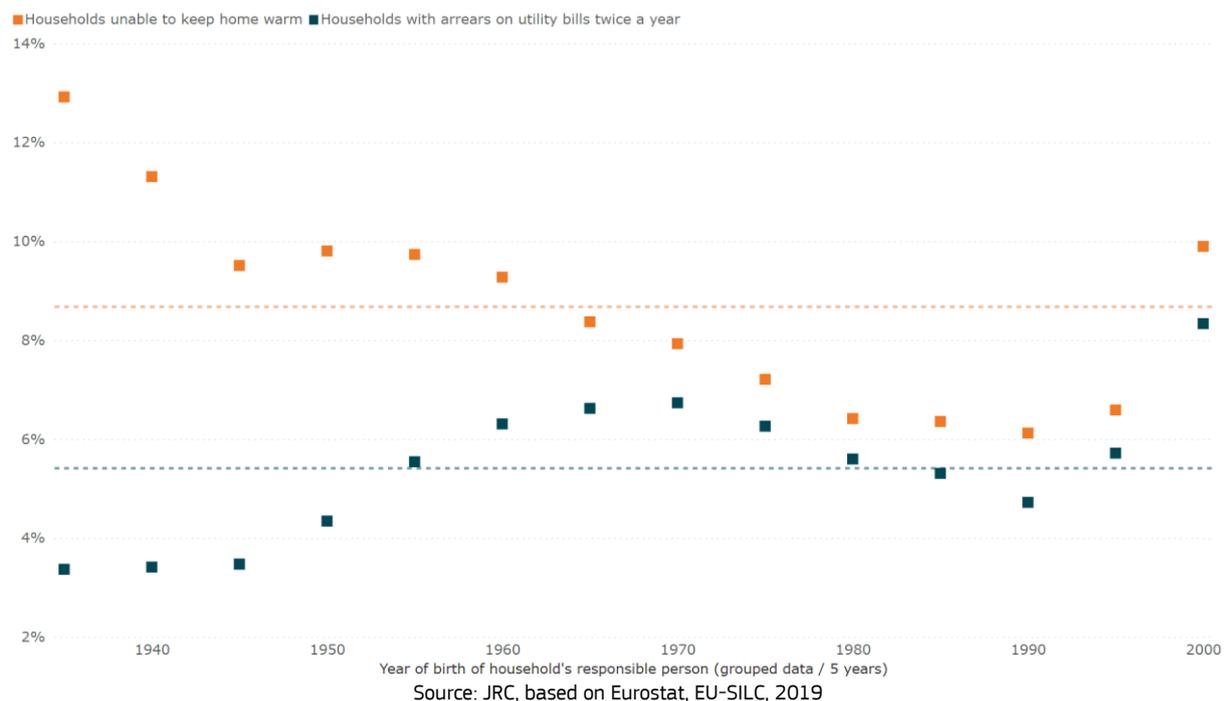
By looking into the data available for households' responsible persons we can generate an understanding of how energy poverty unrolls over various socio-demographic categories.

When controlling energy poverty indicators for age clear patterns appear across generations (Figure 32). The elderly population appears to report significantly more difficulties to keep the household adequately warm though report way below average on arrears on utility bills. Middle aged generations report lower thermal discomfort in the house while at the same time reporting more arrears on utility bills. Finally, young adults (18-28) report consistently above the average in both indicators.

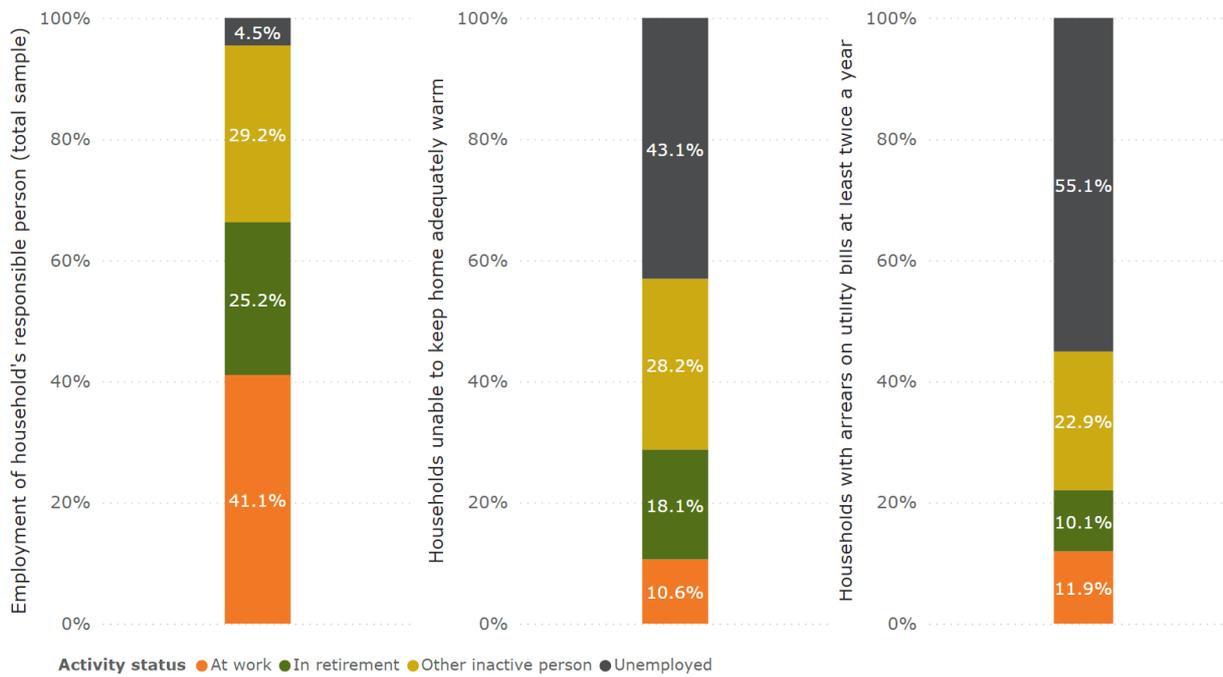
When it comes to the activity status of the household's responsible person it is that energy poverty affects disproportionately unemployed persons (Figure 33). For example, households on which the responsible person is unemployed represent only 4.5% of the survey's sample, nevertheless when it comes to energy poverty indicators these households represent 43.1% of the ones unable to keep home adequately warm and 55.1% of households with arrears on utility bills twice a year.

Similarly, women-led households appear to be affected more by energy poverty in both main indicators (Figure 34). The situation is diverse across EU countries though not allowing more generalised conclusions (Figures 35 and 36).

**Figure 32.** Energy poverty indicators and age (EU average 2019)

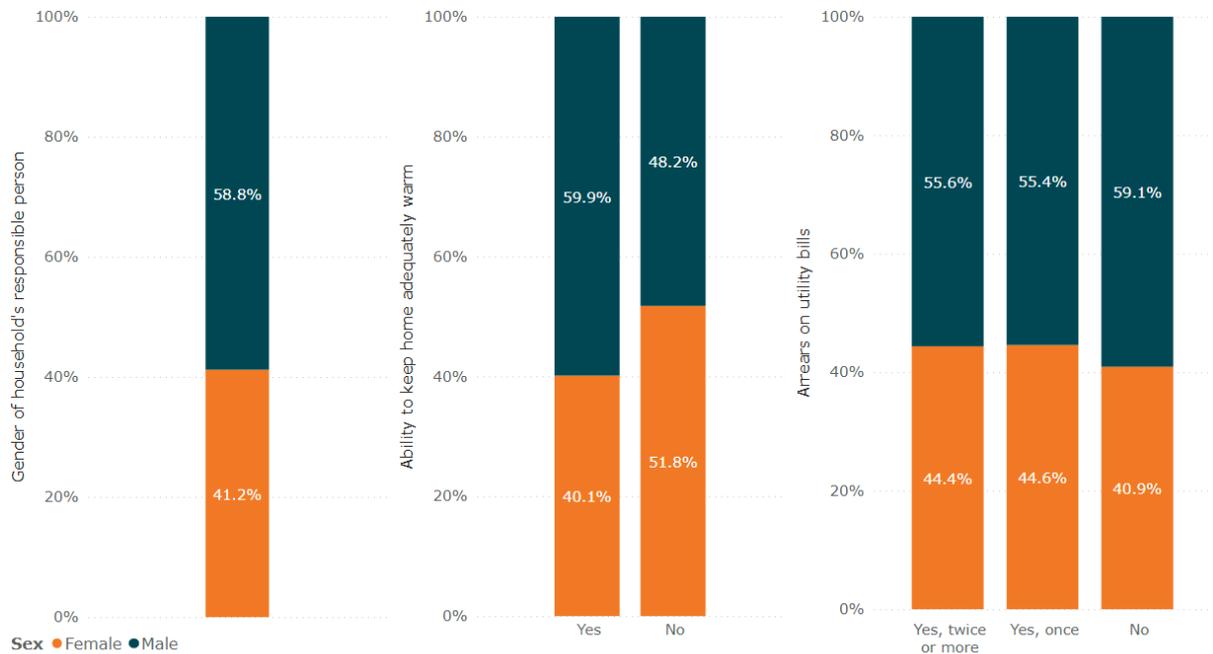


**Figure 33.** Energy poverty indicators and employment status (EU average 2019)



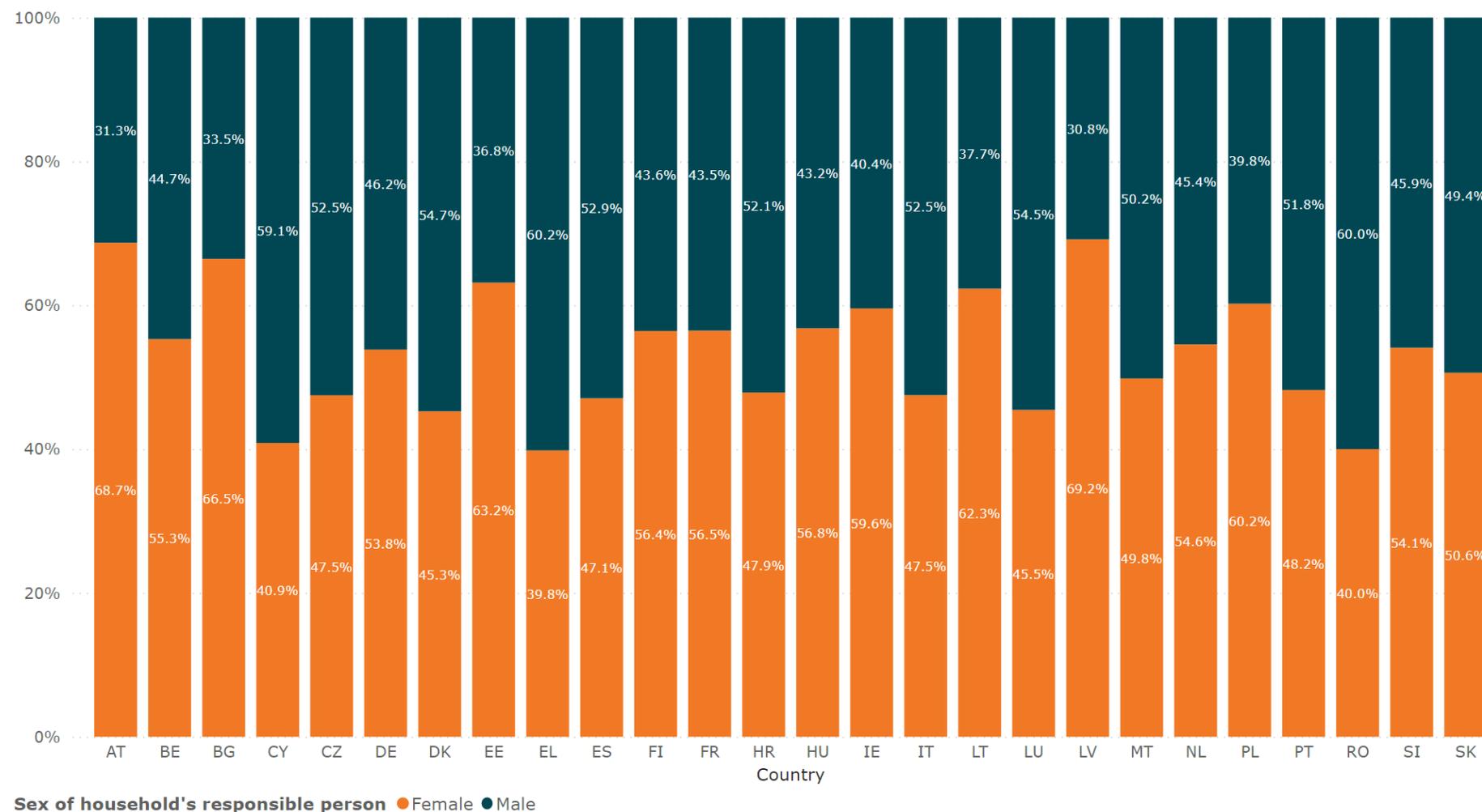
Source: JRC, based on Eurostat, EU-SILC, 2019

**Figure 34.** Energy poverty in the EU by gender of household's responsible person (2019)



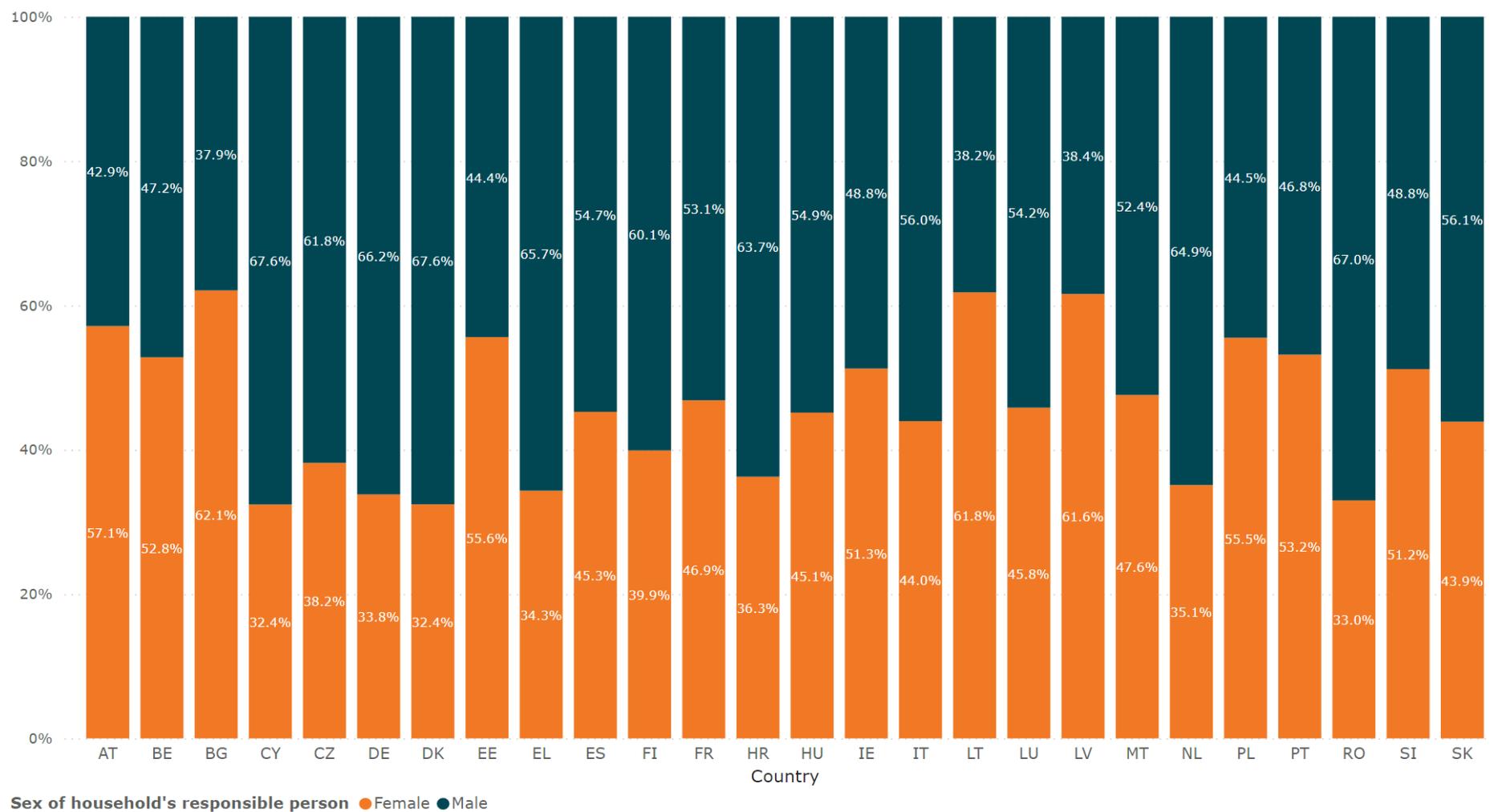
Source: JRC, based on Eurostat, EU-SILC, 2019

**Figure 35.** Inability to keep household adequately warm by gender of responsible person (2019)



Source: JRC, based on Eurostat, EU-SILC, 2019

**Figure 36.** Arrears of household's utility bills at least twice a year by gender of responsible person (2019)



Source: JRC, based on Eurostat, EU-SILC, 2019

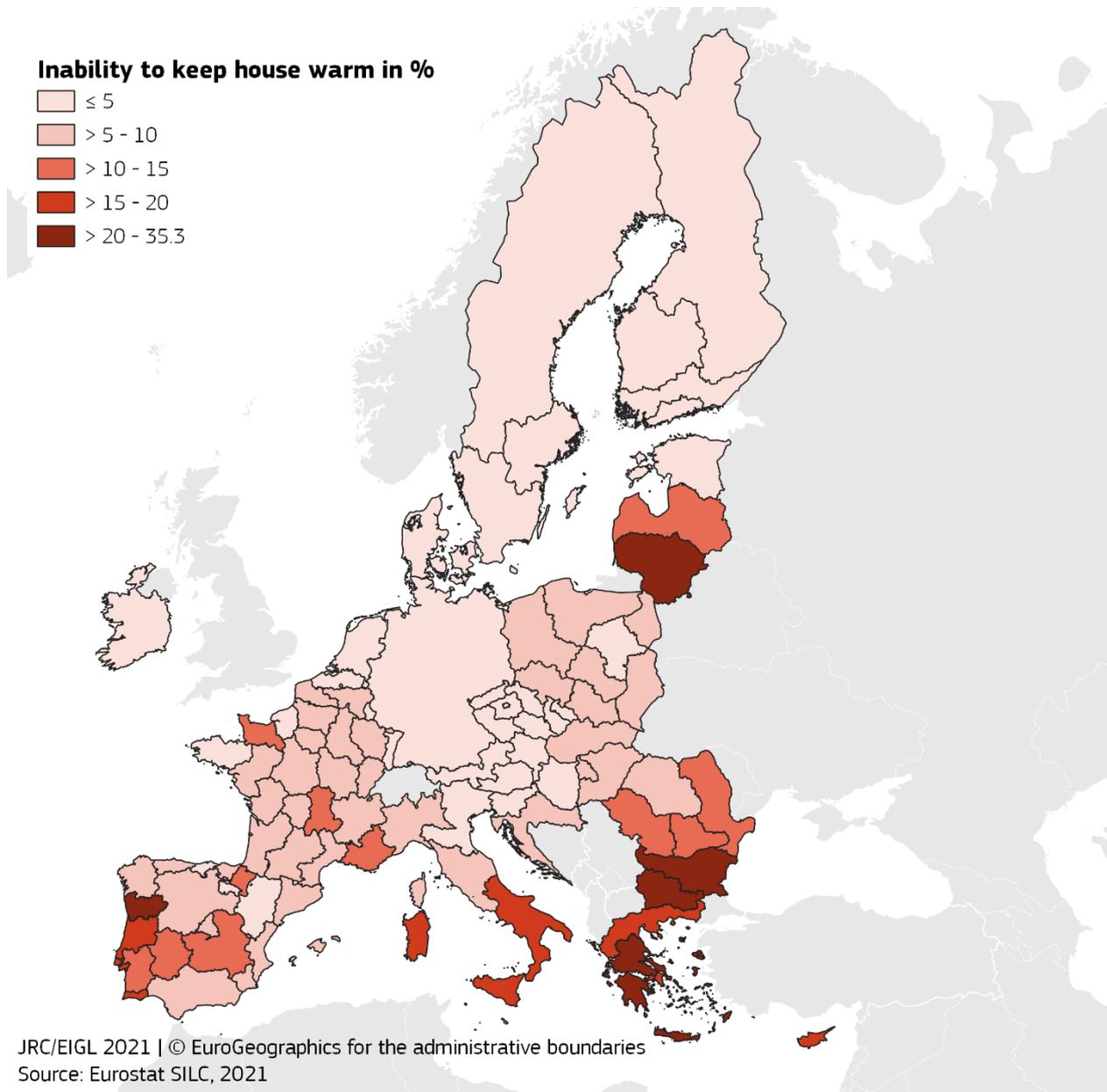
## 5 Regional data and urbanisation

One of the most acknowledged issues on energy poverty data is that the level of granularity of the various indicators used is rather low. In this section, we present the data at the highest spatial resolution available. Most European countries report data only at country or NUTS 1 level. Nevertheless, via mapping the available data we indicate the level of regional disparities across and within countries in relation to energy poverty (Figure 37 and Figure 38).

The maps reveal greater territorial homogeneity regarding the indicator on the arrears of utility bills, than the indicator on the inability to keep home warm within countries. Looking into the degree of urbanisation and the way these indicators are affected, we see that from country to country depending on the density of the urban fabric and level of urbanisation the picture is different not allowing for generalisation across the EU.

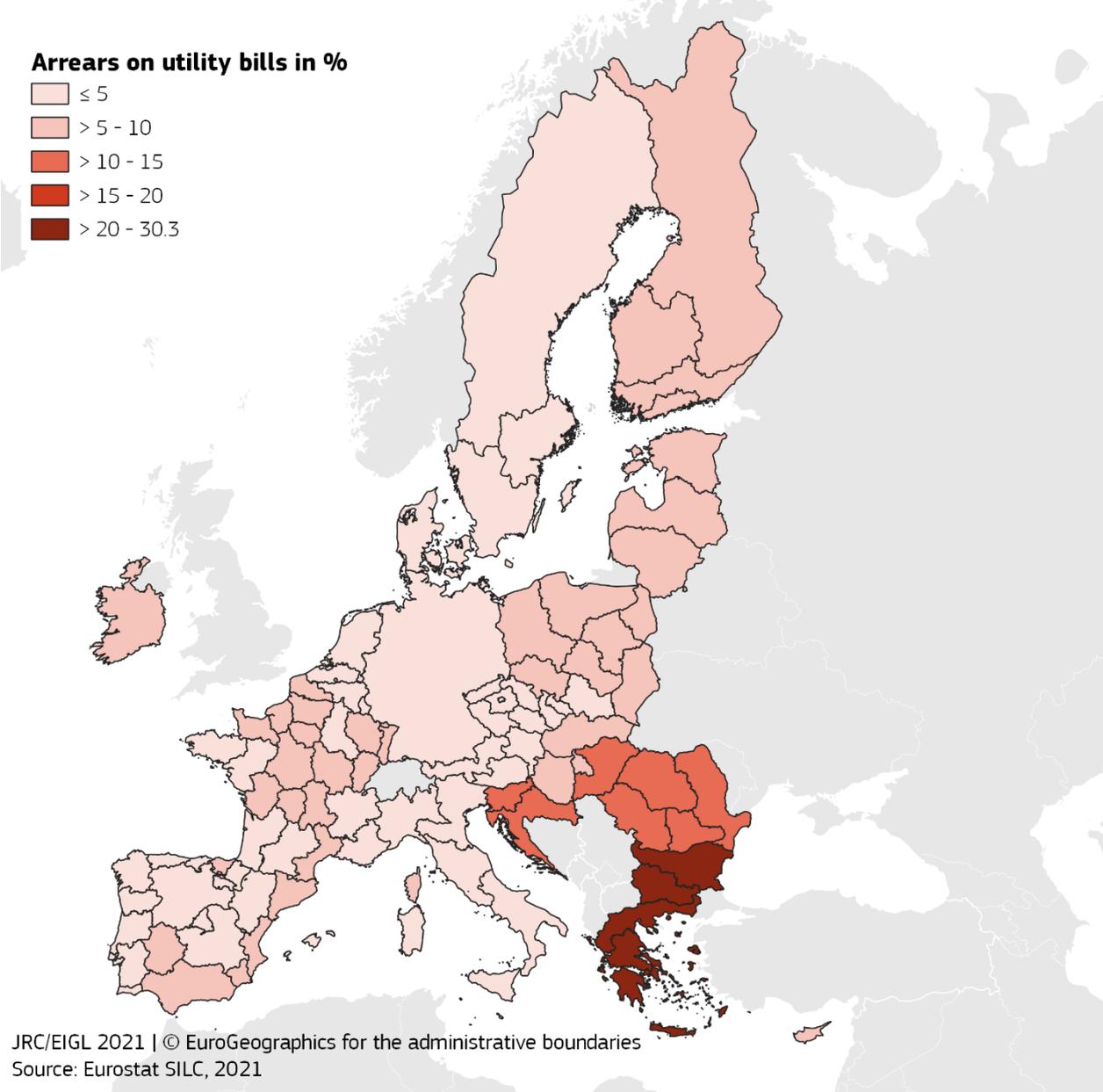
The only noticeable is that intermediately populated areas report significantly lower rates of energy poverty. For example, across the EU, 27.1% of households with arrears in utility bills come from those areas while 38.8% are from rural and 34.1% are from urban areas. Similarly, 27.7% of households reporting inability to keep home warm are located in intermediate areas, 36.1% from rural and 36.2% from urban.

**Figure 37.** Regional disparities of energy poverty in the EU (2019 inability to keep house warm)



Source: JRC, based on Eurostat, EU-SILC, 2019

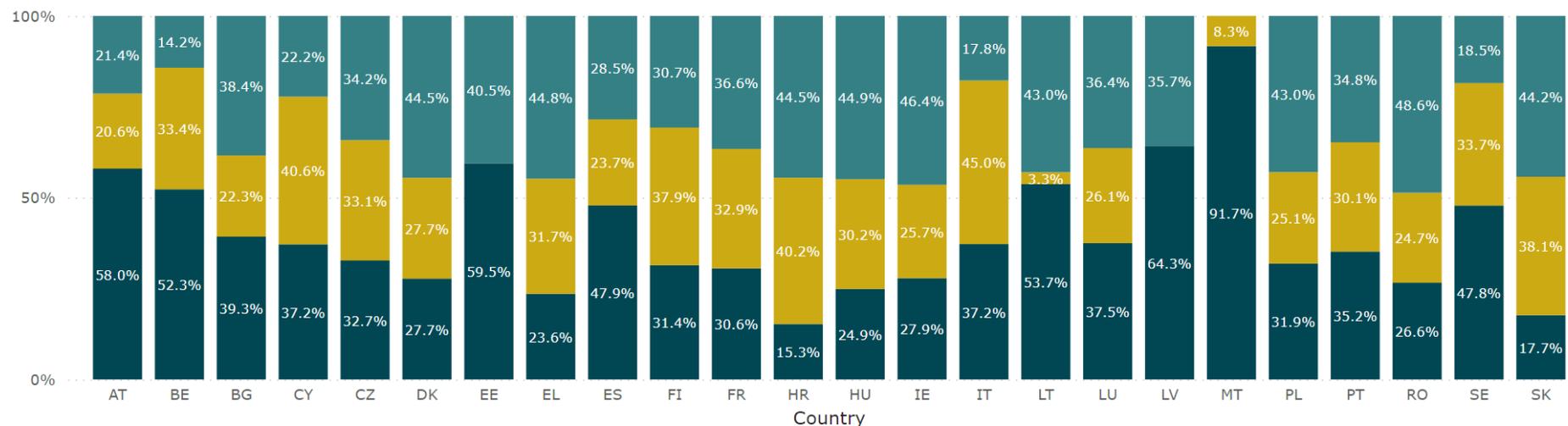
**Figure 38.** Regional disparities of energy poverty in EU (2019 arrears on utility bills)



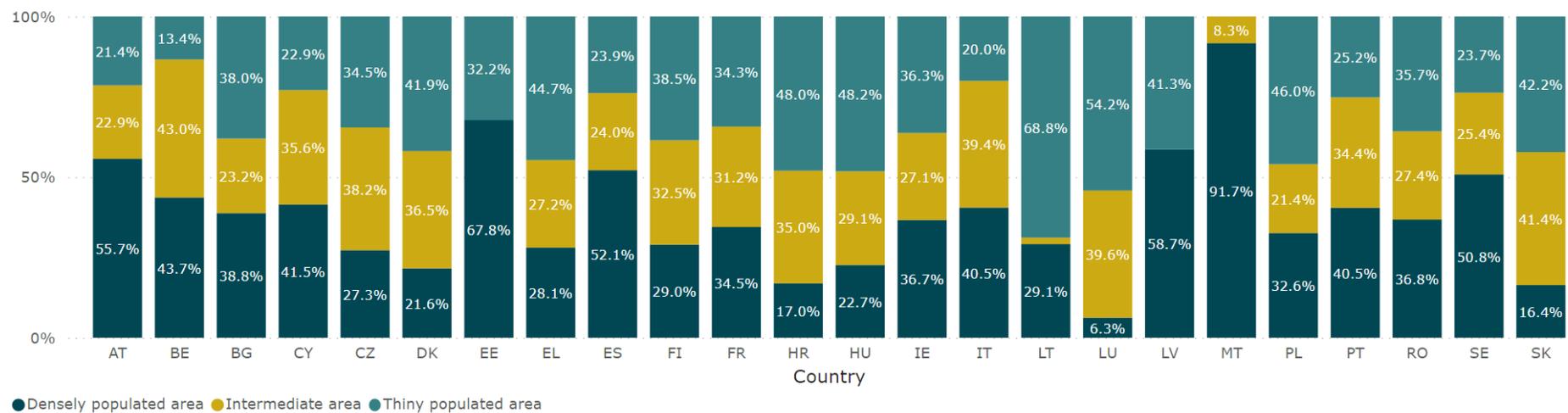
Source: JRC, based on Eurostat, EU-SILC, 2019

**Figure 39. Energy poverty and degree of urbanisation across EU countries (2019)**

Households unable to keep home warm by degree of urbanisation 2019



Households with arrears on utility bills by degree of urbanisation 2019



● Densely populated area ● Intermediate area ● Thinly populated area

Source: JRC, based on Eurostat, EU-SILC, 2019

## 6 Key messages

This report will be updated when more up-to-date data covering the years 2020-2021 becomes available. The update will shed light on the impact on energy poverty of the pandemic and the spike of energy prices, and focus on more sociodemographic categories.

Below, we summarise, per section, some key points which emerge from our analysis.

Household budget and expenditure:

- Data are only available for 23-24 Member States.
- The data are relatively old (2015).
- Rural areas have a higher share of expenditure on energy and transport.
- Richer countries have a lower share of expenditure on energy and a higher share of expenditure on personal transport.
- Retired people spend more of their budget on energy.

Energy poverty indicators:

- Data are available for all Member States for key indicators, but some provide limited granularity.
- The reference year is 2019, reflecting pre-pandemic patterns. Data for 2020 are still not available for all countries.
- Energy poverty rates reduced in the vast majority of countries between 2015 and 2019, yet the impact of COVID-19 and the recent spike in energy prices are expected to reverse this.
- Urbanisation levels, diverse housing markets and varying qualities of building stock across Europe create a heterogeneous landscape of energy poverty when controlling for tenure status and dwelling types.
- As expected, energy poverty affects poorer households disproportionately, with the lowest two income quintiles representing more than 60% of affected households.
- This is also reinforced by inequalities in the housing market, as low-income households face market-rate rents to a larger degree.
- Households with mortgages are the only ones clearly demonstrating lower energy poverty rates when compared to other tenure categories.
- Elderly people experience more thermal discomfort at home but keep up with their utility bills. Young people (18-28) are also significantly affected by energy poverty.
- Unemployed people are the most affected by energy poverty in terms of employment status.
- Households led by women experience higher rates of energy poverty.

Regional assessment and urbanisation:

- There is greater regional homogeneity regarding arrears on utility bills compared to the inability to keep the home warm. While a large share of households (>10%) shows arrears on utility bills, mainly in south-east Europe, the inability to keep the home warm occurs in many parts of the EU.
- In general, there is no clear link between the degree of urbanisation and energy poverty, and the picture is different for each Member State. On average, intermediately populated areas report significantly lower rates of energy poverty compared to urban or rural areas.

## **List of abbreviations and definitions**

COICOP	Classification of individual consumption by purpose
EU	European Union
EC	European Commission
HBS	Household budget survey
NUTS	Nomenclature of territorial units for statistics
PPS	Purchasing Power Standard
SILC	Statistics on Income and Living Conditions

## **Country codes**

BE	Belgium
BG	Bulgaria
CZ	Czechia
DK	Denmark
DE	Germany
EE	Estonia
IE	Ireland
EL	Greece
ES	Spain
FR	France
HR	Croatia
IT	Italy
CY	Cyprus
LV	Latvia
LT	Lithuania
LU	Luxembourg
HU	Hungary
MT	Malta
NL	Netherlands
AT	Austria
PL	Poland
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