European Commission

Expanding Energy Poverty Measurement in the EU: Integrating New Climate, Health, and Mobility Indicators

EU
Energy Poverty
Advisor Hub

Expanding Energy Poverty Measurement in the EU: Integrating new Climate, Health and Mobility Indicators

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Executive Summary

This report advances the measurement of energy poverty (EP) in the European Union (EU) by **strengthening, updating, and expanding the national indicators within the Energy Poverty Advisory Hub (EPAH) indicator framework and dashboard**. It responds to a growing demand by key stakeholders for assessments that go beyond energy consumption, expenditure, and dwelling conditions, recognising that **EP is shaped by a broader set of interconnected factors spanning climate exposure, public health, housing quality, and transport access,** the latter reflecting how limited access to affordable and efficient mobility can increase households' overall energy burden, particularly where dependence on private vehicles is unavoidable.

To reflect this multidimensional reality, the report introduces two sets of changes to the existing EPAH framework. First, **five existing indicators were revised and updated**, including replacing the "Excess Winter Mortality/Deaths" indicator with a revised version for 2020 to 2025, updating three housing indicators using the 2023 Eurostat EU-SILC Energy Efficiency Module, and recalibrating the household expenditure indicator to align with the updated 2018 COICOP classification. Second, **nine new indicators were added to the dashboard to address underrepresented dimensions of EP**, including summer excess mortality, cold- and heat-stress days, recent dwelling energy-efficiency improvements, poverty risk rates, material deprivation, car ownership, transport expenditure, and public transport usage. **These indicators were selected based on the recent scientific literature** on different facets of EP, up-to-date, reliable datasets covering most EU Member States, and their relevance for capturing multiple dimensions of EP conditions. Together, these additions **enable a more comprehensive and forward-looking diagnosis of EP conditions, particularly amid intensifying climate extremes and growing transport-related vulnerabilities**.

The report also presents an **integrated cross-analysis of eight key indicators using three complementary approaches across 17 EU Member States**, due to limited data availability for all MS for specific indicators involved in this part of the study. A historical analysis traces trends, patterns, and cross-country differences in climate stress and excess mortality from 2015 to 2024. A Spearman correlation analysis identifies structural relationships between indicators, revealing **strong links between heat stress and poor housing conditions, and between cold housing and general poverty.** A Principal Component Analysis was used to **group Member States into four Climate Groups and eight Country Vulnerability Groups**, providing a structured and evidence-based foundation for targeted policy responses.

The findings confirm that **EP is deeply intertwined with climate stress and health outcomes, particularly under conditions of severe heat exposure**. The analysis underscores the **growing relevance of summer EP, not only in Southern Europe but increasingly in countries with traditionally colder or milder climates**, and highlights that the data infrastructure underpinning EP assessment must evolve to reflect this shift.

By updating existing indicators, incorporating new ones, and applying robust statistical methods to identify vulnerability patterns and Country Vulnerability Groups, this work **strengthens the EPAH indicators framework's capacity to support Member States, local authorities, and Covenant of Mayors signatories in designing effective, contextually appropriate EP mitigation strategies**.

Table of Contents

Table of Figures

Table of Tables

List of Abbreviations

BSO	Building Stock Observatory
COICOP	Classification of Individual Consumption According to Purpose
CoM	Covenant of Mayors for Climate and Energy in Europe
CG	Climate Groups
CVG	Countries Vulnerability Groups
EPAH	Energy Poverty Advisory Hub
EP	Energy poverty
EU	European Union
EU-Avg	Average value of the indicator for the European Union
EU-SILC	European Union Statistics on Income and Living Conditions
FCO	Forced car ownership
GEO	Geographical entity
JRC	Joint Research Centre
MSD	Materially and socially deprived
PCA	Principal Component Analysis
SUV	Sport utility vehicle
TCO	Transport cost operation
UTCI	Universal Thermal Climate Index
WMO	World Meteorological Organization

1. Introduction

Accelerating the energy transition while tackling energy poverty (EP) has become a central challenge for EU energy and social policy. EP affects a significant share of the European population, with considerable variation among Member States in both its characteristics and severity. Addressing it effectively requires not only targeted policy action but also a deeper, continually evolving understanding of its causes, manifestations, and interactions with broader social and environmental conditions. Recent EU legislation reflects this urgency: the revised Energy Efficiency Directive (EED) (EU/2023/1791)[1] and the revised Energy Performance of Buildings Directive (EPBD) (EU/2024/1275)[2] introduce specific measures and targeted approaches for vulnerable households. Yet translating the complexity of EP into measurable, policy-relevant indicators remains a persistent challenge, and different frameworks for doing so have evolved considerably in recent years (della Valle *et al.*, 2025).

Accurate EP measurement requires periodic updates and reviews, informed by new scientific evidence and evolving data availability. Building on two previous reports by the European Commission Initiative Energy Poverty Advisory Hub (EPAH) (EPAH, 2022b; EPAH 2023), this report further explores the multidimensional nature of EP and advances the EPAH indicator framework in two ways: by updating five existing indicators to reflect new definitions, data sources, and measurement approaches, and by introducing nine new indicators that capture dimensions of EP not previously represented in the dashboard.

Most existing EP assessments focus primarily on energy expenditure, building stock, and income. Indicators related to transport, climate, and health remain comparatively underrepresented, despite growing evidence of their relevance. Transport poverty, for instance, is frequently analysed in isolation, without accounting for its interaction with household EP or how it compounds existing financial vulnerability (Dingley *et al.*, 2025). **This narrow scope means that widely used indicator sets may not fully capture the multidimensional nature of EP conditions across the EU**.

The climate dimension is particularly pressing. As the frequency and intensity of extreme weather events increase, in both winter and summer, their impacts on vulnerable and low-income households intensify (Zhang *et al.*, 2025; Paglialunga, Coveri, and Zanfei, 2022). Heat and cold stress are closely linked to health outcomes and excess mortality: extreme heat disproportionately affects people with pre-existing cardiovascular and respiratory conditions, while cold stress exacerbates chronic diseases and increases the severity of respiratory illnesses (Jones and Ponomarenko, 2022). Poor housing conditions, insufficient thermal insulation, the absence of adequate heating or cooling equipment, and energy bill arrears all amplify these risks, highlighting the interconnection between climate exposure, health vulnerability, and EP (European Commission, 2025; Recalde *et al.*, 2019). Despite this, the current EU policy framework does not yet reflect these linkages as the EP definition in the EED refers to EP

[1] Directive (EU) 2023/1791 of the European Parliament and of the Council of 13 September 2023 on energy efficiency and amending Regulation (EU) 2023/955 (recast).

[2] Directive (EU) 2024/1275 of the European Parliament and of the Council of 24 April 2024 on the energy performance of buildings (recast).

indicators on energy expenditure, housing conditions, and income, without incorporating climate or health dimensions.

This report addresses that gap directly. It proposes updates to existing indicators and introduces new ones spanning climate, health, and mobility, and presents a cross-analysis of their interactions with the four EED EP indicators: "Inability to keep home adequately warm", "Arrears on utility bills", "Population living in a dwelling with a leaking roof, damp walls, floors or foundation, or rot in window frames or floor", and "At-risk-of-poverty rate", with the aim of strengthening EP assessment within a broader climate and health framework.

The report is structured as follows:

- Methodology presents the framework for identifying gaps in the existing indicator set, the rationale for the proposed updates and additions, and the approach to data cross-analysis.
- Indicators restructuring details the updates to five existing EPAH indicators, including changes in data source, measurement approach, disaggregation options, and geographical coverage.
- New EPAH indicators introduce nine new EP-related indicators, define each one, document geographical data availability, and discuss their advantages, limitations, and suggested applications.
- Cross-analysis between climate, health, and EED EP indicators presents the results of a temporal analysis across Member States, including trend identification, correlation analysis, and allocation of countries to vulnerability profiles based on shared risk characteristics.
- Recommendations and conclusions translate the analytical findings into evidence-based, actionable recommendations for EP mitigation and identify opportunities for further research on EP indicators.

2. Methodology

To further expand knowledge of the multidimensional measurement and monitoring of EP, this report updates and introduces EP-related indicators drawn from recent scientific literature, building on and expanding research conducted for previous EPAH indicator reports (EPAH, 2022b; EPAH, 2023) and the EPAH indicators dashboard. Following the approach established in prior EPAH work, indicators are aligned where possible to the EED definition of EP[3] and the Covenant of Mayors for Climate and Energy in Europe (CoM) reporting guidelines, while also encompassing indicators that capture the broader context, causes, and consequences of EP across Member States, including dimensions such as climate stress and mobility that extend beyond the boundaries of the EU definition.

The adjustments are structured around two main objectives. The first is addressing underrepresented topics and dimensions of EP, incorporating updated data across a significant number of countries and exploring potential connections with the CoM guidelines on EP measurement at the local level, with the aim of providing a deeper and more consistent assessment of EP across its multiple dimensions and scales (CoM, 2022). The second is broadening the scope of EP assessment by integrating distinct, reliable, and up-to-date research and datasets, harmonised across countries, to support the inclusion of new indicators that reflect emerging evidence on the causes and consequences of EP.

Within this framework, five previously published EPAH indicators were identified as requiring restructuring based on updated datasets and revised methodological approaches: "Excess winter mortality/deaths", "Population living in a dwelling equipped with heating facilities", "Population living in dwellings comfortably warm in winter time", "Share of households unable to keep the dwelling comfortably cool in the summer", and "Final consumption expenditure of households". In addition, nine new indicators were incorporated into the EPAH framework and dashboard: "Excess mortality during summer", "Cold stress days", "Heat stress days", "People living in dwellings whose energy efficiency improved in the last 5 years", "At-risk-of-poverty rate", "Share of the population that is materially and socially deprived (MSD) and owns a car", "Share of household final consumption expenditure allocated to transport costs", "Persons who cannot afford a personal car", and "Persons using or not public transport, by frequency".

The report also presents a cross-analysis of historical trends and structural interconnections between climate, health, and EED EP indicators, covering "Cold stress days", "Heat stress days", "Excess mortality during winter", "Excess mortality during summer", "Inability to keep home adequately warm", "Arrears on utility bills", "Population living in a dwelling with a leaking roof, damp walls, floors or foundation, or rot in window frames or floor", and "At-risk-of-poverty rate". This analysis is organised into three parts: Part A examines the temporal variation of each indicator,

[3] A household's lack of access to essential energy services, where such services provide basic levels and decent standards of living and health, including adequate heating, hot water, cooling, lighting, and energy to power appliances" (Energy Efficiency Directive, 2023).

identifying trends and enabling cross-country comparisons; Part B presents a correlation analysis aimed at detecting and evaluating structural relationships between indicators; and Part C presents the results of the countries' grouping process based on a global analysis of all eight indicators.

A more detailed description of the methodology applied in each analysis of the present study is presented in the following sections, as outlined below: Section 3 presents the updates to the five existing EPAH indicators; Section 4 defines the nine new EP-related indicators in detail; and Section 5 describes the analytical approach used for the combined cross-analysis between climate, health, and EED EP indicators.

3. Restructured EPAH Indicators

One of the major challenges in defining and maintaining EU-wide EP indicators that accurately reflect national realities lies in the unavailability of data for several countries and the lack of up-to-date information across different datasets. These two challenges are central to the EPAH multidimensional EP indicator framework, which is organised by topics and subtopics, and where limited indicator coverage or outdated data can create research and policy gaps in the evaluation and monitoring of relevant EP drivers and consequences.

To address this, five national-level EP indicators were restructured in this report using reliable and up-to-date information: "Excess winter mortality/deaths", "Population living in a dwelling equipped with heating facilities", "Population living in dwellings comfortably warm in winter time", "Share of households unable to keep the dwelling comfortably cool in the summer", and "Final consumption expenditure of households". Table 1 provides an overview of the modifications undertaken for each indicator, which are discussed in detail in the subsequent sections. Disaggregation options available on the EPAH dashboard, along with updated data for the restructured indicators, are presented in Appendix A.

Table 1. Overview of the restructured indicators and the respective modifications.

EPAH Original indicator	Modification	EPAH Restructured indicator
Excess winter mortality/deaths	New dataset (EUROMOMO – data from 2019 to 2025); Different calculation method and updated definition.	Excess mortality during winter
Population living in a dwelling equipped with heating facilities	New dataset (Eurostat (ilc_lvhe01), Eurostat (ilc_lvhe02), Eurostat (ilc_lvhe03) – data for 2023).	Population living in private households by heating system used in the dwelling
Population living in dwellings comfortably warm in winter time	New dataset (Eurostat (ilc_lvhe11) - data for 2023); Updated indicator definition.	Population living in a dwelling not comfortably warm during winter
Population living in dwellings comfortably cool in summer time	New dataset (JRC, based on EU-SILC data) - data for 2023); Updated indicator definition.	Households unable to keep dwelling comfortably cool in the summer
Final consumption expenditure of households	New dataset (Eurostat (nama_10_cp18) – data from 2015 to 2024); Updated indicator definition; Disaggregation option "Transport" reclassified as a standalone indicator.	Household final consumption expenditure by purpose

The results of the update of the five indicators, along with the most recent available data and respective bar charts and maps, are presented in sections 3.1 to 3.5.

3.1. Excess Mortality during Winter

The indicator "Excess winter mortality/deaths" has been restructured and renamed "Excess mortality during winter". It was updated using data from the European Mortality Monitoring Project (EUROMOMO), which, although outside Eurostat's scope, is updated weekly. This change reflects an ongoing effort within the EPAH indicators dashboard to expand beyond traditional data sources and explore alternative databases relevant to EP-related topics.

The indicator quantifies the extent to which observed mortality during a specific winter period exceeds or falls below expected levels for a given country. It is measured using the weekly z-score of winter mortality, which enables cross-country comparisons by accounting for differences in population size, as expressed in Equation 1.

$$z = \frac{x - \mu}{\sigma} \qquad \text{(Equation 1)}$$

In Equation 1, z represents the number of standard deviations by which the observed number of deaths in a given period departs from the baseline mortality level in a specific country; μ denotes the observed number of deaths in that period and country; x corresponds to the mortality baseline, i.e. the expected number of deaths for that country and period; and σ represents the standard deviation of mortality around the baseline for that period, reflecting the normal variability in deaths not explained by the baseline. The overall winter z-score is obtained by averaging the weekly z-score values for the winter period, defined as weeks 51 to 12 of the following year.

Figure 1 presents the most recent available map of results for this indicator, extracted from the EPAH dashboard, and Figure 2 shows the corresponding bar chart, both referring to winter 2024/2025. The dataset used for the indicator “Excess mortality during winter” provides only national-level values, as regional information (according to the NUTS I, II or III levels) is not available.

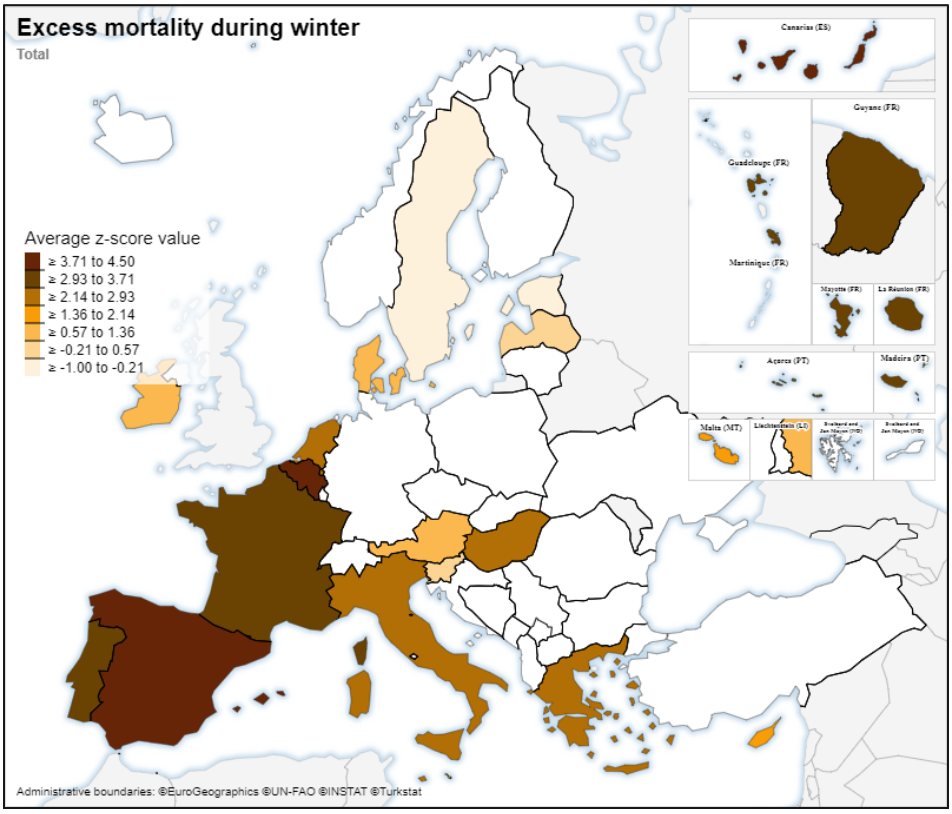


Figure 1. Map – Excess mortality during winter – Winter 2024/2025 (EPAH dashboard, 2026).

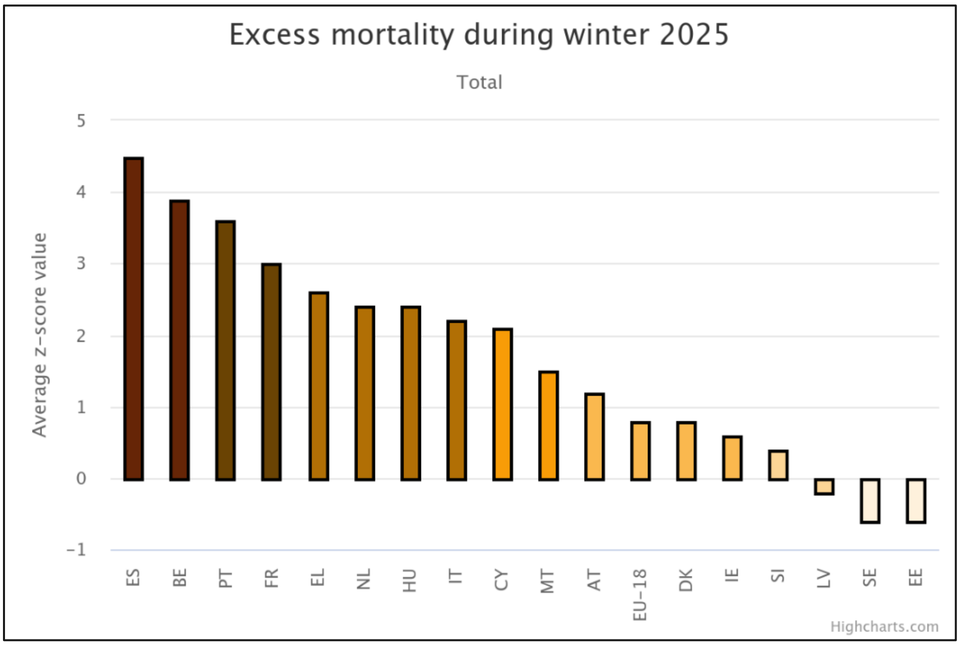


Figure 2. Bar chart and updated data - Excess mortality during winter - Winter 2024/2025 (EUROMOMO).

Note: EU-18 is the average value of the indicator obtained for the 18 EU Member States with available data for the period.

Table 2 presents the technical details for the restructured indicator, including the statistical code used in the data source, the identification name used in the EP indicators section of the EPAH dashboard, the period of available data, the number of GEOs (Geographical Entities, including countries and broader territorial aggregates), represented in the most recent update relative to the maximum 44-GEO list from Eurostat, and the data source[4]. Disaggregation options for this indicator are presented in Appendix A.

Table 2. Excess mortality during winter - Indicator technical details.

(Sub)Topics	Name	Timeline	#GEO	Source
Socioeconomic Aspects (Health)	Excess mortality during winter	2019-2025[5]	22/44[6]	EUROMOMO

It should be noted that the EPAH dashboard retains data from the previous version of this indicator ("Excess winter mortality/deaths"), as it provides valuable historical information covering the period 2005–2014. However, because these data are from a different source and use a different calculation method, this dataset is not included in the main list of energy poverty indicators. Instead, it remains accessible via a direct link on the "Excess mortality during winter" indicator page of the dashboard.

[4] Values for the United Kingdom were derived by calculating the median across its constituent countries.

[5] Data from 2005 to 2014 are available in the EPAH dashboard for the previous version of the indicator (“Excess winter mortality/deaths”).

[6] Data for the indicator “Excess mortality during winter” is available for 22 GEOs, namely 21 countries (Austria, Belgium, Cyprus, Denmark, Estonia, Finland, France, Greece, Hungary, Ireland, Italy, Latvia, Malta, Netherlands, Norway, Portugal, Slovenia, Spain, Sweden, Switzerland, and United Kingdom) and 1 aggregate (EU-18).

3.2. Population Living in Private Households by Heating System Used in the Dwelling

The EPAH indicator "Population living in a dwelling equipped with heating facilities", which had not been updated since 2012 due to a lack of data, was restructured using data collected in 2023 as part of the Eurostat EU-SILC Energy Efficiency Module and renamed as “Population living in private households by heating system used in the dwelling”. The restructured indicator not only captures the share of households with at least one heating facility but also introduces a significantly expanded set of disaggregation options, covering heating system type, age, sex, risk of poverty or social exclusion, degree of urbanisation, household composition, and level of disability. This represents a substantial improvement over the previous version, for which the only available disaggregation was by heating system type.

Figure 3 presents the most recent available map of results for this indicator, extracted from the EPAH dashboard, considering the disaggregation option by heating system type (“central heating”), and Figure 4 shows the corresponding bar chart, both based on 2023 data. Appendix A provides detailed information for each GEO, including updated data and all available disaggregation options. The database used for the indicator “Population living in private households by heating system used in the dwelling” provides only national-level values, as regional information (at NUTS I, II, or III levels) is unavailable.

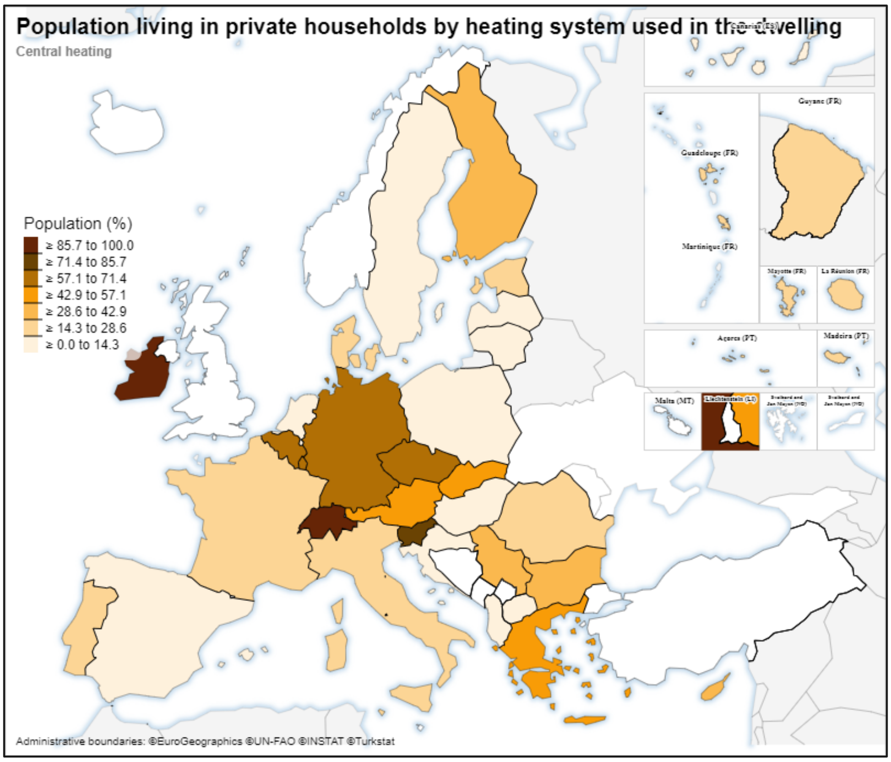


Figure 3. Map – Population living in private households by heating system used in the dwelling – Central heating - 2023 (EPAH dashboard, 2026).

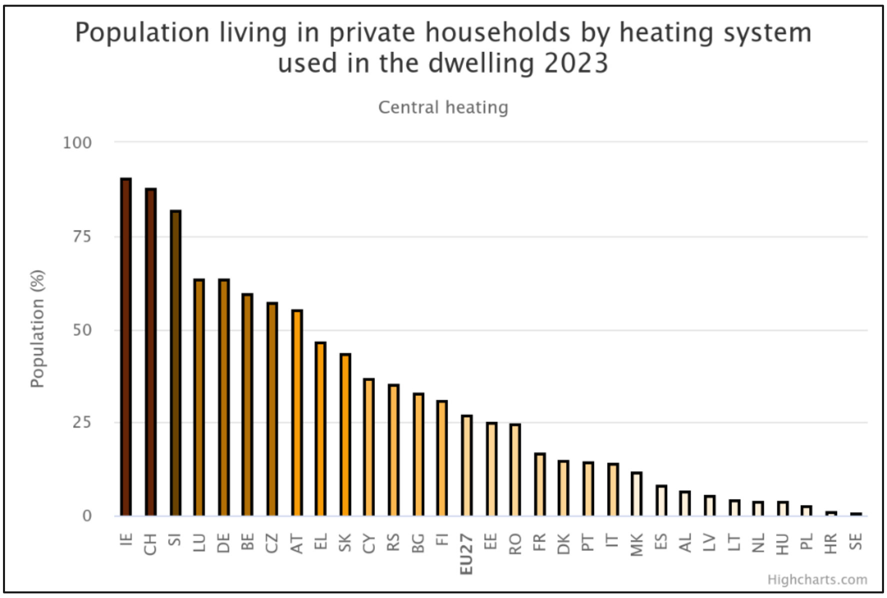


Figure 4. Bar chart and updated data – Population living in private households by heating system used in the dwelling – Central heating – 2023 (*Eurostat*).

Table 3 presents the technical details for the restructured indicator, including the statistical codes used in the data source, the identification name used in the EP indicators section of the EPAH dashboard, the period of available data, the number of GEOs represented in the most recent update relative to the maximum 44-GEO list, and the data sources used.

Table 3. Population living in private households by heating system used in the dwelling - Indicator technical details.

(Sub)Topics	Name	Timeline	#GEO	Source
Facilities/housing (Building Stock)	Population living in private households by heating system used in the dwelling	2023	33/44[7]	Eurostat (ilc_lvhe01) Eurostat (ilc_lvhe02) Eurostat (ilc_lvhe03)

[7] Data for the indicator "Population living in private households by heating system used in the dwelling" is available for 33 GEOs, namely 32 countries (Albania, Austria, Belgium, Bulgaria, Croatia, Cyprus, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, North Macedonia, Norway, Poland, Portugal Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, and Switzerland) and 1 aggregate (EU-27). It is noteworthy that particular disaggregation options may not have available information for all the 33 GEOs.

3.3. Population Living in a Dwelling not Comfortably Warm During Winter

The indicator "Population living in dwellings comfortably warm in winter time", although updated annually, is only available for 2007 and 2012. Therefore, it was restructured using data collected in 2023 as part of the Eurostat EU-SILC Energy Efficiency Module. The updated definition inverts the framing of the original indicator, resulting in the restructured indicator "Population living in a dwelling ***not*** comfortably warm during winter", which measures the share of the population reporting that their home was not comfortably warm during the winter period. Nevertheless, since the restructured version of this indicator only has available information for 2023, the previous version “Population living in dwellings comfortably warm in winter time” was retained in the EPAH dashboard to preserve relevant information collected for the years 2007 and 2012. This reformulation aligns the indicator more directly with EP vulnerability assessment, foregrounding the population experiencing thermal discomfort rather than those without it.

The restructured indicator also introduces a significantly expanded set of disaggregation options, covering age, sex, risk of poverty or social exclusion, degree of urbanisation, household composition, and level of disability, which is a substantial improvement over the previous version, which offered no disaggregation options.

It is worth noting that this indicator, alongside "Share of households unable to keep the dwelling comfortably cool in the summer", reflects the physical capacity of a dwelling to maintain thermal comfort, taking into account the building's insulation and the heating or cooling systems in place. Neither indicator measures whether households have the financial means to achieve thermal comfort; they capture structural and technical conditions rather than affordability constraints. Moreover, the indicator “Population living in a dwelling not comfortably warm during winter” is based on the personal perception of thermal indoor comfort, being a self-reported indicator that may be influenced by different factors such as socioeconomic, cultural, and behavioural characteristics.

Figure 5 presents the most recent available map of results for this indicator, extracted from the EPAH dashboard, and Figure 6 shows the corresponding bar chart, both based on 2023 data. Appendix A provides detailed information for each GEO, including updated data and all available disaggregation options. The dataset underpinning the indicator “Population living in a dwelling not comfortably warm during winter” is available exclusively at the national level, as no disaggregated data exist for regional classifications such as NUTS I, II, or III.

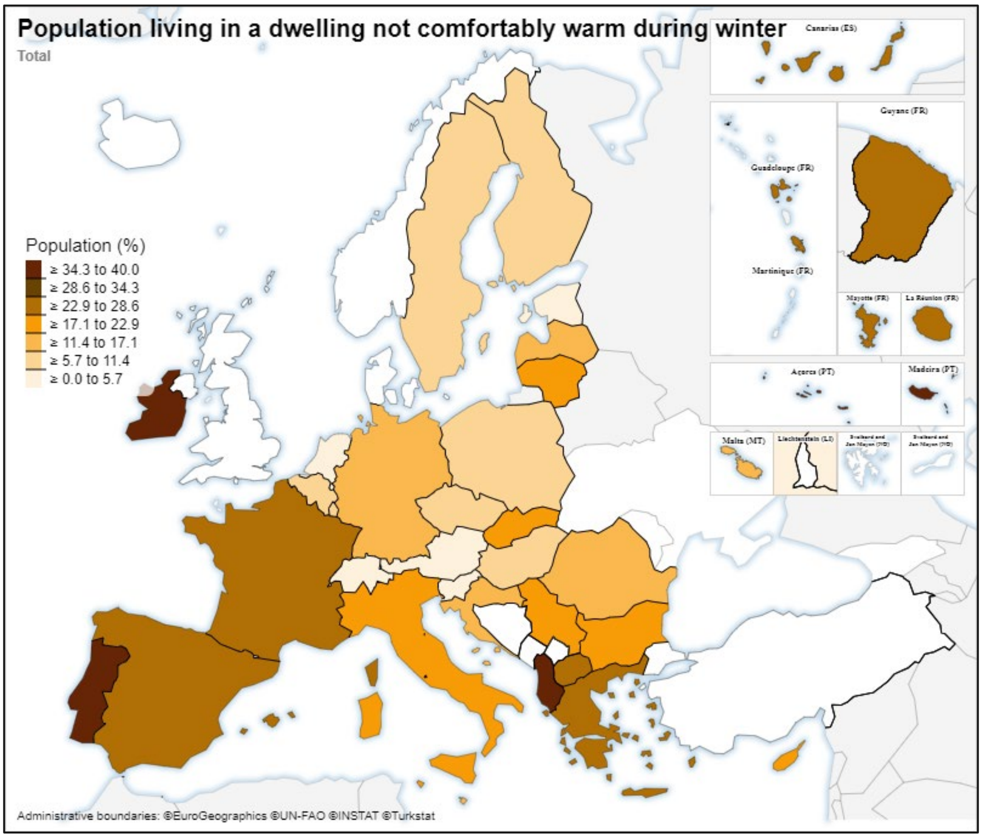


Figure 5. Map - Population living in a dwelling not comfortably warm during winter - 2023 (EPAH dashboard, 2026).

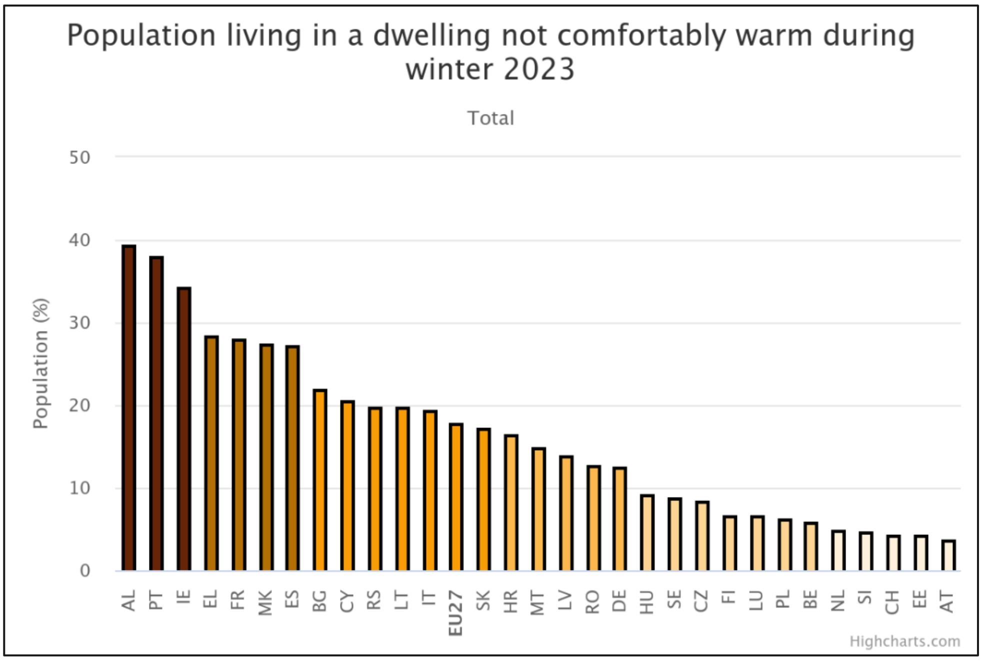


Figure 6. Bar chart and updated data – Population living in a dwelling not comfortably warm during winter – 2023 (*Eurostat*).

Table 4 presents the technical details for the restructured indicator, including the statistical codes used in the data source, the identification name used in the EP indicators section of the EPAH dashboard, the period of available data, the number of GEOs represented in the most recent update relative to the maximum 44-GEO list, and the data sources used.

Table 4. Population living in a dwelling not comfortably warm during winter - Indicator technical details.

(Sub)Topics	Name	Timeline	#GEO	Source
Facilities/housing (Building Stock)	Population living in a dwelling not comfortably warm during winter	2023[8]	32/44[9]	Eurostat (ilc_lvhe11) Eurostat (ilc_lvhe12) Eurostat (ilc_lvhe13)

Similar to the "Excess mortality during winter" indicator, the EPAH dashboard retains data from the previous version of this indicator ("Population living in dwellings comfortably warm in winter time") because it provides valuable historical information for 2007 and 2012. However, given that the two indicators describe contrasting sides of the same condition, with no conceptual continuity between them, this dataset is not included in the main list of energy poverty indicators. Instead, it remains accessible through a direct link within the "Population living in a dwelling not comfortably warm during winter" indicator page on the EPAH online dashboard.

[8] Data for 2007 and 2012 are available in the EPAH dashboard for the previous version of the indicator ("Population living in a dwelling not comfortably warm during winter").

[9] Data for the indicator "Persons living in a dwelling not comfortably warm during winter" is available for 32 GEOs for 2023, namely 31 countries (Albania, Austria, Belgium, Bulgaria, Croatia, Cyprus, Czechia, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, North Macedonia, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, and Switzerland) and 1 aggregate (EU-27).

3.4. Households Unable to Keep Dwelling Comfortably Cool in the Summer

Similarly to the restructuring of "Population living in a dwelling not comfortably warm during winter", the existing indicator "Population living in dwellings comfortably cool in summer time", with available information only for 2007 and 2012, was restructured using data collected in 2023 as part of the Eurostat EU-SILC Energy Efficiency Module and further elaborated in the Joint Research Centre (JRC) report "Addressing Residential Cooling Demand and Summer Energy Poverty in the EU — Towards a Cooler Future" (Koukoufikis *et al.*, 2026), based on the Eurostat database (code ilc_hcmp03). The restructured indicator, "Households unable to keep dwelling comfortably cool in the summer", measures the share of the households reporting that they are unable to maintain comfortable indoor temperatures during the summer period. Nevertheless, since the restructured version of this indicator only has available information for 2023, the previous version "Population living in dwellings comfortably cool in summer time" was retained in the EPAH dashboard to preserve relevant information collected for the years 2007 and 2012. It should be noted that the indicator "Households unable to keep their dwelling comfortably cool in summer" is expressed as a share of households rather than a share of the population, as the underlying dataset is reported at the household level. These two bases are not directly equivalent and therefore do not represent the same measure.

As noted in section 3.3, this indicator reflects the physical and technical capacity of a dwelling to maintain thermal comfort in summer, accounting for building insulation and the availability of cooling systems, rather than households' financial ability to do so. It should also be noted that, unlike the restructured winter comfort indicator, the current version of this indicator does not offer disaggregation options, which limits the depth of analysis possible at this stage.

Figure 7 presents the most recent available map of results for this indicator, extracted from the EPAH dashboard, and Figure 8 shows the corresponding bar chart, both based on 2023 data. Further information on the indicator is presented in Appendix A. Data for the indicator "Households unable to keep dwelling comfortably cool in the summer" are available solely at the national scale, since no breakdown is provided for regional levels (NUTS I, II, or III).

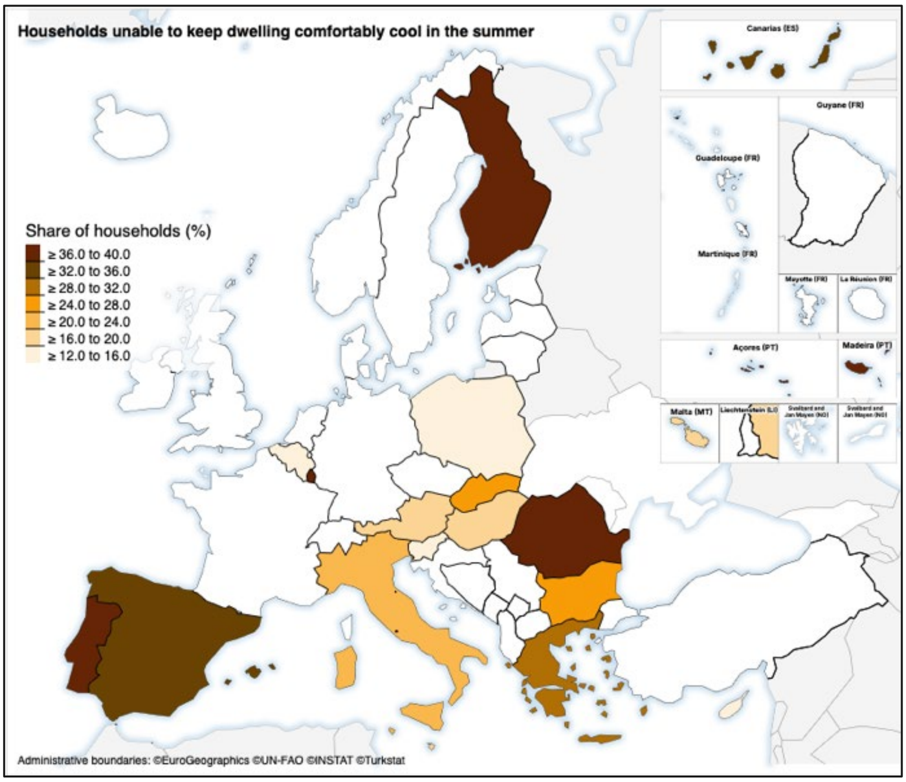


Figure 7. Map - Households unable to keep dwelling comfortably cool in the summer - 2023 (EPAH dashboard, 2026).

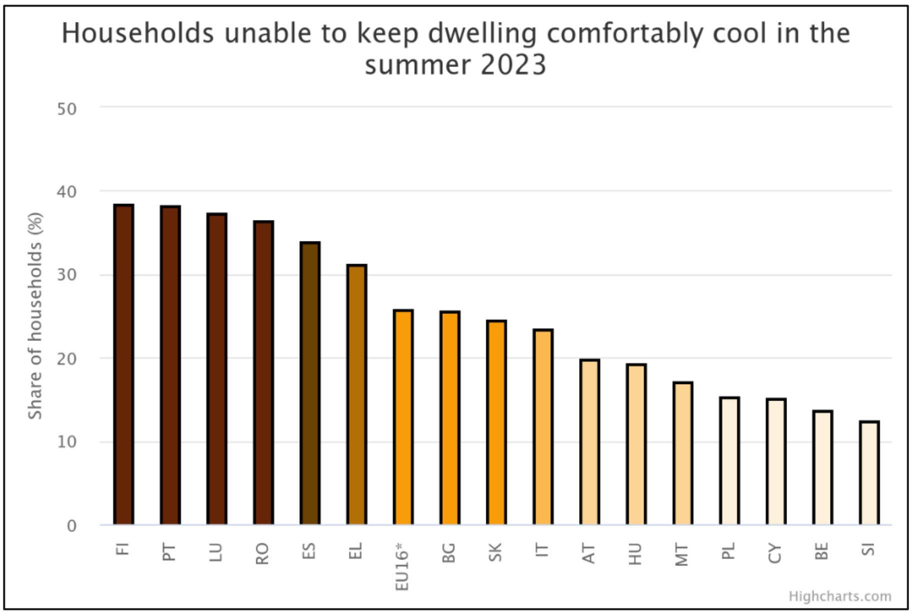


Figure 8. Bar chart and updated data - Households unable to keep dwelling comfortably cool in the summer – 2023 (JRC, based on EU-SILC data).

Note: EU-16 is the average value of the indicator obtained for the 16 EU Member States with available data for the period.

Table 5 presents the technical details for the restructured indicator, including the statistical code used in the data source, the identification name used in the EP indicators section of the EPAH dashboard, the period of available data, the number of GEOs represented in the most recent update relative to the maximum 44-GEO list, and the data sources used.

Table 5. Households unable to keep dwelling comfortably cool in the summer - Indicator technical details.

(Sub)Topics	Name	Timeline	#GEO	Source
Facilities/housing (Building Stock)	Households unable to keep dwelling comfortably cool during the summer	2023[10]	17/44[11]	JRC, based on EU-SILC data

Similar to the cases described above, the EPAH dashboard retains data from the previous version of this indicator ("Population living in dwellings comfortably cool in summer time") because it provides valuable historical information for 2007 and 2012. However, given that the two indicators describe contrasting sides of the same condition, are based on a different data source, and differ in their unit of measurement — the previous indicator expressed as a share of the population, the current one as a share of households — this dataset is not included in the main list of energy poverty indicators. Instead, it remains accessible through a direct link within the "Households unable to keep dwelling comfortably cool during the summer" indicator page on the dashboard.

[10] Data for 2007 and 2012 are available in the EPAH dashboard for the previous version of the indicator ("Population living in dwellings comfortably cool in summer time").

[11] Data for the indicator "Share of households unable to keep dwelling comfortably cool during the summer" is available for 17 GEOs for 2023, namely 16 countries (Austria, Belgium, Bulgaria, Cyprus, Finland, Greece, Hungary, Italy, Luxembourg, Malta, Poland, Portugal, Romania, Slovakia, Slovenia, and Spain) and 1 aggregate (EU-16).

3.5. Household Final Consumption Expenditure by Purpose

The EPAH indicator "Final consumption expenditure of households" was restructured on three grounds. First, the dataset underpinning the indicator was based on Eurostat data organised according to the 1999 COICOP (Classification of Individual Consumption According to Purpose), which was superseded by an updated classification in 2018. Second, the indicator presented data exclusively as expenditure per capita, which limits cross-country comparability: two countries may show similar per capita expenditure within a given consumption category while that amount represents substantially different shares of total household income, reflecting distinct vulnerability conditions despite identical expenditure values. Expressing expenditure as a share of household income enables more meaningful comparisons across countries with different income levels and reduces the distorting effect of varying average household sizes. Third, the housing and transport components were available in the EPAH dashboard only as distinct subcategories, constraining direct analysis and comparison across expenditure types.

Three modifications were therefore made to this indicator. The dataset was updated to the Eurostat series aligned with the 2018 COICOP (nama_10_cp18), which is periodically updated and includes data through 2024. The data format was changed from expenditure per capita to share of total household expenditure, directly available in the updated dataset, resulting in the renamed indicator "Household final consumption expenditure by purpose". Finally, the transport-related disaggregation options were separated from this indicator and restructured into the standalone indicator "Household final consumption expenditure allocated to transport costs", described in section 4.7 of this report.

Figure 9 presents the most recent available map of results for this indicator, extracted from the EPAH dashboard, considering the disaggregation option by cost category “electricity, gas, and other fuels”, and Figure 10 shows the corresponding bar chart, both based on 2024 data. Detailed information on the updated indicator data and available disaggregation options is presented in Appendix A. The databased used for the indicator “Household final consumption expenditure by purpose” provides only national-level values, as regional information (according to the NUTS I, II or III levels) is not available.

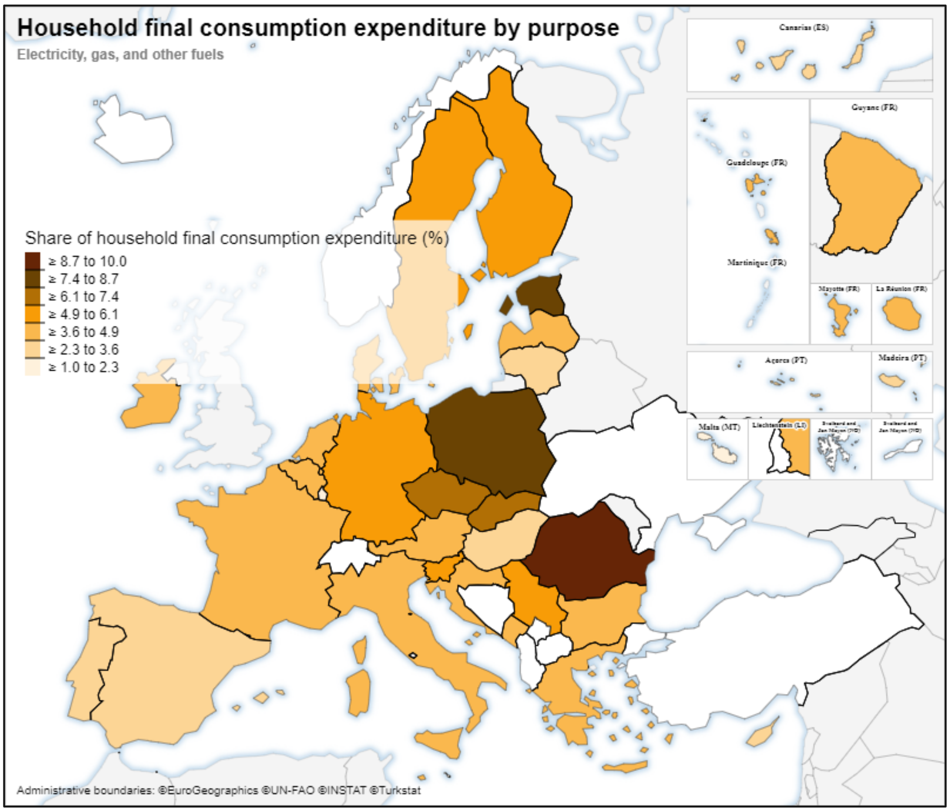


Figure 9. Map - Household final consumption expenditure by purpose – Electricity, gas, and other fuels - 2024 (EPAH dashboard, 2026).

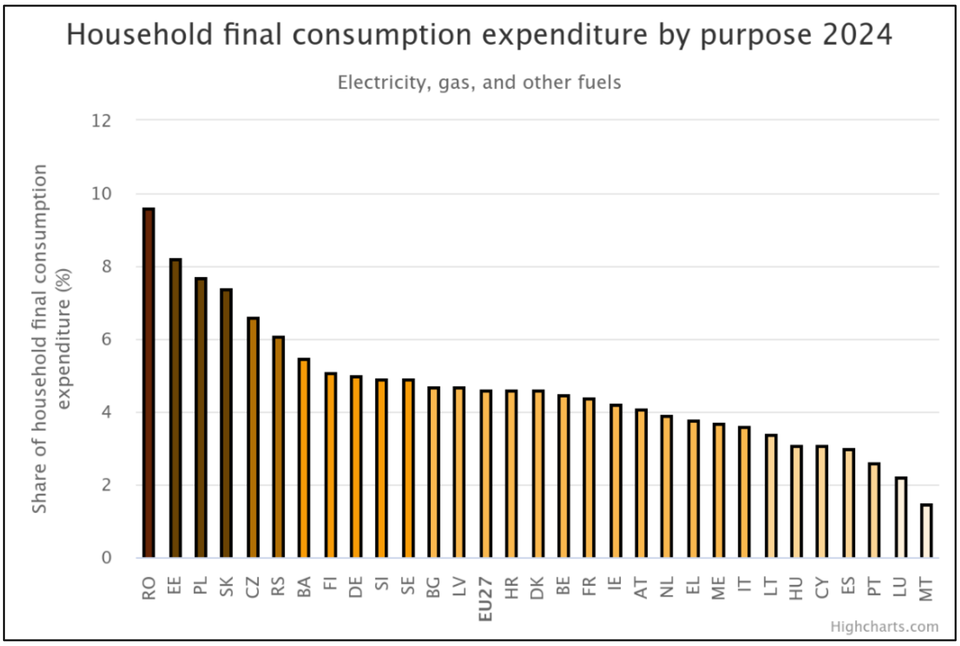


Figure 10. Bar chart and updated data – Household final consumption expenditure by purpose – Electricity, gas, and other fuels – 2024 (Eurostat).

Table 6 presents the technical details for the restructured indicator, including the statistical code used in the data source, the identification name used in the EP indicators section of the EPAH dashboard, the period of available data, the number of GEOs represented in the most recent update relative to the maximum 44-GEO list, and the data source used.

Table 6. Household final consumption expenditure by purpose - Indicator technical details.

(Sub)Topics	Name	Timeline	#GEO	Source
Socio-economic aspects **(Socio Economic and Living Conditions)**	Household final consumption expenditure by purpose	2015-2024	32/44[12]	Eurostat (nama_10_cp18)

[12] Data for the indicator "Share of household final consumption expenditure by purpose" is available for 32 GEOs for 2024, namely 31 countries (Austria, Belgium, Bulgaria, Croatia, Cyprus, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Montenegro, Netherlands, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, and Türkiye) and 1 EU average value (EU-27).

4. New EPAH indicators

Nine new indicators are proposed for inclusion in the EPAH energy poverty indicators framework to more comprehensively capture the multifaceted nature of EP and enable deeper analysis of its climate, mobility, and health dimensions. This process focuses on obtaining new and periodically updatable information across the 44 analysed Geographical Entities (GEOs), drawing on a range of European datasets, studies, and reports that extend beyond Eurostat and the Building Stock Observatory (BSO), while remaining aligned with the CoM EP indicator framework (CoM, 2025). The nine new indicators are described below:

1. **Excess mortality during summer [Average z-score]:** Quantifies the extent to which observed mortality during a specific summer period exceeds or falls below expected levels in a given country.
2. **Cold stress days [Number of days]:** Measures the annual number of days on which the daily minimum temperature falls within a range capable of inducing physiological and psychological cold stress in humans.
3. **Heat stress days [Number of days]:** Indicates the annual number of days on which the daily maximum temperature falls within a range capable of inducing physiological and psychological heat stress in humans.
4. **Population living in dwellings whose energy efficiency improved in the last 5 years [Share of the population (%)]:** Measures the share of the population aged 16 or older living in dwellings where energy efficiency has been improved in the last five years, including all measures that affect the thermal conditions of the dwelling.
5. **At-risk-of-poverty rate [Share of the population (%)]:** Measures the share of the population whose equivalised disposable income after social transfers falls below the poverty threshold, defined as 60% of the national median equivalised disposable income after social transfers.
6. **Population that is Materially and Socially Deprived (MSD) and owns a car [Share of the population (%)][13]:** Measures the share of the population in MSD conditions that reports owning a car.
7. **Household final consumption expenditure allocated to transport costs [Share of household final consumption expenditure (%)]:** Indicates the share of the total household final consumption

[13] Until 2020, MSD population was defined as the percentage of the population that cannot afford at least three of the following nine items: 1) to pay their rent, 2) mortgage or utility bills; 3) to keep their home adequately warm; 4) to face unexpected expenses; 5) to eat meat or proteins regularly; 6) to go on holiday; 7) a television set; 8) a washing machine; 9) a car. “Severe material deprivation rate” was defined as the enforced inability to pay for at least four of the above-mentioned items. After 2020, the MSD population started to be defined as a composite indicator of deprivation based on 13 items, namely: ability to face unexpected expenses, ability to afford one week´s annual holiday away from home, no arrears (mortgage, rent, utility bills, hire purchase), ability to afford a meal with meat, chicken, fish or a vegetarian equivalent every second day, ability to keep home adequately warm, ability to replace worn-out furniture, ability to replace worn-out clothes with new ones, ability to buy new clothes, ability to have two pairs of properly fitting shoes, ability to spend a small amount of money each week on oneself, ability to get together with friends/family for a drink/meal at least once a month, ability to regularly participate in a leisure activity, and ability to have internet connection at home. A household is considered in MSD conditions if it lacks at least 5 of these items (European Commission, 2024).

expenditure spent on transport, covering road, rail, air, and water transport across both public and private modes.

8. **Population who cannot afford a personal car [Share of the population (%)]:** Measures the share of the population living in households that declare they cannot afford to own a car for personal use.
9. **Population using or not public transport, by frequency [Share of the population (%)]:** Indicates the share of the population using, or never using, public transport — such as buses, trams, trains, and metro, excluding privately rented vehicles such as taxis and bicycles.

Each of the nine indicators is examined in greater detail in section 4, which provides a critical analysis of their strengths and limitations in the EU context. In that section, each indicator is assessed according to the following structure:

i. **Current situation:** the indicator definition is presented alongside a map and bar chart showing the most recent available data for each GEO.

ii. **Technical details:** covers the topic and subtopic, period of available data, data source, number of GEOs, and disaggregation options. The alignment of the indicator with the CoM guidelines for EP diagnosis and mitigation is also assessed (CoM, 2025).

iii. Rationale: explains the main reasons and advantages of including the respective new indicator in the EPAH dashboard.

iv. **Limits and application suggestions:** analyses the strengths and limitations of each indicator, examines potential shortcomings in its application to EP measurement, and describes concrete scenarios and application cases for its effective use.

v. **Updates:** summarises the most important information about the indicator and presents the most recent available data for the EU.

Table 7 presents an overview of the new nine indicators by EPAH topic and subtopic. Appendix B lists the GEOs represented for each indicator.

Table 7. Classification of the nine new EP indicators.

Topic	Subtopic	New Indicator
Mobility		Population that is materially and socially deprived and owns a car
		Household final consumption expenditure allocated to transport costs
		Population who cannot afford a personal car
		Population using or not public transport
Climate		Cold stress days
		Heat stress days
Health		Excess mortality during summer

Socioeconomic and Living Conditions		At-risk-of-poverty rate
Facilities/housing	Building Stock	Population living in dwellings whose energy efficiency had been improved in the last 5 years

The current situation, technical details, rationale for inclusion as a new EPAH indicator, limits and application suggestions, and updates are presented for each of the nine new indicators in sections 4.1 to 4.9.

4.1. Excess Mortality during Summer

i.Current situation

The indicator "Excess mortality during summer" quantifies the extent to which observed mortality during a given summer period exceeds or falls below expected levels for a given country. It is measured as the average weekly z-score for the summer period, defined as weeks 25 to 39 of the same year, computed using the same methodology described in section 3.1 (Equation 1).

Figure 11 presents the most recent available map of results for this indicator, extracted from the EPAH dashboard, and Figure 12 shows the corresponding bar chart, both based on summer 2025 data[14]. Detailed information on the most recent data and available disaggregation options is provided in Appendix B. Data for the indicator “Excess mortality during summer” are reported only at the national level, as no breakdown is available at regional available (NUTS I, II, or III).

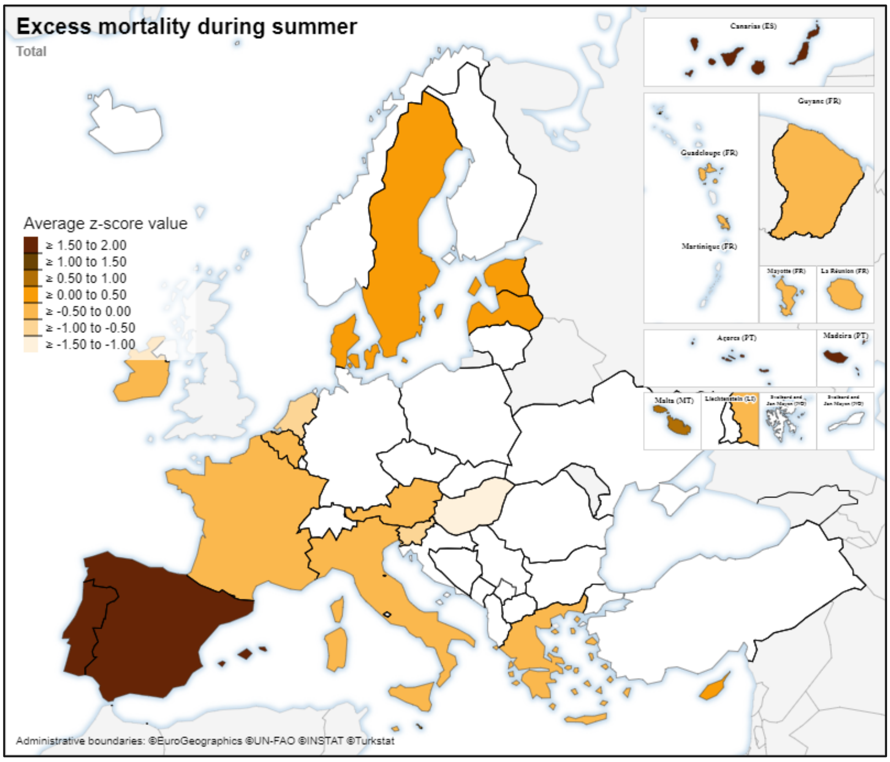


Figure 11. Map – Excess mortality during summer – Summer 2025 (EPAH dashboard, 2026).

[14] As with the indicator "Excess mortality during winter", values for the United Kingdom were derived by calculating the median across its constituent countries.

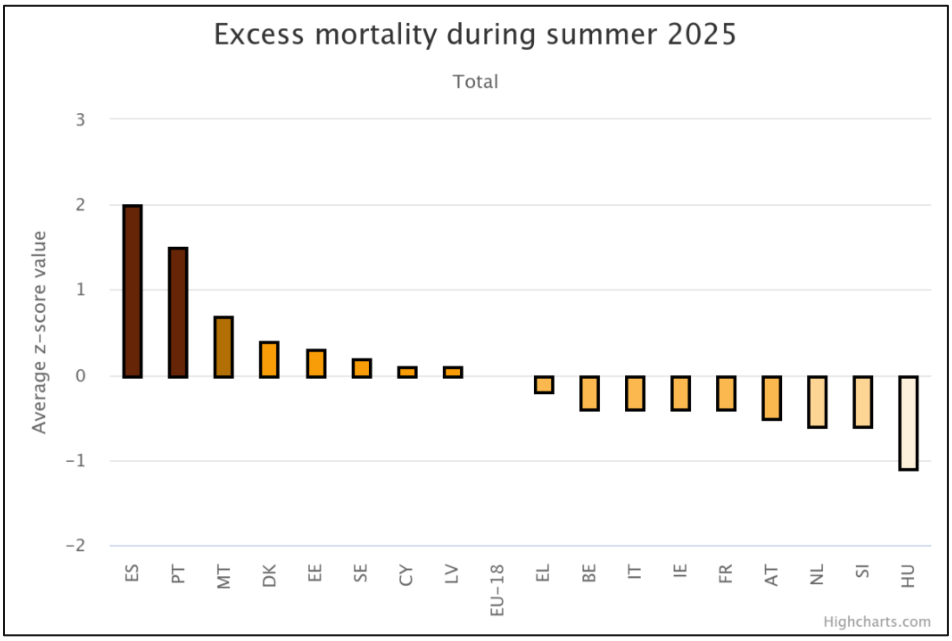


Figure 12. Bar chart and updated data - Excess mortality during summer - Summer 2025 (EUROMOMO).

Note: EU-18 is the average value of the indicator obtained for the 18 EU Member States with available data for the period.

ii.Technical details

Table 8 presents the technical details for the "Excess mortality during summer" indicator, including the statistical code used in the data source, the identification name used in the EP indicators section of the EPAH dashboard, the period of available data, the number of GEOs represented in the most recent update relative to the maximum 44-GEO list, and the data source used.

This indicator can be indirectly linked to the CoM indicator "Persons with respiratory and circulatory problems", included in the CoM Reporting Guidelines on Energy Poverty, as respiratory and circulatory conditions are frequently exacerbated by heat stress and may contribute to higher excess mortality during summer months.

Table 8. Excess mortality during summer - Indicator technical details.

(Sub)Topics	Name	Timeline	#GEO	Source
Socioeconomic Aspects (Health)	Excess mortality during summer	2019 -2025	22/44[15]	EUROMOMO

[15] Data for the indicator "Excess mortality during summer" is available for 22 GEOs, namely 21 countries (Austria, Belgium, Cyprus, Denmark, Estonia, Finland, France, Greece, Hungary, Ireland, Italy, Latvia, Malta, Netherlands, Norway, Portugal, Slovenia, Spain, Sweden, Switzerland, and United Kingdom) and 1 aggregate (EU-18).

iii.Rationale

One of the most significant consequences of anthropogenic climate change is the rise in global average temperatures, which is increasing the frequency and severity of heatwaves (Huber *et al.*, 2024; Li *et al.,* 2024). In Europe, the Copernicus Programme reports that average temperatures over the last five years are 2.4°C above typical values from the second half of the 19th century, compared to a global increase of 1.3°C (Copernicus, 2025).

The relationship between extreme heat and increased mortality is well established, particularly among vulnerable population groups. Those with cardiovascular conditions face compounded risks from peripheral vasodilation, dehydration, and electrolyte imbalances during periods of intense heat, while individuals with respiratory diseases (including asthma and chronic pulmonary conditions) are adversely affected by heightened air pollution and airway dehydration (Ballester *et al.*, 2023; Rai *et al.*, 2023). Elderly people and those in materially and socially deprived (MSD) conditions are disproportionately exposed to these risks (Arsad *et al.*, 2022; Janoš *et al.,* 2025). Households in EP situations face particular vulnerability, as they are less likely to have the economic, technical, or infrastructural means to cope with extreme heat, for instance, through the installation and operation of cooling equipment.

Summer EP and heat-related mortality are therefore interconnected across multiple dimensions. Poor housing conditions, the absence of cooling equipment, low income, MSD conditions, and energy expenditure patterns all influence mortality levels during extreme heat periods, effects that are especially pronounced in Southern European countries with historically severe heat stress conditions (Sanchez-Guevara *et al.*, 2019; Santamouris and Kolokotsa, 2015). While EP research and composite indicators have historically emphasised excess winter mortality, the growing relevance of summer mortality, driven by intensifying climate conditions, makes its inclusion in EP assessment frameworks increasingly important (European Commission, 2025).

The indicator “Excess mortality during summer” was included as an EPAH indicator because no existing indicator captured excess mortality associated with periods of heat stress, only those related to winter. In the context of increasing frequency and severity of heatwaves, having an indicator linked to the potential health impacts of population heat exposure is relevant to the analysis of EP conditions. It also enables comparisons across GEOs with different levels of adaptability to heat stress (*e.g.,* dwelling conditions, public health systems, availability of cooling systems), as well as comparisons with excess mortality observed during periods of cold exposure.

iv.Limits and application suggestions

As noted in previous EPAH indicator reports (EPAH, 2022; EPAH, 2023), the winter mortality indicator should be analysed in combination with other indicators that link EP drivers to health outcomes, as strongly recommended. Relevant indicators include those related to building stock conditions, MSD conditions, inability to keep homes adequately cool, and energy expenditure by income quintile. Institutional factors such as the level of investment in national health systems can also significantly influence mortality rates during extreme heat events (Fowler *et al.*, 2015) and should be considered when interpreting cross-country differences. The following limits and use cases illustrate both the constraints and the analytical potential of this indicator:

- Limit 1: In specific years, elevated summer mortality may partly reflect indirect effects of prolonged heatwaves, such as increased wildfire frequency and associated air pollution, which affect populations with cardiovascular and respiratory conditions independently of EP levels.
- Limit 2: Extreme heat-related weather events can strain the capacity of national health systems, thereby reducing access to healthcare and contributing to higher excess mortality during the summer, regardless of a country's EP profile.
- Limit 3: Countries with a higher share of elderly citizens or those with chronic respiratory and cardiovascular diseases may record elevated summer mortality values even where EP levels are relatively low.
- Limit 4: Countries with high levels of urban population density may be associated with urban heat island effects, particularly in contexts with limited urban vegetation, green spaces, or parks. These conditions can lead to heightened exposure to heat during the summer, potentially affecting population health and excess mortality levels, without necessarily being linked to higher levels of EP.
- Use-case 1: Low-income households unable to afford air conditioning, which entails high upfront costs and higher energy bills, are disproportionately exposed to the health consequences of heatwaves and prolonged heat stress, particularly those with pre-existing comorbidities.
- Use-case 2: Countries where housing stock has been designed predominantly for cold climates, with limited passive cooling features and low rates of ownership of cooling equipment, may experience sharp increases in summer excess mortality during atypical heat events, even when overall EP levels are not high.

v.Updates

Three Mediterranean countries, Spain, Portugal, and Malta, recorded among the highest values of excess summer mortality in 2025. While these countries have historically experienced severe heat stress, the 2025 figures highlight the exceptional intensity of that summer relative to previous years. Notably, countries not typically associated with severe heat exposure, including Denmark, Estonia, Sweden, and Latvia, also recorded elevated excess mortality during the summer of 2025. These results reflect the multidimensional nature of heat-related mortality risk: beyond climate conditions alone, factors such as housing stock adapted to cold rather than warm temperatures, low rates of ownership of cooling equipment, and the share of the population with comorbidities all contribute to mortality during summer heat events.

4.2. Cold Stress Days

i. Current situation

The indicator "Cold stress days" measures the annual number of days when the daily minimum temperature falls within a range that can induce physiological and psychological cold stress in humans. It is based on data from the EU Copernicus Programme via the Thermal Trace tool and is expressed in days, with worldwide data availability.

The dataset provides gridded climate information, organised on a regular latitude-longitude grid, for the number of days in a given year, classified by cold stress severity. Severity is measured using the Universal Thermal Climate Index (UTCI), a bioclimate index developed by the World Meteorological Organization (WMO) to quantify the thermal stress imposed on the human body. The UTCI is derived from a thermophysiological model and expressed as an equivalent temperature representing the physiological response to outdoor climate conditions (Di Napoli et al., 2020). The cold stress severity classes in the dataset are defined according to minimum temperature thresholds and are cumulative in nature, meaning that days classified under a more severe category are also counted within less severe ones:

- Days with a minimum temperature below 9°C indicate slight cold stress (T9).
- Days with a minimum temperature below 0°C indicate moderate cold stress (T0).
- Days with a minimum temperature below -13°C indicate strong cold stress (T-13).
- Days with a minimum temperature below -27°C indicate very strong cold stress (T-27).
- Days with a minimum temperature below -40°C indicate extreme cold stress (T-40).

National values for this indicator were derived through the following steps. The global gridded dataset, divided into cold stress severity classes, was clipped to the European domain and reprojected onto a common European map. Country-level averages were then calculated based on national boundaries from the Natural Earth database, and the resulting data for each severity class were saved as tables and georeferenced files for further analysis and mapping. All processing steps were performed in Python.

Analysing cumulative values alone does not allow direct interpretation of results. Disaggregated analysis by severity class enables the identification of distinct patterns for specific countries, such as a country presenting a considerable number of strong or very strong cold stress days while recording relatively few moderate cold stress days. It also allows direct comparison with the total annual number of days, enabling determination of the share of the year falling within each class. Non-cumulative values were therefore calculated for each severity class using specific temperature ranges, as described in section 2.3:

- Extreme cold stress: days with a minimum temperature below -40°C.
- Very strong cold stress: days with minimum temperature between -40°C and -27°C, calculated as the difference between the number of days T-27 and T-40.

- Strong cold stress: days with minimum temperature between -27°C and -13°C, calculated as the difference between the number of days T-13 and T-27.
- Moderate cold stress: days with minimum temperature between -13°C and 0°C, calculated as the difference between the number of days T0 and T-13.
- Slight cold stress: days with minimum temperature between 0°C and 9°C, calculated as the difference between the number of days T9 and T0.

These non-cumulative values are used as the data for the indicator "Cold stress days" throughout this report.

Figure 13 presents the most recent available map of results for this indicator, extracted from the EPAH dashboard, and Figure 14 shows the corresponding bar chart, both based on 2024 data, for the total cold stress days (days with minimum temperature below than 9°C). Detailed information on the most recent data by severity class is provided in Appendix B. The dataset underpinning the indicator "Cold stress days" is available exclusively at the national level, as no disaggregated data exist for regional classifications such as NUTS I, II, or III.

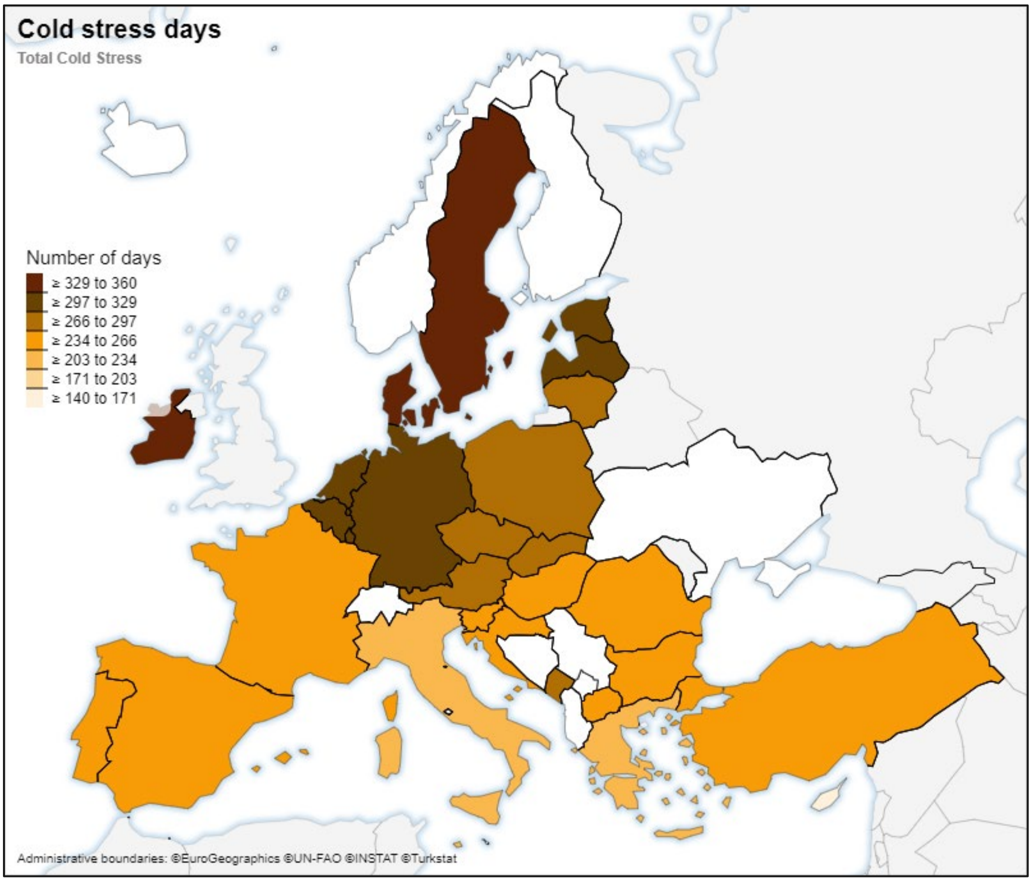


Figure 13. Map – Cold stress days – Total cold stress days - 2024 (EPAH dashboard, 2026).

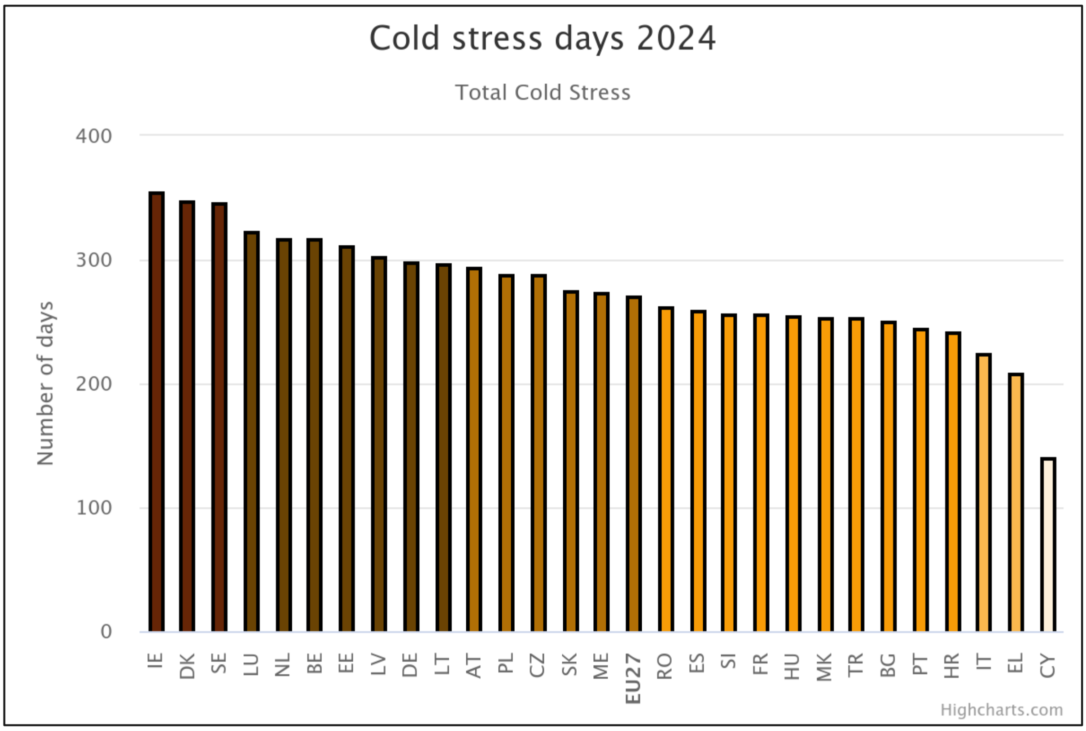


Figure 14. Bar chart and updated data – Cold stress days – Total cold stress days – 2024 (Copernicus).

Note: EU27 is the average value of the indicator obtained for the 27 EU Member States with available data for the period.

ii. Technical details

Table 9 presents the technical details for the "Cold stress days" indicator, including the statistical code used in the data source, the identification name used in the EP indicators section of the EPAH dashboard, the period of available data, the number of GEOs represented in the most recent update relative to the maximum 44-GEO list, and the data source used.

The indicator "Cold stress days" is directly relevant to the CoM indicator "Frequency of cold waves", included in the CoM Reporting Guidelines on Energy Poverty.

Table 9. Cold stress days - Indicator technical details.

SubTopics	Name	Timeline	#GEO	Source
Climate	Cold stress days	1940-2024	40/44[16]	Copernicus

[16] Data for the indicator "Cold stress days" is available for 40 GEOs, namely 39 countries (Albania, Austria, Belgium, Bosnia and Herzegovina, Bulgaria, Croatia, Cyprus, Czechia, Denmark, Estonia, Finland, France, Georgia, Germany, Greece, Hungary, Iceland, Ireland, Italy, Kosovo, Latvia, Lithuania, Luxembourg, Moldova, Montenegro, Netherlands, North Macedonia, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Türkiye, Ukraine, and United Kingdom) and 1 aggregate (EU-27).

iii. Rationale

Although the indicator “Cold stress days” is primarily climate related, its inclusion as an EPAH EP related indicator provides relevant insights into severe cold exposure conditions. Cross-analysis of this information with other indicators, particularly those related to energy performance, housing conditions, and excess winter mortality, may be important to unveil the main drivers of EP in certain GEOs.

Moreover, this indicator is also pertinent to analyse possible connections between outdoor cold exposure and thermal indoor comfort, particularly through a combined analysis of this new indicator with existing ones such as “Persons living in a dwelling not comfortably warm during winter”, “Inability to keep home adequately warm”, and “Persons living in private households by heating system used in the dwelling”.

iv. Limits and application suggestions

Prolonged periods of low temperatures can have considerable impacts on the health of citizens, as discussed in section 4.1 in relation to excess winter mortality, where the potential association between cold stress and increased mortality rates is highlighted (Gao *et al*., 2024). Regions with temperate climates tend to be less adapted to extreme cold, which can amplify the effects of cold spells in countries where such events occur infrequently (Alahmad et al., 2023).

It is important to note that, despite apparent similarities in definition, cold stress days and cold spells are distinct climate phenomena. Cold stress days refer to the annual number of days on which the daily minimum temperature falls within a range that can induce physiological and psychological cold stress, categorised by severity class. Cold spells, by contrast, refer to episodes of anomalously low temperatures persisting over consecutive days, typically defined using absolute or relative thresholds calibrated for specific regions or countries.

Beyond the climate dimension, several factors can aggravate the effects of cold stress on the population. Poor building energy performance, the absence of adequate heating equipment, malfunctioning heating systems, insufficient thermal insulation in the building envelope, and inefficient windows all contribute to inadequate indoor temperatures during cold periods (Mei and Seo, 2024; Rehman, Hamdy, and Hasan, 2024). During severe cold stress days, increased heating demand leads to higher energy bills, and households in EP situations may be forced to restrict or suspend heating use to contain costs, further exacerbating indoor cold stress conditions (Eisfeld and Seebauer, 2022; Grey *et al*., 2017).

A key limitation of the indicator "Cold stress days" is that it cannot, when considered in isolation, establish a direct or unequivocal link to EP conditions. A country with a high number of extreme or very strong cold stress days is not automatically a country with high EP levels, and conversely, a country with fewer severe cold days does not necessarily have a lower incidence of EP. Disposable household income and other socioeconomic factors mediate this relationship, reflecting the complex and indirect association between extreme winter conditions and EP (Awaworyi Churchill, Smyth, and Trinh, 2022).

Effective use of this indicator therefore depends on combining it with other EPAH indicators across relevant topics, including building stock ("Population living in a dwelling equipped with heating facilities", "Dwellings with energy label A"), energy consumption and equipment ("Final energy consumption in households by energy use"), socioeconomic and living conditions ("Inability to keep home adequately warm"), and energy expenditure ("Low absolute energy expenditure M/2") (EPAH, 2022).

The following limits and use cases illustrate the constraints and analytical potential of this indicator:

- Limit 1: A country where severe cold periods are frequent may have developed infrastructure and adaptive strategies to reduce their impact on the population, such as district heating networks, incentives for housing retrofitting and efficient heating equipment, heating cost subsidies, and health systems with expertise in cold-related conditions. A country where such events are rare may, by contrast, suffer greater impacts due to limited experience, procedures, and infrastructure to manage their effects.
- Use-case 1: During cold stress days, increased household energy demand to maintain indoor thermal comfort can lead to higher energy expenditure, placing particular pressure on vulnerable households already facing EP conditions.
- Use-case 2: The impact of cold stress is likely to be more severe in dwellings with poor construction quality, particularly those with inefficient windows, insufficient thermal insulation in walls and roofs, or the presence of leaks, damp, or rot, where the energy required to maintain thermal comfort is substantially higher due to the building's low energy efficiency.

v. Updates

In 2024, at least one day of extreme cold stress was recorded in only three EU Member States, all in Northern Europe: Estonia, Finland, and Sweden. These countries, however, are not among those with the highest excess winter mortality for 2024/2025, a result that may reflect the effectiveness of accessible heating infrastructure, including district heating and efficient individual heating systems, as well as construction solutions adapted to cold climates. These findings highlight the indirect and complex relationship between climate conditions, EP, and mortality outcomes. The same three countries also recorded the highest values of very strong and strong cold stress days in 2024.

By contrast, Cyprus, Portugal, and Greece recorded no extreme or very strong cold stress days and fewer than five strong cold stress days in 2024, illustrating the considerable disparity in cold stress intensity between Northern and Southern European countries.

4.3. Heat Stress Days

i. Current situation

The indicator "Heat stress days" measures the annual number of days on which the daily maximum temperature falls within a range that can induce physiological and psychological heat stress in humans. It is based on data from the EU Copernicus Programme via the Thermal Trace tool and is expressed in days, with worldwide data availability.

As with the indicator "Cold stress days", the dataset provides gridded climate information organised on a regular latitude-longitude grid, with the number of days in a given year classified by heat stress severity, measured using UTCI values. The heat stress severity classes in the dataset are defined according to maximum temperature thresholds and are cumulative in nature:

- Days with a maximum temperature above 26°C indicate moderate heat stress (T26).
- Days with a maximum temperature above 32°C indicate strong heat stress (T32).
- Days with a maximum temperature above 38°C indicate very strong heat stress (T38).
- Days with a maximum temperature above 46°C indicate extreme heat stress (T46).

The same methodology used for the indicator "Cold stress days" was applied here. The global gridded dataset, divided into heat stress severity classes, was clipped to the European domain and reprojected onto a common European map. Country-level averages were then calculated based on national boundaries from the Natural Earth database. and the resulting data for each severity class were saved as tables and georeferenced files. All processing steps were performed in Python. Non-cumulative values were calculated for each severity class using the following temperature ranges:

- Extreme heat stress: days with a maximum temperature above 46°C.
- Very strong heat stress: days with maximum temperature between 38°C and 46°C, calculated as the difference between the number of days T38 and T46.
- Strong heat stress: days with maximum temperature between 32°C and 38°C, calculated as the difference between the number of days T32 and T38.
- Moderate cold stress: days with maximum temperature between 26°C and 32°C, calculated as the difference between the number of days T26 and T32.

Figure 15 presents the most recent available map of results for this indicator, extracted from the EPAH dashboard, and Figure 16 shows the corresponding bar chart, both based on 2024 data, for the total heat stress days (days with maximum temperature above 26°C). The EU average was calculated as the mean of the Member States with available data. Additional information on updated data and disaggregation options is depicted in Appendix B. The available data for the indicator “Heat stress days” are based solely on national values, as no disaggregated data exist for regional classifications such as NUTS I, II, or III.

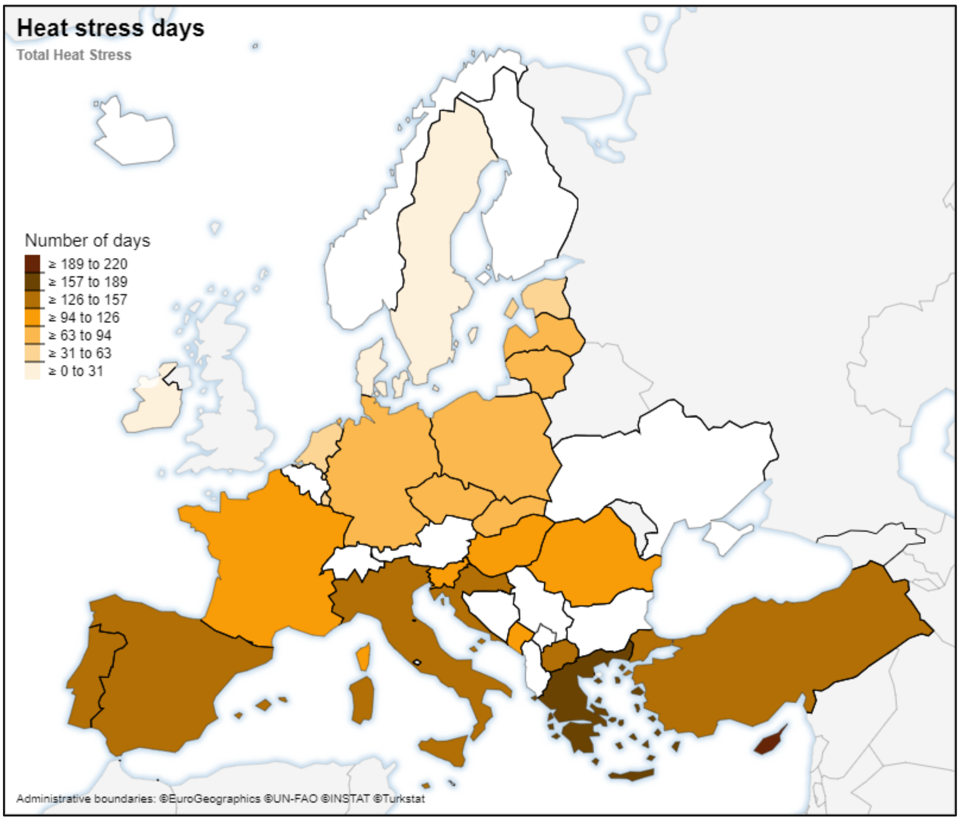


Figure 15. Map – Heat stress days – Total heat stress days – 2024 (EPAH dashboard, 2026).

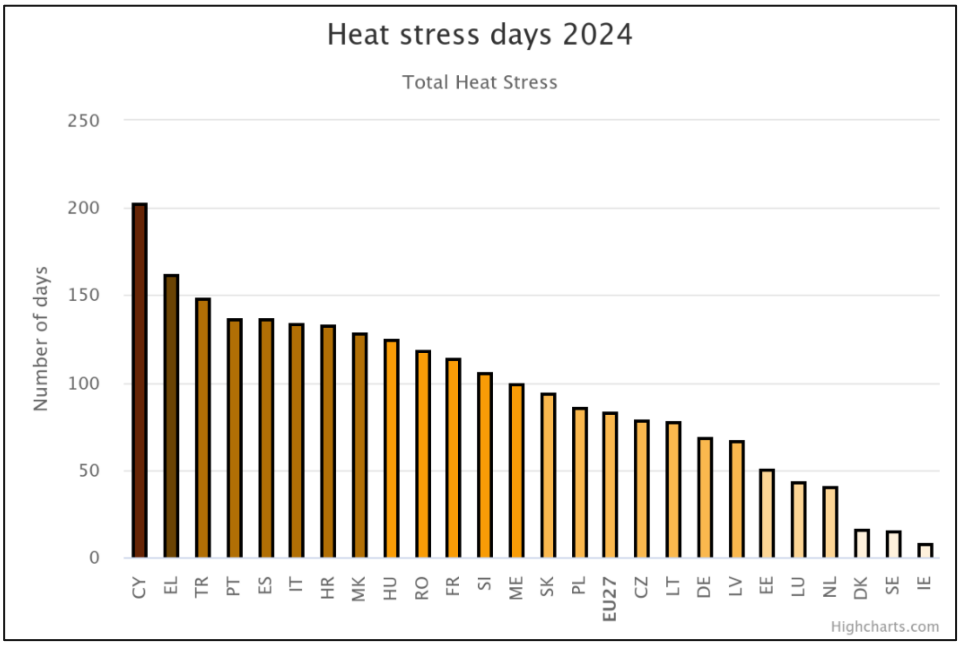


Figure 16. Bar chart and updated data - Heat stress days – Total heat stress days – 2024 (Copernicus).

Note: EU27 is the average value of the indicator obtained for the 27 EU Member States with available data for the period.

ii. Technical details

Table 10 presents the technical details for the "Heat stress days" indicator, including the statistical code used in the data source, the identification name used in the EP indicators section of the EPAH dashboard, the period of available data, the number of GEOs represented in the most recent update relative to the maximum 44-GEO list, and the data source used.

The indicator "Heat stress days" is directly relevant to the CoM indicator "Frequency of heat waves", included in the CoM Reporting Guidelines on Energy Poverty.

Table 10. Heat stress days - Indicator technical details.

(Sub)Topics	Name	Timeline	#GEO	Source
Climate	Heat stress days	1940-2024	40/44[17]	Copernicus

iii. Rationale

Similarly to the indicator “Cold stress days”, including the indicator “Heat stress days” as an EPAH indicator is considerably valuable to provide a deeper understanding of severe heat exposure and summer EP conditions, where cross-analysing this new indicator with other existing ones, particularly associated with energy performance of the dwelling, housing conditions, perceptions of thermal indoor comfort, and excess summer mortality are key steps for unveiling EP conditions related to heat waves and higher outdoor temperatures.

iv. Limits and application suggestions

The increasing frequency and intensity of extreme heat events is one of the most significant consequences of climate change. As discussed in section 4.1 regarding the indicator "Excess mortality during summer", extreme heat is strongly associated with cardiovascular and respiratory diseases and disproportionately affects populations with pre-existing conditions and older adults (Nawaro et *al.*, 2023). It is also important to note that, as with the distinction between cold stress days and cold spells, heat stress days and heatwaves are not the same climate phenomenon and should not be treated as interchangeable.

High outdoor temperatures increase energy demand and interact with other EP drivers, particularly building energy performance. In temperate and colder climates, even energy-efficient buildings may be at risk during summer because their envelopes are designed to retain heat in winter rather than

[17] Data for the indicator “Heat stress days” is available for 40 GEOs, namely 39 countries (Albania, Austria, Belgium, Bosnia and Herzegovina, Bulgaria, Croatia, Cyprus, Czechia, Denmark, Estonia, Finland, France, Georgia, Germany, Greece, Hungary, Iceland, Ireland, Italy, Kosovo, Latvia, Lithuania, Luxembourg, Moldova, Montenegro, Netherlands, North Macedonia, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Türkiye, Ukraine, and United Kingdom) and 1 aggregate (EU-27).

facilitate cooling and ventilation. This is compounded by a relative scarcity of cooling equipment in many households and lower population adaptation to extreme heat compared to the more widespread ownership of heating equipment and familiarity with cold conditions, contributing to elevated levels of indoor overheating (Chen *et al.*, 2025). Summer EP has emerged as a significant and growing concern, particularly in Southern European countries with high heat exposure. Historically, EP research has concentrated on winter conditions, and appropriate methodologies for measuring and addressing summer EP remain underdeveloped (EPAH, 2022; Torrego-Gómez *et al.*, 2024). Multiple factors shape the relationship between extreme heat and EP vulnerability, including urban density and associated microclimate effects, higher energy expenditure in households equipped with cooling systems, and the specific vulnerabilities of older adults, those with MSD conditions, and citizens with pre-existing chronic diseases (Torrego-Gómez *et al.*, 2024).

As with "Cold stress days", the indicator "Heat stress days" cannot establish a direct link to EP conditions when analysed in isolation. A country with a high number of extreme or very strong heat stress days is not automatically a country with high EP levels, though it represents a relevant risk factor in EP detection assessments.

Effective application of this indicator relies on cross-analysis with other EPAH indicators across relevant topics, including building stock ("Population living in a dwelling equipped with heating facilities", "Dwellings with energy label A"), energy consumption and equipment ("Final energy consumption in households by energy use"), socioeconomic and living conditions ("Inability to keep home adequately warm", "Share of households unable to keep the dwelling comfortably cool in the summer"), and energy expenditure ("Low absolute energy expenditure M/2") (EPAH, 2022).

The following limits and use cases illustrate the constraints and analytical potential of this indicator:

- Limit 1: Countries with a history of frequent heat events may have developed passive cooling strategies, such as solar shading, cross-ventilation, and appropriate building orientation, that mitigate impacts and reduce reliance on active cooling. Countries where extreme heat is rare may, by contrast, be more vulnerable due to limited adaptive infrastructure, including building designs that favour year-round solar exposure and the prevalence of heating-only systems without cooling capacity.

- Use-case 1: On days with strong or very strong heat stress, increased use of cooling equipment leads to higher energy expenditure, placing additional pressure on vulnerable households already facing energy bill arrears and potentially worsening thermal discomfort and EP conditions.

- Use-case 2: Households without active cooling equipment, which typically requires significant upfront investment, are considerably more exposed to the effects of heat stress days and less able to maintain adequate indoor thermal comfort during extreme heat periods.

v. Updates

No EU Member State recorded a single extreme heat stress day in 2024. Only four Member States reported more than 15 days of very strong heat stress: Cyprus, Spain, Greece, and Croatia.

Twelve Member States recorded no very strong heat stress days in 2024, with this occurring predominantly in Northern Europe. However, results for the indicator "Excess mortality during summer" show that three of the Member States with the highest excess mortality in summer 2025 are also located in Northern Europe: Denmark, Estonia, and Sweden. This apparent contrast may be due to national infrastructure predominantly oriented towards heating and passive construction measures designed for cold conditions, leaving populations poorly equipped to manage significant rises in outdoor temperatures during summer periods.

4.4. Population Living in Dwellings whose Energy Efficiency had been Improved in the last 5 years

i.Current situation

According to the European Commission Recommendation on Energy Poverty (2023), EP is directly linked to three factors: low income, high energy expenditure, and poor household energy efficiency. The importance of the energy efficiency dimension in EP measurement is reflected in the EPAH indicators framework through the building stock and energy consumption subtopics (EPAH, 2022; EPAH, 2023), and is further underscored by the recent EU-SILC Energy Efficiency Module, which collected seven energy efficiency variables, four mandatory and three optional. Prior to this module, due to data availability constraints, the EPAH framework lacked indicators capable of directly measuring progress in dwelling energy efficiency or assessing the impact of programmes and funding schemes supporting the implementation of energy efficiency measures.

The indicator "Population living in dwellings whose energy efficiency had been improved in the last 5 years" measures the share of the population aged 16 or older living in dwellings with energy efficiency improvements made in the past 5 years. This includes all measures affecting the thermal conditions of the dwelling, such as the application of thermal insulation to external walls, roofs, or floors, the replacement of windows with more efficient units such as double or triple-glazed glass, and the installation of more efficient heating systems. While Eurostat provides this information only as a general improvement measure, some national databases disaggregate it by type of intervention, including improvements to thermal insulation of external walls, roof, or floor, replacement of single-glazed windows, or substitution of heating systems.

Data for this indicator are obtained from Eurostat (code ilc_lvhe08). Figure 17 presents the most recent available map of results, extracted from the EPAH dashboard, and Figure 18 shows the corresponding bar chart, both based on 2023 data covering 27 GEOs. Additional information on updated data and disaggregation options is available in Appendix B. Data for the indicator “Population living in dwellings whose energy efficiency had been improved in the last 5 years” are reported solely at the national scale, since no breakdown is provided for regional levels (NUTS I, II, or III).

A more detailed analysis of building energy efficiency and its relationship with EP conditions in the EU can be found in the EPAH report (EPAH, 2026).

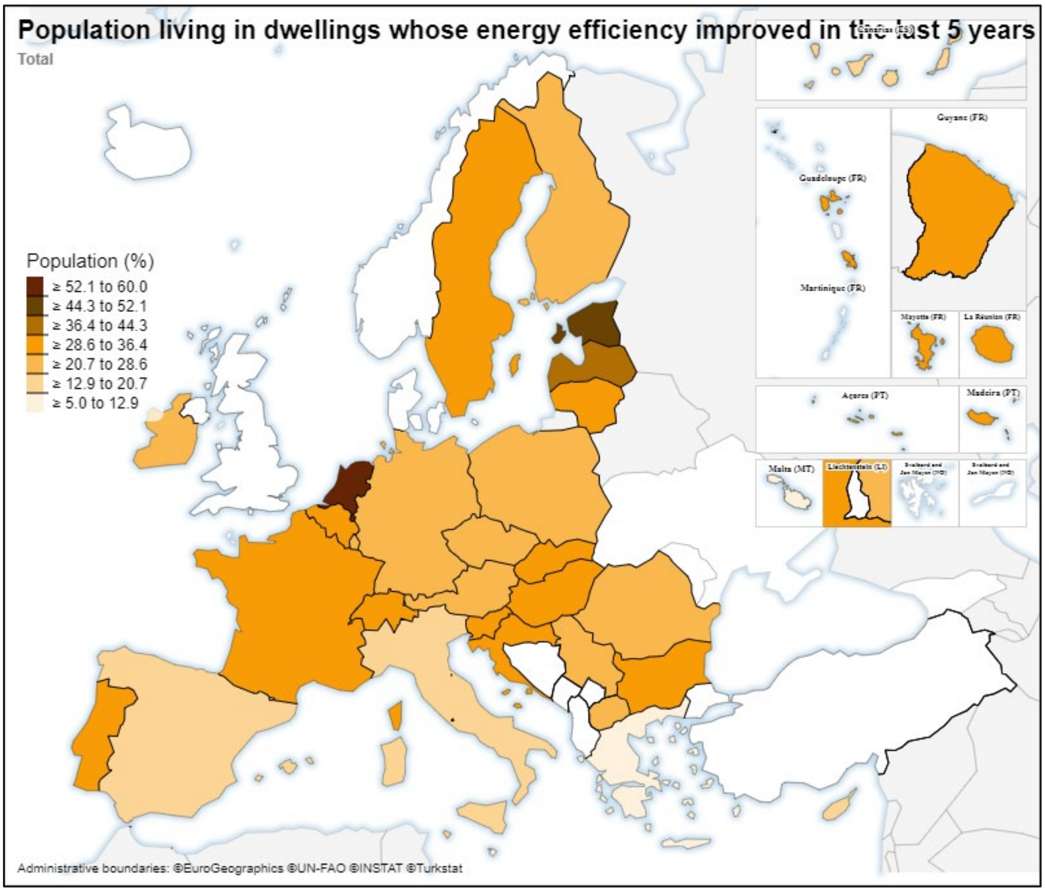


Figure 17. Map – Population living in dwellings whose energy efficiency had been improved in the last 5 years – 2023 (EPAH dashboard, 2026).

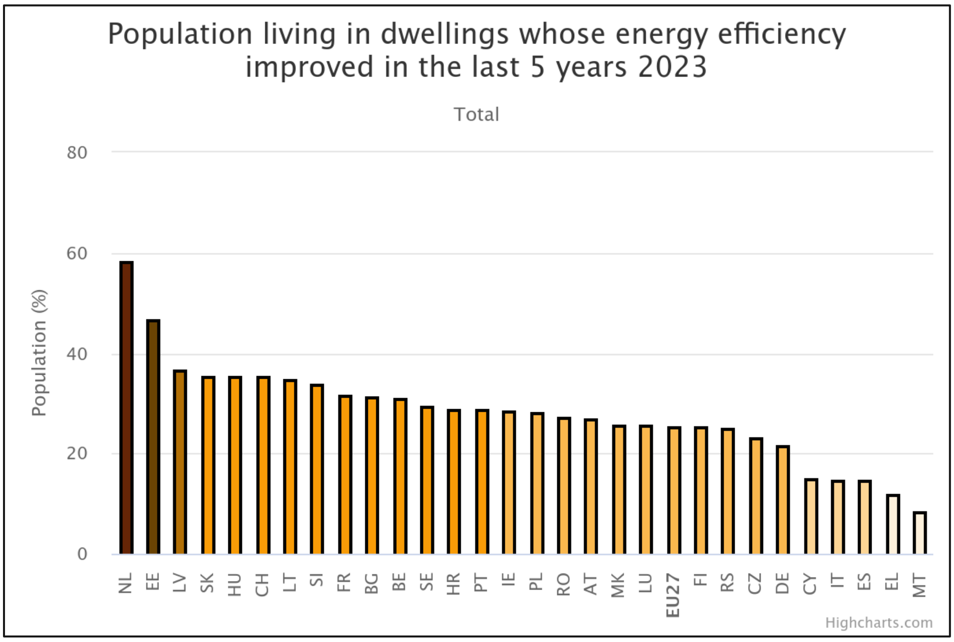


Figure 18. Bar chart and updated data – Population living in dwellings whose energy efficiency had been improved in the last 5 years – 2023 (*Eurostat*).

ii.Technical details

Table 11 presents the technical details for the "Population living in dwellings whose energy efficiency had been improved in the last 5 years" indicator, including the statistical code used in the data source, the identification name used in the EP indicators section of the EPAH dashboard, the period of available data, the number of GEOs represented in the most recent update relative to the maximum 44-GEO list, and the data source used.

This indicator can be associated with the CoM indicator "Share of buildings renovated per year", included in the CoM Reporting Guidelines on Energy Poverty (2025).

Table 11. Population living in dwellings whose energy efficiency had been improved in the last 5 years - Indicator technical details.

(Sub)Topics	Name	Timeline	#GEO	Source
Facilities/Housing **Building Stock**	Population living in dwellings whose energy efficiency had been improved in the last 5 years	2023	32/44[18]	Eurostat (ilc_lvhe08)

iii.Rationale

The new indicator "Population living in dwellings whose energy efficiency had been improved in the last 5 years" brings relevant insights into the national progress towards enhancing household energy efficiency, a key factor to actively help to mitigate EP conditions. Moreover, this indicator helps reduce gaps across indicators of energy efficiency across different measures, as the existing EPAH indicators under the Facilities/Housing subtopic are more closely associated with dwelling conditions or with the presence and type of heating and cooling systems.

iv.Limits and Application Suggestions

The relationship between energy efficiency and EP has been consistently identified in the literature as inverse: improvements in household energy efficiency, particularly through building retrofit interventions, reduce energy consumption and associated expenditure for space heating and cooling (Boemi and Papadopoulos, 2019). This relationship is reinforced by gains in indoor thermal comfort resulting from improved energy performance (Aranda *et al.*, 2017).

A further dimension concerns the relationship between energy efficiency and income inequality. Government-funded energy efficiency programmes targeting low-income households can help reduce

[18] Data for the indicator "Population living in dwellings whose energy efficiency improved in the last 5 years" is available for 32 GEOs, namely 31 countries (Albania, Austria, Belgium, Bulgaria, Croatia, Cyprus, Czechia, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, North Macedonia, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, and Switzerland) and 1 aggregate (EU-27).

financial vulnerability by lowering energy costs, reducing up-front cost investments, and increasing disposable income (Dong, Dou, and Jiang, 2022). Improving energy efficiency in the most vulnerable households is therefore an important lever for mitigating EP conditions more broadly, as the Social Climate Fund aims to do.

The type and depth of energy efficiency measures adopted can vary considerably in their impact on dwelling performance. Thermal insulation is widely regarded as one of the most effective measures, particularly when implemented during construction or major renovation, as it reduces heat flux and lowers energy demand for both heating and cooling (Aditya *et al.*, 2017; Gouveia and Palma, 2019). Window efficiency is equally significant, as high-performance units reduce heat losses and allow natural light to enter, potentially reducing the need for artificial lighting (Kaasalainen *et al.*, 2020). Even replacing old or malfunctioning heating and cooling equipment with more efficient units can lead to meaningful reductions in energy use and expenditure (Palma *et al.*, 2022; Khafiso, Adekunle, and Aigbavboa, 2025). The fact that this indicator does not specify the type of intervention undertaken is therefore an important constraint, as it limits the precision with which the impact of specific measures on household energy performance and EP mitigation can be assessed.

Since this indicator captures only the recent implementation of energy efficiency measures rather than their actual impact on energy performance, it is most valuable when analysed alongside indicators that better translate energy efficiency improvements into EP outcomes, such as "Dwellings with energy label A", "Population living in dwellings with presence of leak, damp and rot", "Persons living in a dwelling not comfortably warm during winter", and "Share of households unable to keep the dwelling comfortably cool in the summer".

The following limits and use cases illustrate the constraints and analytical potential of this indicator:

- Limit 1: A household where a single window was replaced with a double-glazed unit and a household where thermal insulation was applied to all external walls and all windows were replaced are treated equivalently by this indicator, despite the substantially different impacts on energy performance, indoor thermal comfort, and EP mitigation potential.
- Limit 2: A household where only windows were replaced with more efficient units, without any accompanying thermal insulation, is treated equivalently by this indicator to one where a comprehensive envelope upgrade was carried out, despite the potentially marginal impact of window-only replacement on indoor thermal comfort and energy performance.
- Use-case 1: A household undertaking a comprehensive renovation that incorporates multiple active and passive energy-efficiency measures may achieve substantial improvements in indoor thermal comfort, alongside meaningful reductions in energy consumption and expenditure, illustrating the full mitigation potential of deep retrofit interventions.

v.Updates

The most recent data reveal considerable variation across countries, ranging from nearly 60% in the Netherlands to 8.4% in Malta. The EU-27 average of approximately 26% indicates that a significant share of the population across Member States lives in dwellings where no energy efficiency improvements have been made in the last five years.

Notable disparities are observed between Northern and Southern European countries. Northern countries generally record higher values, reflecting long-standing national traditions of building renovation supported by public policies and funding schemes. Southern countries tend to present lower values, which may partly reflect the more recent uptake of building renovation programmes in these regions.

4.5. At-Risk-of-Poverty Rate

i. Current situation

The indicator "At-risk-of-poverty rate" measures the share of the population whose equivalised disposable income after social transfers falls below a specific poverty threshold, defined as 60% of the national median equivalised disposable income.

It is worth noting that the EPAH dashboard already includes the related indicator "At risk of poverty or social exclusion", which, while similar in nature, is not equivalent. The "At-risk-of-poverty rate" captures only the income dimension, whereas "At risk of poverty or social exclusion" additionally incorporates material and social deprivation and very low household work intensity. Including both indicators in the EPAH dashboard enables a more comprehensive understanding of EP, reflecting both monetary poverty and broader social vulnerability.

Figure 19 presents the most recent available map of results for this indicator, extracted from the EPAH dashboard, and Figure 20 shows the corresponding bar chart, both based on 2025 Eurostat data (code ilc_li02) covering 32 GEOs. Additional information on updated data and disaggregation options is available in Appendix B. The available data for the indicator “At-risk-of-poverty rate” is based exclusively on national values, as no disaggregated data exist for regional classifications such as NUTS I, II, or III.

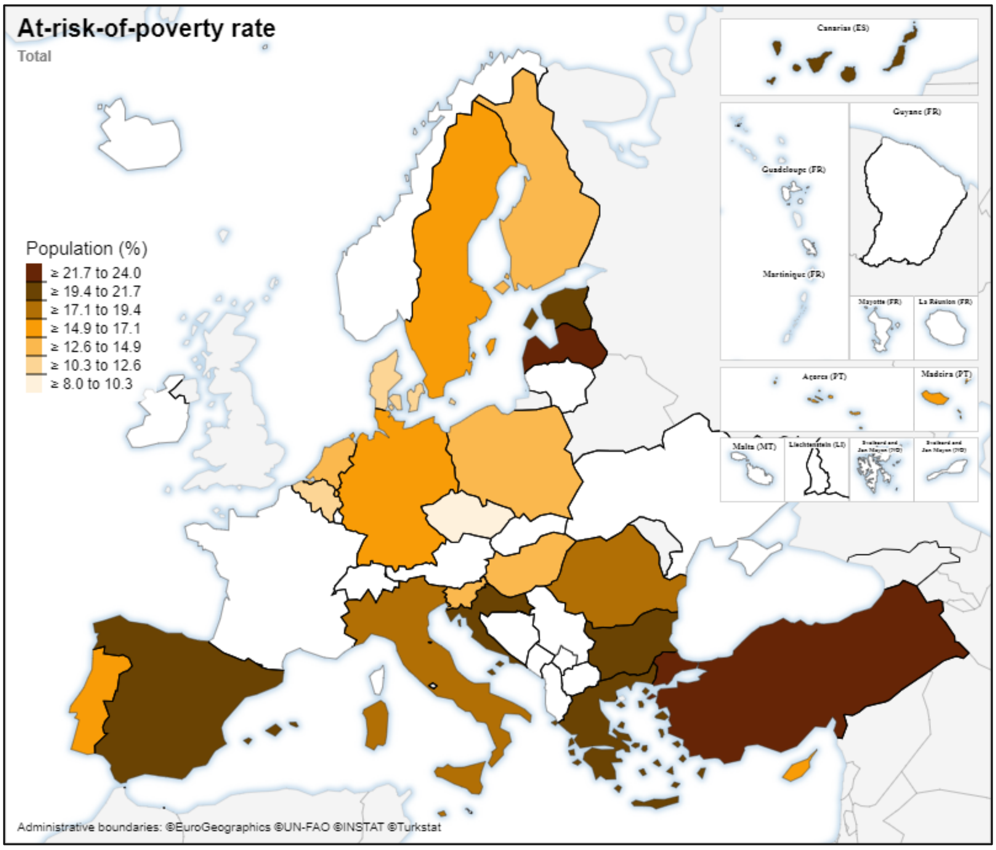


Figure 19. Map – At-risk-of-poverty rate – 2025 (EPAH dashboard, 2026).

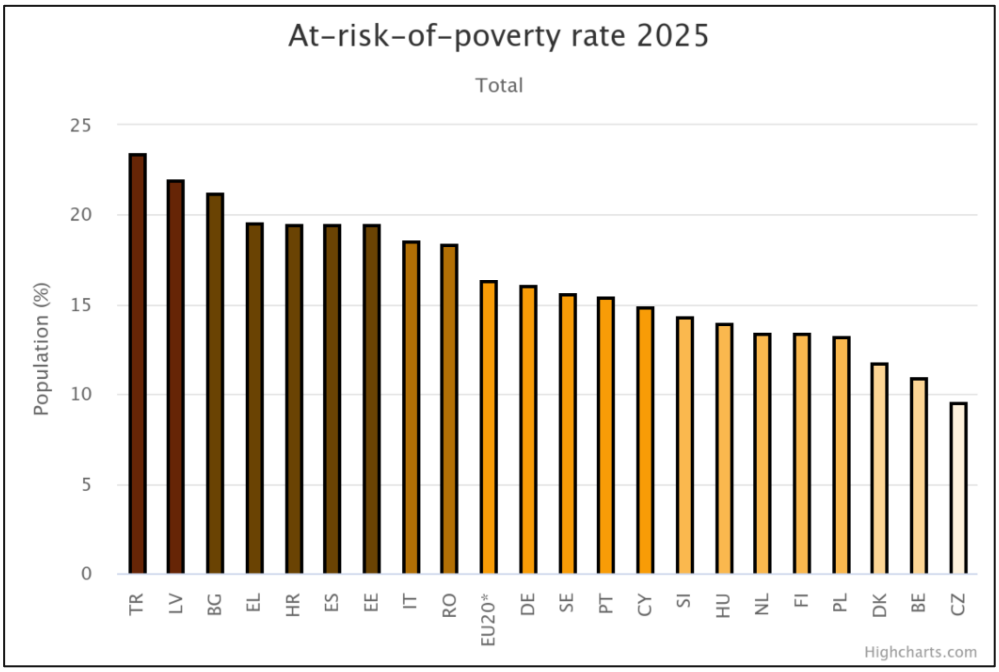


Figure 20. Bar chart and updated data – At-risk-of-poverty rate – 2025 (Eurostat).

Note: EU20 is the average value of the indicator obtained for the 20 EU Member States with available data for the period.

ii. Technical details

Table 12 presents the technical details for the "At-risk-of-poverty rate" indicator, including the statistical code used in the data source, the identification name used in the EP indicators section of the EPAH dashboard, the period of available data, the number of GEOs represented in the most recent update relative to the maximum 44-GEO list, and the data source used.

Table 12. At-risk-of-poverty rate - Indicator technical details.

(Sub)Topics	Name	Timeline	#GEO	Source
Socio-economic aspects	At-risk-of-poverty rate	2000-2025	32/44[19]	Eurostat (ilc_li02)

[19] Data for the indicator "At-risk-of-poverty rate" is available for 32 GEOs for 2024, namely 31 countries (Austria, Belgium, Bulgaria, Croatia, Cyprus, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, and Türkiye) and 1 aggregate (EU-27). Data for 2025 is still being updated, with available information for 21 countries (Belgium, Bulgaria, Croatia, Cyprus, Czechia, Estonia, Finland, Germany, Greece, Hungary, Italy, Latvia, Netherlands, Poland, Portugal, Romania, Slovenia, Spain, Sweden, Turkey) and 1 aggregate (EU-20).

(Socio-economic and living conditions)				

iii. Rationale

The indicator “At-risk-of-poverty rate” is one of the four EP indicators referenced in the revised Energy Efficiency Directive (EU) 2023/1791, which requires Member States to include it in their national EP assessments and energy and climate plans, alongside "Inability to keep the home adequately warm", "Arrears on utility bills", and "Population living in a dwelling with leak, damp or rot" (European Parliament and Council, 2023). Of these four EED indicators, the "At-risk-of-poverty rate" was the only one not yet included in the EPAH dashboard. Its addition ensures that Member States have access to up-to-date information on all four EED indicators in a single framework, supporting the development of national EP assessments and targeted mitigation plans

iv. Limits and application suggestions

The limitations of the "At-risk-of-poverty rate" are broadly similar to those of the "At risk of poverty or social exclusion" indicator, discussed in a previous EPAH report (EPAH, 2022). It should be noted, however, that the "At-risk-of-poverty rate" is comparatively narrower in scope, as it does not capture material deprivation or social exclusion. Social exclusion may arise from factors beyond income poverty, though it remains closely associated with it.

The principal limitation of both indicators for EP assessment is that they reflect general poverty rather than EP specifically. Neither includes any component or disaggregation that explicitly captures households' inability to meet basic energy needs. The relationship between general poverty and EP is not straightforward: the drivers of EP are multidimensional and extend beyond monetary poverty to encompass regional climate conditions, socioeconomic structures, policy environments, and energy market heterogeneity across Member States (Certomà *et al.*, 2023).

As with the indicator "At risk of poverty or social exclusion" (EPAH, 2022), cross-analysis with energy expenditure and energy efficiency indicators is recommended to improve the EP relevance of results. Relevant indicators for this purpose include "Share of household income allocated to expenditure, by purpose", "Share of households unable to keep the dwelling comfortably cool in the summer", "Inability to keep home adequately warm", "Population living in a dwelling with presence of leak, damp, and rot", and "Persons living in dwellings whose energy efficiency had been improved in the last 5 years".

The following limits and use cases illustrate the constraints and analytical potential of this indicator:

- Limit 1: A household may fall below the income poverty threshold without experiencing EP, if it resides in a highly energy-efficient dwelling, benefits from subsidised energy tariffs, or has access to low-cost or no-cost energy sources.
- Limit 2: A middle-income household living in a dwelling with poor energy performance, located in a region exposed to extreme climate conditions, may face substantial energy expenditure to maintain adequate indoor comfort and thus experience EP despite not being classified as income-poor.

- Use-case 1: A household with income below the poverty threshold may restrict appliance use to limit energy costs, even at the expense of adequate indoor thermal comfort. Limited financial capacity may also prevent the maintenance or replacement of inefficient equipment and contribute to arrears on utility bills, compounding existing vulnerability conditions.

v. Updates

According to 2024 data, the five countries with the highest shares of the population at risk of poverty are either more recent EU members, specifically Bulgaria, Latvia, Lithuania, and Croatia, or non-EU Member States, specifically Turkey.

4.6. Population that is Materially and Socially Deprived and Owns a Car

i. Current situation

The indicator "Population that is Materially and Socially Deprived (MSD) and owns a car" measures the share of the population in MSD conditions that reports owning a car. In the literature, the condition in which a citizen owns a car despite economic constraints is referred to as Forced Car Ownership (FCO), a situation associated with higher transport-related expenses and greater vulnerability to fuel price fluctuations (Mattioli, 2017).

Data for this indicator are drawn from a study by the Directorate-General for Employment, Social Affairs and Inclusion of the European Commission and the Oeko-Institut. The study is depicted in the EU report "Transport Poverty: Definitions, Indicators, Determinants, and Mitigation Strategies" (European Commission, 2024) and combines EU-SILC data on the population in MSD conditions with self-reported car ownership. Figure 21 presents the most recent available map of results for this indicator, extracted from the EPAH dashboard, and Figure 22 shows the corresponding bar chart, both based on 2022 data. Additional information on updated data is available in Appendix B. The dataset underpinning the indicator "Population that is MSD and owns a car" is available exclusively at the national level, as no disaggregated data exist for regional classifications such as NUTS I, II, or III.

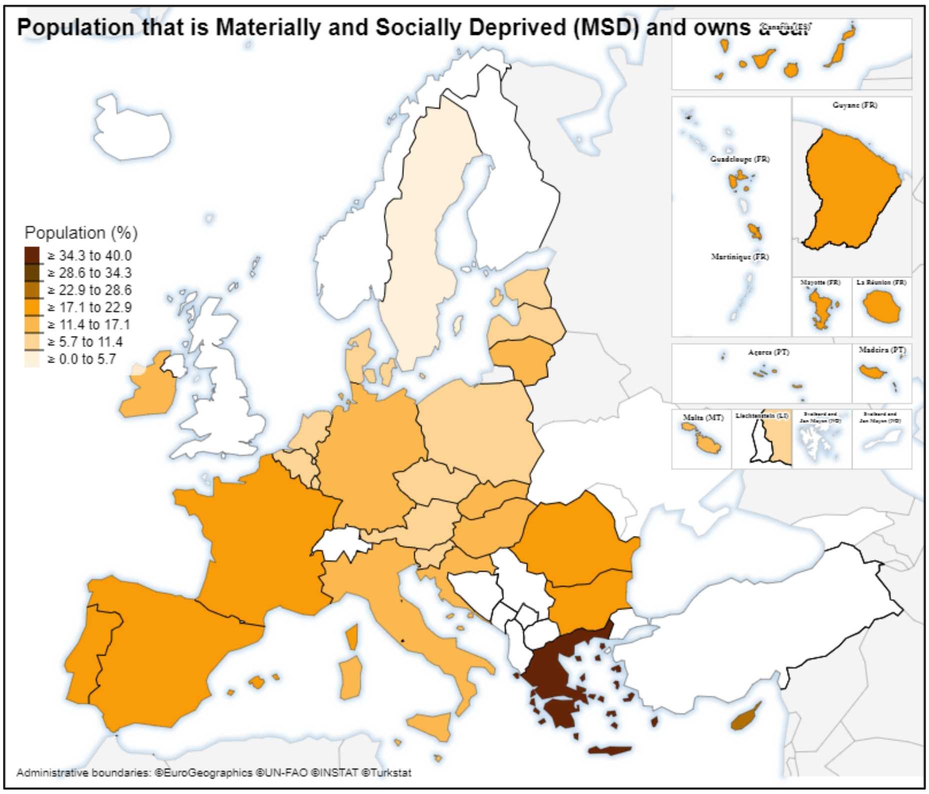


Figure 21. Map – Population that is MSD and owns a car – 2022 (EPAH dashboard, 2026).

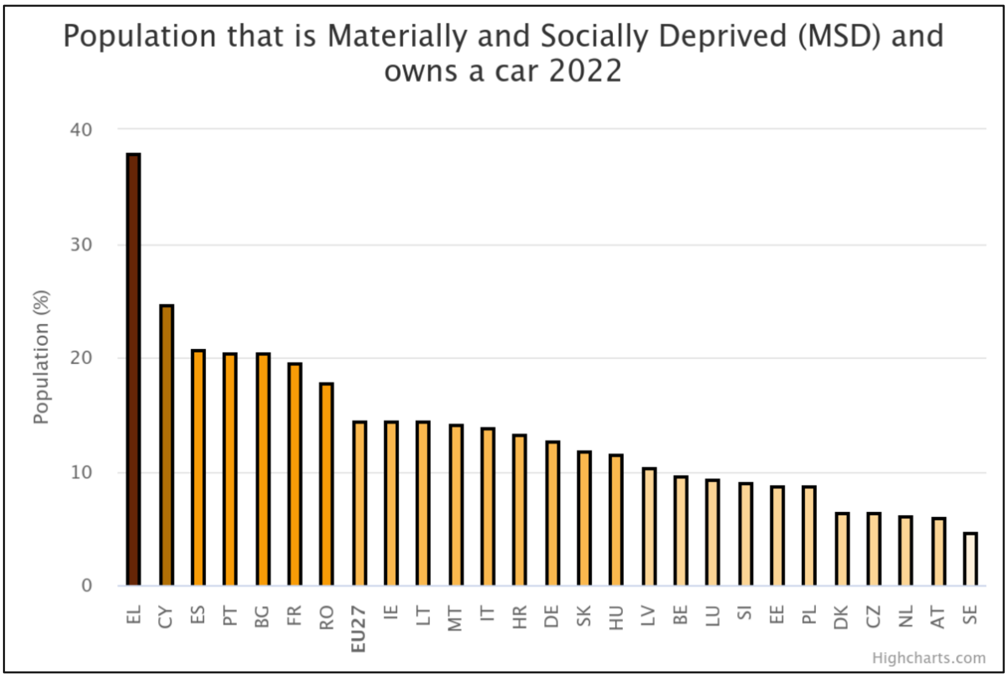


Figure 22. Bar chart and updated data – Population that is MSD and owns a car – 2022 (DG EMPL and Oeko-Institut).

ii.Technical details

Table 13 presents the technical details for the "Population that is MSD and owns a car" indicator, including the statistical code used in the data source, the identification name used in the EP indicators section of the EPAH dashboard, the period of available data, the number of GEOs represented in the most recent update relative to the maximum 44-GEO list, and the data source used. It should be noted that the definition of MSD applied in the dataset corresponds to the one in effect until 2020. No disaggregation options are available for this indicator.

Table 13. Population that is MSD and owns a car - Indicator technical details.

(Sub)Topics	Name	Timeline	#GEO	Source
Mobility	Population that is MSD and owns a car	2016-2022	28/44[20]	DG EMPL and Oeko-Institut

While the CoM Reporting Guidelines on Energy Poverty include several mobility-related indicators, none can be directly linked to the indicator "Population that is MSD and owns a car".

[20] Data for the indicator “Share of the population that is MSD and owns a car” is available for 28 GEOs, namely 27 countries (Austria, Belgium, Bulgaria, Croatia, Cyprus, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, and Sweden) and 1 aggregate (EU-27).

iii.Rationale

The inclusion of the indicator “Population that is MSD and owns a car” in the EPAH indicators provides relevant information on households that already face vulnerability conditions or EP scenarios and own a car. Analysing this indicator provides a deeper understanding of possible connections between EP and transport poverty, enabling evaluation of FCO conditions and their respective effects on the population. Additionally, this new indicator is part of the endeavour to include multifaceted indicators and unveil vulnerability conditions associated with the multiple dimensions of the problem.

iv.Limits and application suggestions

Transport poverty is defined as the difficulty or inability to afford or access the transport needed to reach essential services such as education, healthcare, or the workplace (DG EMPL, 2024). To support Member States in addressing this issue, the JRC launched the Transport Poverty Hub Dashboard, a tool for analysing indicators related to accessibility, adequacy, affordability, and the availability of mobility solutions at both national and regional levels. Transport poverty must be analysed in relation to household EP conditions, given the overlapping drivers that underlie both problems and the value of a transdisciplinary approach to EP measurement (Awaworyi Churchill and Smyth, 2019; EPAH, 2023; Dingley *et al*., 2025).

The relationship between car ownership and disposable income is well established in the literature. A car is among the most expensive consumer goods, carrying significant costs related to purchase, maintenance, fuel, and insurance (Gössling, Kees, and Litman, 2022). Nevertheless, specific structural conditions can generate FCO scenarios, including low-quality, limited-coverage, unsafe, or unaffordable public transport, which produce societal inequalities and mobility deprivation (Sun and Thakuriah, 2021). Peripheral urban housing increases daily commuting distances and creates transport needs outside peak hours that public transport may not adequately serve (Curl, Clark, and Kearns, 2018). Rural and low-density areas may lack public transport altogether, making private vehicles the only viable option (Velaga *et al*., 2012). Households including persons with reduced mobility, physical disabilities, advanced age, or chronic health conditions can also be susceptible to FCO regardless of available public transport options (Goralzik *et al*., 2022).

The conditions that effectively compel car ownership can lead to higher transport expenditure, reducing available income and generating financial stress and deprivation in other essential areas, including energy, food, and housing costs. These effects are particularly pronounced among vulnerable groups and can aggravate pre-existing EP conditions or create new ones, in some cases pushing middle-income households into EP (Curl, Clark, and Kearns, 2018). This dynamic underscores the importance of including transport poverty indicators in household EP analysis to better understand the problem's underlying drivers.

It is important to note that the relationship between car ownership and income is not straightforward. In high-density cities with high-quality, affordable public transport and well-developed infrastructure for alternative mobility options, voluntary car-free households are increasingly observed among those not facing material or social deprivation (Tozluoğlu, Liao, and Spray, 2024; van Eenoo, 2023). This highlights the value of an indicator that does not focus solely on car ownership but combines it with a vulnerability dimension, providing a more reliable picture of the impacts of FCO on the population.

When applying this indicator, it is essential to first assess whether car ownership is genuinely voluntary or effectively compelled by structural conditions. Only after making this distinction should the underlying drivers be examined, including urban density, public transport availability, and peripheral housing patterns, to identify the specific conditions that explain the observed national results.

The following limits and use cases illustrate the constraints and analytical potential of this indicator:

- Limit 1: Countries with a higher share of the population living in rural areas may record higher values not because of greater MSD prevalence, but because limited public transport access and longer commuting distances make car ownership a practical necessity. The same applies to countries with low-quality, unaffordable, or limited-coverage public transport.
- Limit 2: Households in MSD or EP conditions may still own a car out of personal preference, even in urban areas with affordable and accessible public transport, which limits the indicator's precision in identifying FCO scenarios.
- Use-case 1: Even households living in energy-efficient dwellings with efficient equipment may report arrears on utility bills or EP conditions due to FCO-related costs, illustrating the connection between transport expenditure and broader household vulnerability.
- Use-case 2: Households with reduced mobility or physical disabilities may need to own a car to access medical care or other essential services due to limited public transport accessibility, poor service quality, or physical inability to use available options.

v.Updates

Considerable disparities are observed across the countries with available data, ranging from nearly 40% of the population in Greece who are MSD and own a car to less than 5% in Sweden. These differences may reflect not only variation in MSD prevalence but also differences in public transport infrastructure, accessibility and affordability, and average daily commuting distances. The EU-27 average of 14.5% is notably higher than the majority of individual national results.

4.7. Household Final Consumption Expenditure Allocated to Transport Costs

i. Current situation

The indicator "Household final consumption expenditure allocated to transport costs" was derived by disaggregating the indicator "Household final consumption expenditure by purpose", as described in section 3.5. It measures the share of total household expenditure allocated to transport costs, covering both the acquisition and operation of private transport, including vehicle purchase, fuel, maintenance, and insurance, as well as transport services such as tickets, fares, and public transport. This indicator directly captures the financial impact of transport costs on household expenditure, which are strongly influenced by commuting distances, fuel price variations, income inequality, public transport quality and accessibility, and urban density (Cascajo *et al.*, 2018).

Data are drawn from the Eurostat dataset "Household final consumption expenditure by purpose" (nama_10_cp18). Figure 23 presents the most recent available map of results for this indicator, extracted from the EPAH dashboard, and Figure 24 shows the corresponding bar chart, both based on 2024 data. Additional information on updated data and disaggregation options is available in Appendix B. The available data for the indicator “Household final consumption expenditure allocated to transport costs” is based exclusively on national values, as no disaggregated data exist for regional classifications such as NUTS I, II, or III.

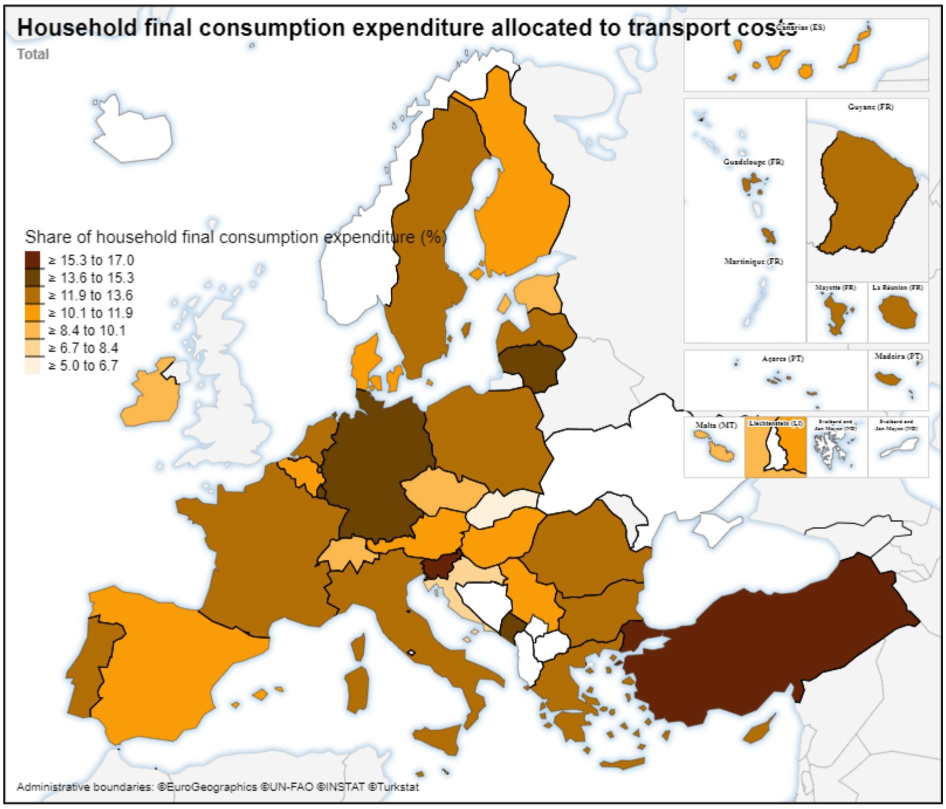


Figure 23. Map – Household final consumption expenditure allocated to transport costs – 2024 (EPAH dashboard, 2026).

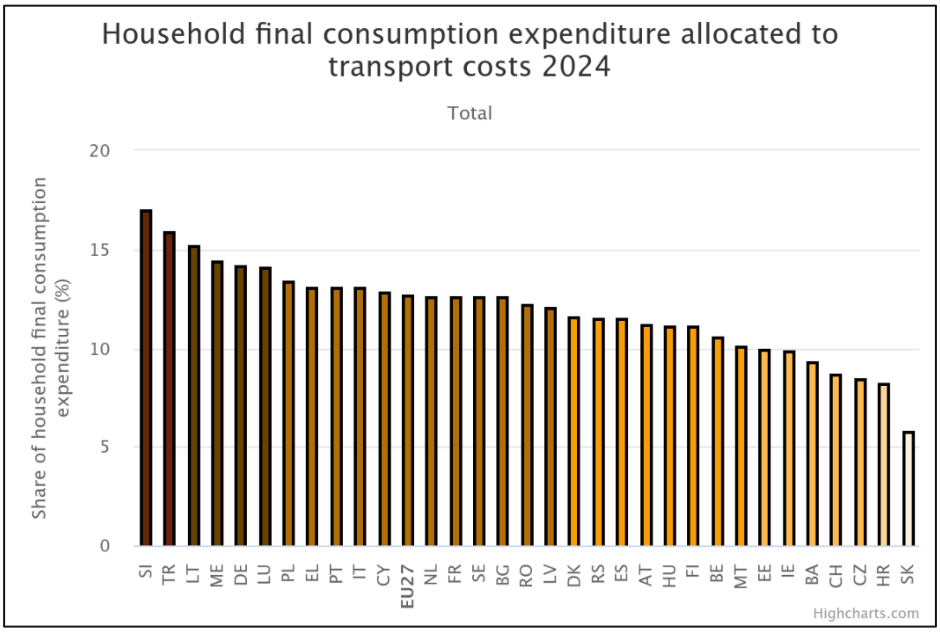


Figure 24. Bar chart and updated data – Household final consumption expenditure allocated to transport costs – 2024 (*Eurostat*).

ii. Technical details

Table 14 presents the technical details for the "Household final consumption expenditure allocated to transport costs" indicator, including the statistical code used in the data source, the identification name used in the EP indicators section of the EPAH dashboard, the period of available data, the number of GEOs represented in the most recent update relative to the maximum 44-GEO list, and the data source used.

Table 14. Household final consumption expenditure allocated to transport costs - Indicator technical details.

(Sub)Topics	Name	Timeline	#GEO	Source
Mobility	Household final consumption expenditure allocated to transport costs	2015-2024	32/44[21]	Eurostat (nama_10_cp18)

This indicator can be associated with two CoM indicators included in the CoM Reporting Guidelines on Energy Poverty: "Inhabitants/households receiving support to pay public transport services/public transport users" and "Social housing apartments not having easy access to public transport/all social housing apartments".

iii. Rationale

Including the indicator “Household final consumption expenditure allocated to transport costs” among the EPAH indicators enables the assessment of the relative impact of transport-related costs within total household expenditure. As a result, it enables the identification of potential vulnerability situations arising from exacerbated transport costs, particularly when combined with other indicators reflecting financial and/or social vulnerability, such as the “At-risk-of-poverty rate” and “At risk of poverty or social exclusion”, thereby unveiling possible dimensions of EP.

iv. Limits and application suggestions

Analysing the share of household final consumption expenditure spent on transport is essential for evaluating transport poverty at the country level. Financial stress resulting from high transport expenditure can affect multiple dimensions of daily life, particularly where income and social inequalities are pronounced, urban growth is unplanned, housing is peripheral, and public transport is inaccessible or unaffordable (Tiznado-Aitken *et al.*, 2022).

[21] Data for the indicator “Share of the household final consumption expenditure allocated to transport costs” is available for 32 GEOs, namely 31 countries (Austria, Belgium, Bulgaria, Croatia, Cyprus, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Montenegro, Netherlands, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, and Türkiye) and 1 aggregate (EU-27).

The relationship between income and transport expenditure has been extensively studied. Higher income inequality is associated with greater overall transport expenditure, driven largely by higher spending on luxury transport among high-income households (Hussain *et al.*, 2024). However, lower-income households typically spend a larger share of their income on transport, particularly in rural areas (Chatterton, 2018). The nature of transport expenditure also varies by income level: while lower-income families bear higher relative costs for public transport and vehicle maintenance, higher-income families allocate a greater proportion of their transport spending to vehicle acquisition and travel (Cascajo *et al.*, 2018). The most challenging scenarios arise among low-income families in FCO conditions, where transport costs generate financial stress and make it difficult to meet other essential needs, including energy, housing, and food costs (Dingley *et al.*, 2025).

A significant constraint of this indicator is the absence of disaggregation by income level. This limits the depth of analysis possible regarding differences between low and high-income households in the share of income spent on transport, which would be particularly valuable for designing targeted policies to reduce transport costs for the most vulnerable citizens in countries where lower-income families bear a disproportionately high transport burden.

The quality, accessibility, and affordability of public transport in specific Member States can further drive up the transport income share through FCO conditions that the indicator does not directly capture. The share of the population living in rural or peripheral urban areas also influences results, as these locations are associated with longer commuting distances and reduced or absent public transport access. These constraints collectively highlight the need for income-disaggregated transport expenditure data to enable more precise EP assessments.

A combined analysis of this indicator with indicators measuring the share of income spent on energy, housing, and food can provide a more comprehensive picture of the overall burden of essential daily expenditure on household budgets and its relationship with EP conditions.

The following limits and use cases illustrate the constraints and analytical potential of this indicator:

- Limit 1: A household may spend a higher share of its income on transport due to personal preferences rather than structural necessity, in contexts where FCO conditions do not apply, and adequate public transport is available, which limits the indicator's ability to distinguish voluntary from compelled transport expenditure.
- Use-case 1: Low-income families living in areas without adequate public transport infrastructure may spend a significant share of their income on private transport due to FCO conditions, potentially compounding existing vulnerability and EP situations.
- Use-case 2: Households that own a car are exposed to fuel price fluctuations. Among low and middle-income populations, sharp price increases can substantially raise transport costs and generate economic hardship, particularly for those with long daily commuting distances or frequent travel needs.
- Use-case 3: Even an average share of income spent on transport can meaningfully increase the overall burden of essential expenditure, reducing resources available for other basic needs and

contributing to vulnerability, underscoring the importance of integrating transport costs into comprehensive EP assessments.

v. Updates

The EU-27 average share of household income spent on transport remained unchanged at 12.7% between 2023 and 2024. At the country level, however, the share decreased in most Member States, with only five countries recording an increase in 2024: Belgium, Germany, Italy, Cyprus, and Slovenia.

4.8. Population who Cannot Afford a Personal Car

i.Current situation

As part of the ongoing effort to broaden the EPAH indicator set and better capture the transport dimension of EP, the indicator "Persons who cannot afford a personal car" measures the share of the population who self-report being unable to afford a personal vehicle. It should be noted that the indicator does not account for differences in vehicle characteristics or average prices across countries; it reflects citizens' own perception of personal car affordability rather than an objective cost assessment.

Figure 25 presents the most recent available map of results for this indicator, extracted from the EPAH dashboard, and Figure 26 shows the corresponding bar chart, both based on 2025 data. The indicator has been updated annually since 2003, with at least one value available for 38 different GEOs. Detailed information on updated data and disaggregation options is available in Appendix B. The available data for the indicator "Population who cannot afford a personal car" is exclusively based on national values, as no disaggregated data exist for regional classifications such as NUTS I, II, or III.

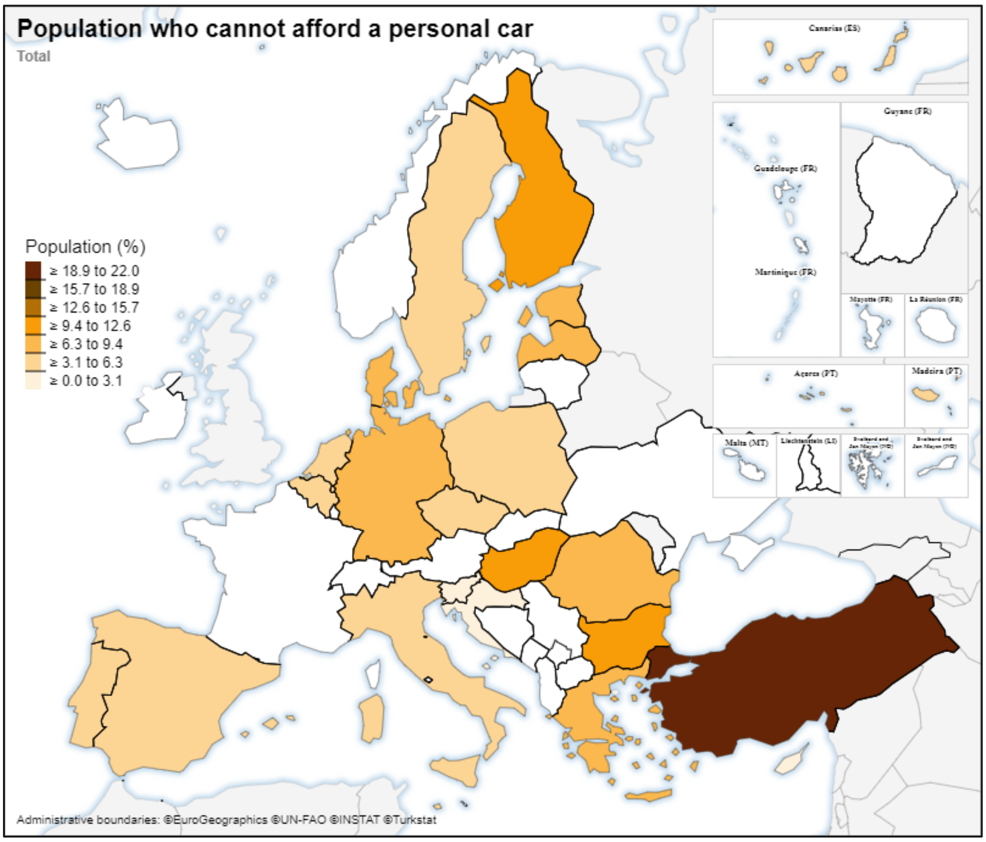


Figure 25. Map – Population who cannot afford a personal car – 2025 (EPAH dashboard, 2026).

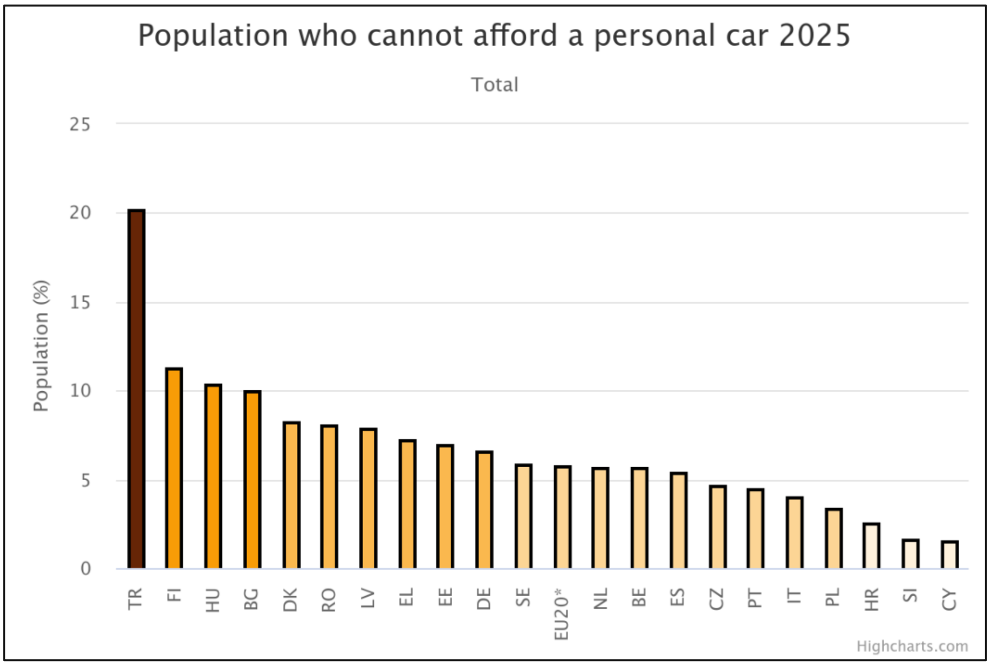


Figure 26. Bar chart and updated data – Population who cannot afford a personal car – 2025 (Eurostat).

Note: EU20 is the average value of the indicator obtained for the 20 EU Member States with available data for the period.

ii.Technical details

Table 15 presents the technical details for the "Population who cannot afford a personal car" indicator, including the statistical code used in the data source, the identification name used in the EP indicators section of the EPAH dashboard, the period of available data, the number of GEOs represented in the most recent update relative to the maximum 44-GEO list, and the data source used.

Table 15. Population who cannot afford a personal car - Indicator technical details.

(Sub)Topics	Name	Timeline	#GEO	Source
Mobility	Population who cannot afford a personal car	2015-2025	32/44[22]	Eurostat (ilc_mddu05)

While this indicator has no direct equivalent among the mobility indicators in the CoM Reporting Guidelines on Energy Poverty, which primarily focus on commuting distances and public transport

[22] Data for the indicator "Population who cannot afford a personal car" is available for 32 GEOs for 2024, namely 31 countries (Austria, Belgium, Bulgaria, Croatia, Cyprus, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg), Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, and Türkiye) and 1 aggregate (EU-27). Data for 2025 is still being updated, with available information for 21 countries (Belgium, Bulgaria, Croatia, Cyprus, Czechia, Estonia, Finland, Germany, Greece, Hungary, Italy, Latvia, Netherlands, Poland, Portugal, Romania, Slovenia, Spain, Sweden, Turkey) and 1 aggregate (EU20).

solutions rather than personal car affordability, complementary analysis using those CoM indicators can nonetheless yield valuable insights.

iii.Rationale

Even though it is based on personal perceptions of affordability of a private vehicle, including the indicator "Population who cannot afford a personal car" enables an analysis of the relation between financial constraints and car ownership. Identifying possible scenarios of households that do not own a vehicle due to existing vulnerabilities or general poverty levels captures scenarios of transport poverty and, in addition, may allow the identification of EP conditions when combined with other existing indicators related to energy expenditure, household energy efficiency, and thermal indoor comfort.

iv.Limits and application suggestions

A private car is among the most expensive items a household can own. A significant share of the population tends to underestimate the total costs of private vehicle ownership, often considering only the purchase price while overlooking other relevant expenditures such as fuel, vehicle depreciation, taxes, insurance, maintenance and repairs, and parking. These costs also occur at different intervals, ranging from daily or weekly payments, such as fuel and parking, to annual or occasional costs, such as insurance and repairs, making it particularly difficult to estimate average monthly ownership costs with precision (Andor *et al.*, 2020; Gössling, Kees, and Litman, 2022). As a result, assessments of car affordability are subject to considerable uncertainty and may vary substantially across Member States.

Vehicle size classification also strongly affects Total Car Ownership (TCO), with larger vehicles typically associated with higher purchase and maintenance costs (Cox *et al.*, 2020). Electric and internal combustion vehicles differ significantly in TCO as well, with purchase price and fuel costs accounting for the majority of the difference (Sendek-Matysiak and Grysa, 2021). The degree of urbanisation further influences TCO: rural areas are associated with longer commuting distances and more frequent private vehicle use than urban environments, leading to potentially higher fuel and maintenance costs (Pot and Piesch, 2024). Personal and cultural characteristics of specific regions may also affect perceptions of the minimum requirements for a private vehicle, further influencing affordability assessments (Klinger, Kenworthy, and Lanzendorf, 2013).

Several important constraints arise when applying this indicator in the context of EP vulnerability. First, limited knowledge of real TCO among respondents may lead to imprecise answers that rely only on purchase costs and exclude fuel, insurance, and maintenance. Second, variations in the minimum standards used to define car affordability, reflecting different household perceptions across countries, affect the cross-country comparability of results. Third, households with very low disposable income may report being unable to afford a car, not because of the specific cost of vehicle ownership, but because they cannot afford any significant additional expenditure given existing financial pressures. Analysing this indicator alongside other mobility-related EPAH indicators and socioeconomic EP indicators, such as "Arrears on utility bills" and "At risk of poverty or social exclusion", is therefore recommended for a more grounded understanding of transport poverty in a given country.

The following limits and use cases illustrate the constraints and analytical potential of this indicator:

- Limit 1: Respondents may report being able to afford a personal car based solely on purchase costs, without accounting for fuel, insurance, repairs, or associated taxes, due to limited awareness of real TCO. Conversely, reported inability to afford a car may reflect existing household vulnerabilities related to energy bills, rent, or other domestic expenditures rather than the cost of car ownership specifically.
- Use-case 1: Low-income families may be unable to afford a personal vehicle not only because of high purchase or fuel costs but also because of pre-existing financial vulnerability, burdensome domestic expenditure, and EP conditions that leave insufficient resources for any significant additional cost.

v.Updates

In 2024, the highest value within the EU was recorded in Romania at 16.0%, nearly three times the EU-27 average of 5.6%, followed by Hungary at 11.9%.

4.9. Population Using or not Public Transport, by Frequency

i. Current situation

The indicator "Population using or not public transport, by frequency" measures the share of the population that reported using or not using local public transport during the previous 12 months. Public transport includes buses, trams, trains, and underground or metro services, but excludes vehicles that can be privately rented on demand, such as taxis or shared vehicles. Usage is reported across five frequency classes: every day, every week, every month, less than once a month, and never.

Data are obtained from Eurostat (ilc_atst01), currently available only for 2024. Figure 27 presents the most recent available map of results for this indicator, extracted from the EPAH dashboard and considering the disaggregation by frequency ("every day"), and Figure 28 shows the corresponding bar chart. Additional information on updated data is available in Appendix B. The dataset underpinning the indicator "Population using or not public transport, by frequency" is available exclusively at the national level, as no disaggregated data exist for regional classifications such as NUTS I, II, or III.

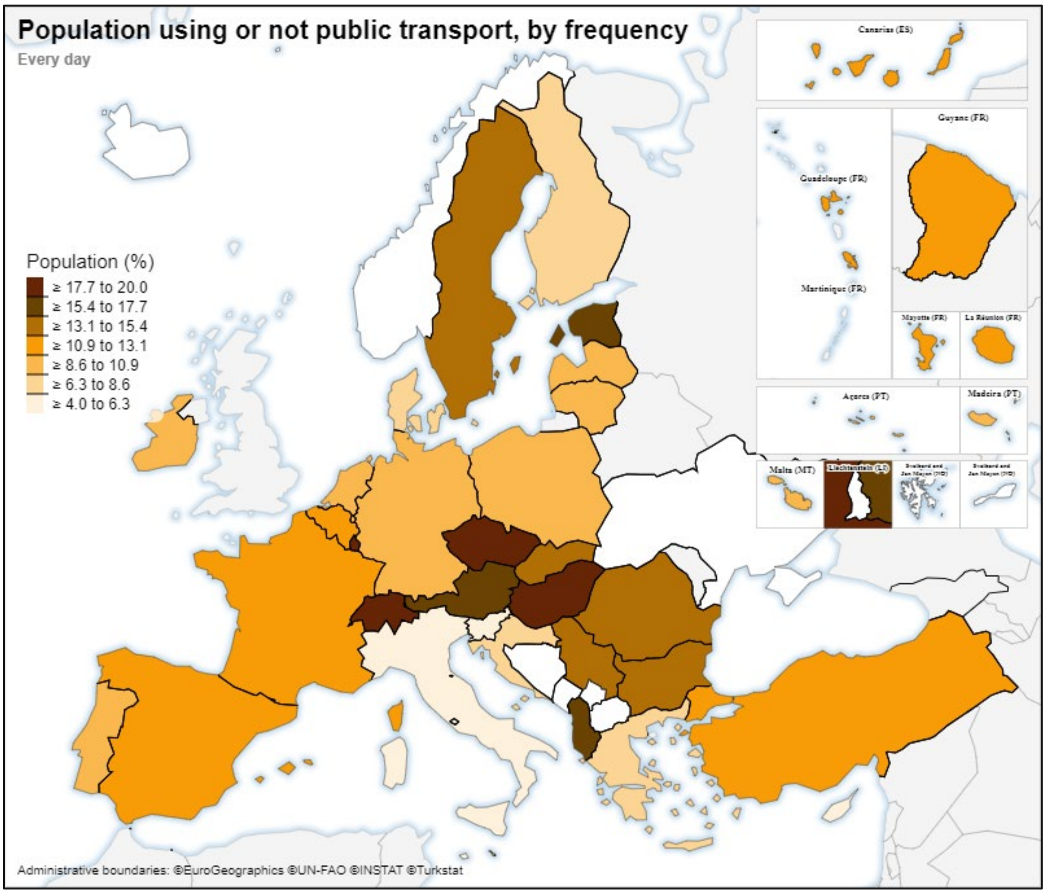


Figure 27. Map – Population using or not public transport, by frequency – Every day use – 2024 (EPAH dashboard, 2026).

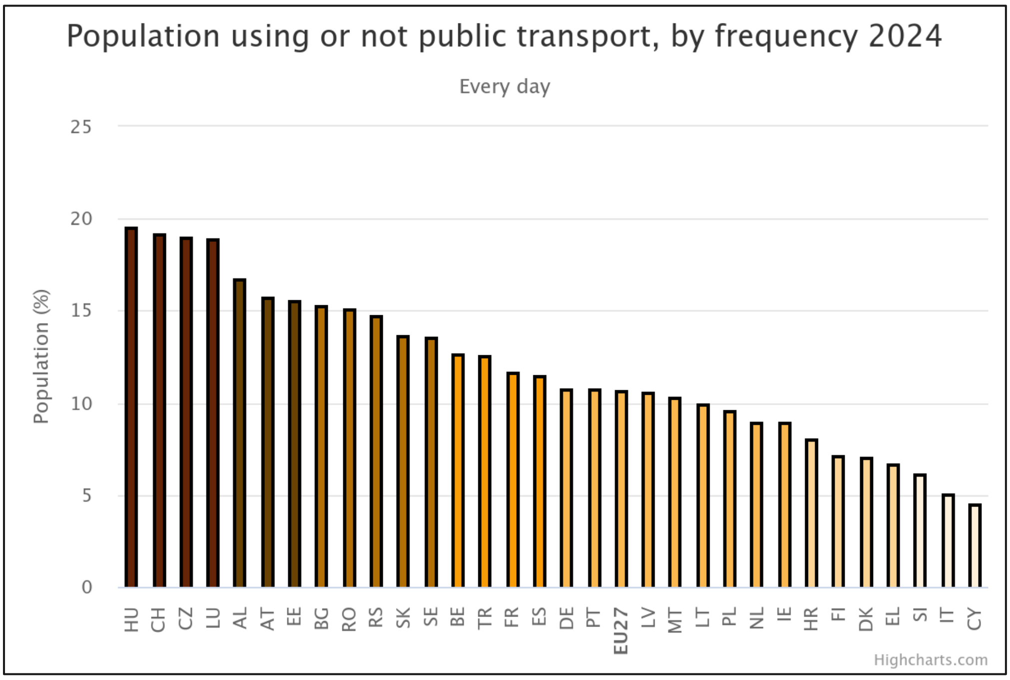


Figure 28. Bar chart and updated data – Population using or not public transport, by frequency – Every day use – 2024 (Eurostat).

ii. Technical details

Table 16 presents the technical details for the "Population using or not public transport, by frequency" indicator, including the statistical code used in the data source, the identification name used in the EP indicators section of the EPAH dashboard, the period of available data, the number of GEOs represented in the most recent update relative to the maximum 44-GEO list, and the data source used.

Table 16. Population using or not using public transport - Indicator technical details.

(Sub)Topics	Name	Timeline	#GEO	Source
Mobility	Population using or not public transport, by frequency	2024	33/44[23]	Eurostat (ilc_atst01)

This indicator can be associated with five mobility indicators in the CoM Reporting Guidelines on Energy Poverty: "Share of the population/households not having access to essential services within 1 hour by walking, cycling or public transport", "Share of the population/households living more than 1 km from the nearest public transport station", "The local public transport travel frequently enough, covering the

[23] Data for the indicator "Population using or not public transport, by frequency" is available for 32 GEOs, namely 31 countries (Albania, Austria, Belgium, Bulgaria, Croatia, Cyprus, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, and Türkiye) and 1 aggregate (EU-27).

essential necessities for the population", "Share of social housing apartments without easy access to public transport", and "Share of inhabitants/households receiving support to pay public transport services".

iii. Rationale

The indicator "Population using or not public transport, by frequency" allows a possible measure of quality, affordability, and accessibility of the existing public transport solutions in a specific country. Even though it is not possible to direct identify EP conditions through this indicator, combining it with other mobility ones, such as "Share of the population that is MSD and owns a car" and "Share of household final consumption expenditure allocated to transport costs", provides a deeper understanding of transport poverty main drivers, along with possible analysis with existing conditions of vulnerability and financial constraints. These combined analyses enable compound evaluations of EP and transport poverty, allowing for the definition of mitigation strategies focused on actively mitigating both problems.

iv. Limits and application suggestions

According to the European Commission's Flash Eurobarometer 561, 34% of respondents across EU-27 countries identified the availability of affordable and well-connected public transport as the most important improvement area in their cities. The two measures most frequently cited as priorities were increasing the frequency of public transport services and expanding connections to surrounding municipalities (European Commission, 2025).

Efficient, affordable, and accessible public transport can enable vulnerable groups and citizens living in peripheral urban areas to reduce the burden on their household budgets, participate in socioeconomic and cultural activities, and access urban centres with greater employment opportunities, thereby reducing mobility restrictions (Lucas *et al.*, 2016). Conversely, limitations in public transport disproportionately affect population groups with urgent or essential mobility needs, including the elderly, persons with chronic diseases, persons with reduced mobility, and children (Dourantes and Murauskaite-Bull, 2023).

Public transport use is closely linked to service quality, which can be assessed across four dimensions: frequency and reliability, comfort and safety, ticket pricing, and the quality of stops and station amenities (Minelgaitė, Dagiliūtė, and Liobikienė, 2020). In rural areas, longer commuting distances and relatively low demand due to sparse populations make public transport infrastructure economically challenging to maintain (Porru *et al.*, 2020). Significant variation in public transport accessibility and use can be observed across Member States and within individual countries.

A key limitation of this indicator is the absence of disaggregation options identifying the reasons behind regular use or non-use of public transport. Ticket prices, accessibility, frequency, reliability, infrastructure conditions, and overcrowding all influence travel behaviour independently, yet none are captured separately by the indicator. This limits the ability to design targeted policies that simultaneously increase regular public transport use and reduce transport poverty vulnerability. Furthermore, the indicator alone does not capture household vulnerability conditions or distinguish between households that choose not to use public transport and those that are structurally unable to do so.

A further limitation concerns the relationship between car ownership and public transport quality, which the indicator does not account for. Higher-quality and more accessible public transport can be associated with lower car ownership rates in a given region, as it partially substitutes for private vehicle use (Holmgren, 2020). The absence of disaggregation options also limits the indicator's ability to identify extreme mobility deprivation scenarios, including households with neither access to regular public transport nor a private vehicle.

Combining this indicator with other EPAH indicators substantially improves the identification of vulnerability conditions that may shape public transport use patterns. Results based on this indicator alone do not fully capture situations in which travel behaviour is constrained by financial arrears, material deprivation, or social exclusion.

The following limits illustrate the key constraints of this indicator:

- Limit 1: The indicator does not distinguish between households in high-density urban areas that do not use public transport by choice, perhaps opting for electric bicycles, car-sharing schemes, or walking, and households in rural areas that do not use public transport because accessible options are simply not available in their area.
- Limit 2: Similarly, the indicator conflates households that choose to rely on private vehicles with those that do not use public transport because mobility solutions are unaffordable or inaccessible, merging voluntary behaviour with constrained mobility into a single figure.
- Limit 3: A household may avoid public transport due to long commuting times in peripheral urban areas, a situation that may itself be linked to financial constraints limiting the ability to reside closer to workplaces or schools.
- Use case 1: A low-income household living in a peripheral urban area with limited public transport coverage may be compelled to own a private vehicle to meet essential daily mobility needs, including commuting to work and accessing healthcare and education. In this scenario, the indicator can help identify regions where the absence of adequate public transport is likely contributing to FCO conditions and associated financial stress, particularly when analysed alongside the indicators "Share of the population that is MSD and owns a car" and "Share of household income spent on transport".
- Use case 2: A household in an area with available but unaffordable public transport may reduce or eliminate its use of these services to contain costs, increasing reliance on private transport or restricting mobility altogether. When combined with indicators such as "Arrears on utility bills" and "At risk of poverty or social exclusion", a pattern of compounded financial vulnerability may emerge, where transport unaffordability is one component of a broader EP condition rather than an isolated constraint.

v. Updates and disclaimer

Southern European countries recorded among the highest shares of individuals reporting never using public transport, with Cyprus at 85.0%, Italy at 68.0%, and Portugal at 67.8%. At the EU level, close to half of the population reports never using public transport.

Among Member States with the highest shares of daily public transport users, Hungary at 19.6% and Czechia at 19.0% recorded the highest figures, approximately double the EU-27 average of 10.7%.

5. Cross-Analysis between Climate, Health, and Energy Poverty Indicators in the Energy Efficiency Directive

To assess the potential interconnections among climate, health, and EED EP indicators, the methodological framework is organised into three analytical parts: historical analysis (Part A), correlation analysis (Part B), and clustering process (Part C). Eight indicators were included across the three parts of the analysis: four new indicators discussed in section 4 and the four EP indicators presented in the EED, including the new indicator "At-risk-of-poverty rate". These eight EP indicators, and their respective periods of data availability, are:

- (I1) Heat stress days [Number of days]: annual data available from 1940 to 2024.
- (I2) Cold stress days [Number of days]: annual data available from 1940 to 2024.
- (I3) Excess mortality during summer [Average z-score value]: weekly data available from 2020 to 2024.
- (I4) Excess mortality during winter [Average z-score value]: weekly data available from 2020 to 2024.
- (I5) Inability to keep home adequately warm [Share of the population (%)]: annual data available from 2003 to 2024; national coverage is limited for 2003 and 2004.
- (I6) Arrears on utility bills [Share of the population (%)]: annual data available from 2003 to 2024; national coverage is limited for 2003 and 2004.
- (I7) Population living in a dwelling with a leaking roof, damp walls, floors, or foundation, or rot in window frames [Share of the population (%)]: annual data available from 2003 to 2023; no country-specific data are available for 2021, no data are available for 2022, and national coverage is limited for 2003 and 2004.
- (I8) At-risk-of-poverty rate [Share of the population (%)]: annual data available from 2003 to 2024; national coverage is limited for 2003 and 2004.

For indicators I1 and I2, data are available by severity class, defined by daily maximum and minimum temperature ranges, covering extreme, very strong, strong, and moderate stress levels, as detailed in sections 4.2 and 4.3. To reduce analytical complexity and focus on conditions of meaningful climate stress, I1 and I2 are computed as follows:

- (I1) Heat stress days: sum of days with extreme, very strong, and strong heat stress in a given year.
- (I2) Cold stress days: sum of days with extreme, very strong, and strong cold stress in a given year.

The analysis is restricted to EU Member States with complete data availability for all eight indicators over the full period, meaning if a country has no available data for one of the eight mentioned EP indicators for the defined period this Member State was excluded from the analysis. This resulted in a sample of 17 countries: Austria, Belgium, Cyprus, Denmark, Estonia, Finland, France, Greece, Hungary, Ireland, Italy, Latvia, the Netherlands, Portugal, Slovenia, Spain, and Sweden. The data availability of the 27 Member States according to the eight indicators involved in the analysis is presented on Table 17.

Table 17. Overview of the 27 EU Member States according to the availability of data of the eight indicators considered in the analysis (I1-I8).

GEO	**Code**	I1	I2	I3	I4	I5	I6	I7	I8
Austria	AT	✓	✓	✓	✓	✓	✓	✓	✓
Belgium	BE	✓	✓	✓	✓	✓	✓	✓	✓
Bulgaria	BG	✓	✓	✗	✗	✓	✓	✓	✓
Cyprus	CY	✓	✓	✓	✓	✓	✓	✓	✓
Czechia	CZ	✓	✓	✗	✗	✓	✓	✓	✓
Germany	DE	✓	✓	✗	✗	✓	✓	✓	✓
Denmark	DK	✓	✓	✓	✓	✓	✓	✓	✓
Estonia	EE	✓	✓	✓	✓	✓	✓	✓	✓
Greece	EL	✓	✓	✓	✓	✓	✓	✓	✓
Spain	ES	✓	✓	✓	✓	✓	✓	✓	✓
Finland	FI	✓	✓	✓	✓	✓	✓	✓	✓
France	FR	✓	✓	✓	✓	✓	✓	✓	✓
Croatia	HR	✓	✓	✗	✗	✓	✓	✓	✓
Hungary	HU	✓	✓	✓	✓	✓	✓	✓	✓
Ireland	IE	✓	✓	✓	✓	✓	✓	✓	✓
Italy	IT	✓	✓	✓	✓	✓	✓	✓	✓
Lithuania	LT	✓	✓	✗	✗	✓	✓	✓	✓
Luxembourg	LU	✓	✓	✗	✗	✓	✓	✓	✓
Latvia	LV	✓	✓	✓	✓	✓	✓	✓	✓
Malta	MT	✗	✗	✓	✓	✓	✓	✓	✓
Netherlands	NL	✓	✓	✓	✓	✓	✓	✓	✓
Poland	PL	✓	✓	✗	✗	✓	✓	✓	✓
Portugal	PT	✓	✓	✓	✓	✓	✓	✓	✓
Romania	RO	✓	✓	✗	✗	✓	✓	✓	✓
Sweden	SE	✓	✓	✓	✓	✓	✓	✓	✓
Slovenia	SI	✓	✓	✓	✓	✓	✓	✓	✓
Slovakia	SK	✓	✓	✗	✗	✓	✓	✓	✓

Finally, Table 18 summarises the three analytical parts, their methods, and objectives.

Table 18. Methodology of the analysis of interconnections between climate, health, and the EED EP indicators.

Part of the cross-analysis	Method	Objectives
Part A: Historical analysis	Temporal analysis of 8 indicators (climate, health, EED EP indicators, 2015-2024 data) through statistical parameters and time series plots (R Software Statistics)	Identifying temporal trends and variations of climate, health and EED EP indicators and conducting comparisons between the results for the analysed Member States
Part B: Correlation analysis	Spearman correlation method applied for 8 indicators (climate, health, EED EP indicators, average calculated for 2020/2023 data) through correlation	Identifying and discussing strong relationships between climate, health and EED EP indicators

	matrix and heatmap (R Software Statistics)	
Part C: Cluster process	Climate and global PCA applied to 15 indicators (health, EED, and disaggregated climate indicators, average calculated for 2020/2023 data) and creation of groups according to the combination of the global relevant PCs (R Software Statistics)	Groups of Member States according to the obtained results of the analysed climate, health and EED EP indicators

i. Part A: Historical analysis

Part A conducts a historical analysis of indicators I1–I8 to identify temporal patterns and variations and to enable structured comparisons across Member States. The analysis was carried out using R Statistics and covers the period 2015–2024, providing a ten-year horizon that captures medium-term trends while ensuring data consistency and comparability. Since data for I3 and I4 are available only from 2020 onwards, the historical analysis of these two indicators is limited to 2020–2024. For I7, given the absence of national-level data for 2021, 2022, and 2024, the analysis covers the remaining available years within the 2015–2024 period.

Results for the 17 Member States are presented as heatmaps and assessed according to four parameters:

- Minimum values: countries recording the lowest values for a given indicator.
- Maximum values: countries recording the highest values for a given indicator.
- Maximum variation: countries showing the greatest range of variation within the 2015–2024 period, calculated as the difference between the maximum and minimum observed values.
- Temporal trend: defined by combining the linear trend coefficient, capturing the average annual rate of change, with the standard deviation, which reflects interannual variability. High and low levels for both parameters are defined relative to the indicator's median distribution. For a specific GEO and indicator, if the value of standard deviation is higher than the median value of standard deviation obtained for the same indicator for all GEOs, it is considered as a “trend with high variability”. The opposite scenario (lower than the median value of the standard deviation) is defined as a trend with “relatively stable levels”. Moreover, a positive value of the linear trend coefficient indicates an increasing trend, whereas a negative result indicates a decreasing trend. Therefore, their joint interpretation produces four distinct patterns: (i) increasing trend with high variability (higher values of standard (; (ii) increasing trend with relatively stable levels; (iii) decreasing trend with high variability; and (iv) decreasing trend with relatively stable levels. This framework enables a structured characterisation of dynamic profiles across countries.

Key findings from Part A are discussed in Section 5. Detailed country-level results for each indicator are provided in Appendix C.

ii. Part B: Correlation analysis

Part B quantifies the relationships among indicators I1–I8[24], enabling an evaluation of structural interconnections across climate, health, and energy efficiency dimensions. Spearman's rank correlation was selected because it identifies monotonic relationships without assuming normality and is less sensitive to extreme values, which are properties particularly relevant for climate-related data (Armstrong, 2019; Kim, Kim, and Ergün, 2015; van den Heuvel and Zhan, 2022).

To ensure consistency across indicators with heterogeneous temporal availability, the correlation analysis is based on country-level averages computed for 2020 and 2023, as these are the only two years for which data are available for all 17 Member States across all eight indicators. This approach avoids pseudo-replication from treating country-year observations as independent and ensures statistical consistency across correlation coefficients.

Spearman coefficients range from -1 (perfect negative monotonic relationship) to 1 (perfect positive monotonic relationship), with 0 indicating no monotonic association. Correlation strength thresholds are not universally standardised and should be interpreted as guidelines rather than strict cutoffs (Hemphill, 2003). The following classification is adopted throughout this study for consistency: negligible (<0.20), weak (0.20–0.39), moderate (0.40–0.59), strong (0.60–0.79), and very strong (≥0.80).

iii. Part C: Principal Component Analysis

Part C groups the 17 Member States according to their combined results across climate, health, and EED EP indicators using Principal Component Analysis (PCA). PCA reduces a set of variables into a smaller number of Principal Components (PCs) that capture the dataset's essential structure. In the specific case of the present study, a PCA was applied to better reflect the main vulnerability drivers related to the analysed EP indicators by analysing the obtained PCs, followed by the definition of groups of countries with similar vulnerability profiles, based on national scores.

Data are standardised prior to analysis. Each PC accounts for a share of the total explained variance, and PCs explaining 10% or more of the variance are considered relevant for interpretation — a threshold consistent with established practice in the literature (Hair *et al.*, 2019; Jackson, 1993; Jolliffe, 2002).

PCs are interpreted based on the magnitude and sign of their loadings. Variables with the highest absolute loadings are treated as the main contributors to each component, while the sign indicates the direction of association. A loading is the coefficient (weight) of an original variable in a PC, indicating both the contribution and direction of that variable in explaining the component's variance. Loadings with an absolute value of 0.30 or above are generally considered relevant for PC interpretation, though lower values may also be informative depending on the results obtained (Greenacre *et al.*, 2022). The

[24] Indicators included in the cross-analysis between climate, health, and the EED EP indicators, namely I1 ("Heat stress days"), I2 ("Cold stress days"), I3 ("Excess mortality during summer"), I4 ("Excess mortality during winter"), I5 ("Inability to keep home adequately warm"), I6 ("Arrears on utility bills"), I7 ("Population living in a dwelling with a leaking roof, damp walls, floors, or foundation, or rot in window frames"), and I8 ("At-risk-of-poverty rate").

value of each PC for a given country is its score: a positive score indicates high values on variables with positive loadings, a negative score indicates high values on variables with negative loadings, and the magnitude of the score reflects the extremity of the country's position on that dimension (Abdi and Williams, 2010).

To capture the distinct structure of thermal stress across severity classes, indicators I1 and I2 are disaggregated in Part C according to the original severity classes available in the dataset, producing nine climate-specific indicators:

- Indicators related to heat stress days: (I1a) extreme heat stress days, (I1b) very strong heat stress days, (I1c) strong heat stress days, and (I1d) moderate heat stress days.
- Indicators related to cold stress days: (I2a) extreme cold stress days, (I2b) very strong cold stress days, (I2c) strong cold stress days, (I2d) moderate cold stress days, and (I2e) slight cold stress days.

Together with mortality indicators I3 and I4 and EED EP indicators I5–I8, this disaggregation results in fifteen indicators for Part C.

The analysis proceeds in two steps. First, a PCA is conducted on the nine climate indicators alone, yielding PCs that capture the structure of thermal stress across severity classes, enabling the definition of climate groups. Second, a global PCA is performed incorporating the climate PCs alongside mortality and EED EP indicators (I3–I8). Countries are then allocated to climate and country vulnerability groups based on their scores on the relevant PCs. Each group and its constituent countries are analysed and discussed in section 5, with results presented as score plots.

A single PCA including all fifteen indicators (nine climate-related, two mortality-related, and four EED EP indicators) was not performed due to the potential overrepresentation of climate components, as climate-related indicators account for the majority of the indicators considered (9 out of 15). To mitigate this imbalance, a two-step analytical approach was adopted, beginning with a PCA restricted exclusively to the nine climate indicators.

As in Part B, country-level averages for 2020 and 2023 are used as inputs for the PCA, ensuring that the analysis reflects stable cross-country differences in vulnerability profiles rather than temporal variation.

The obtained results for each of the three parts of the analysis are presented in sections 5.1 to 5.3.

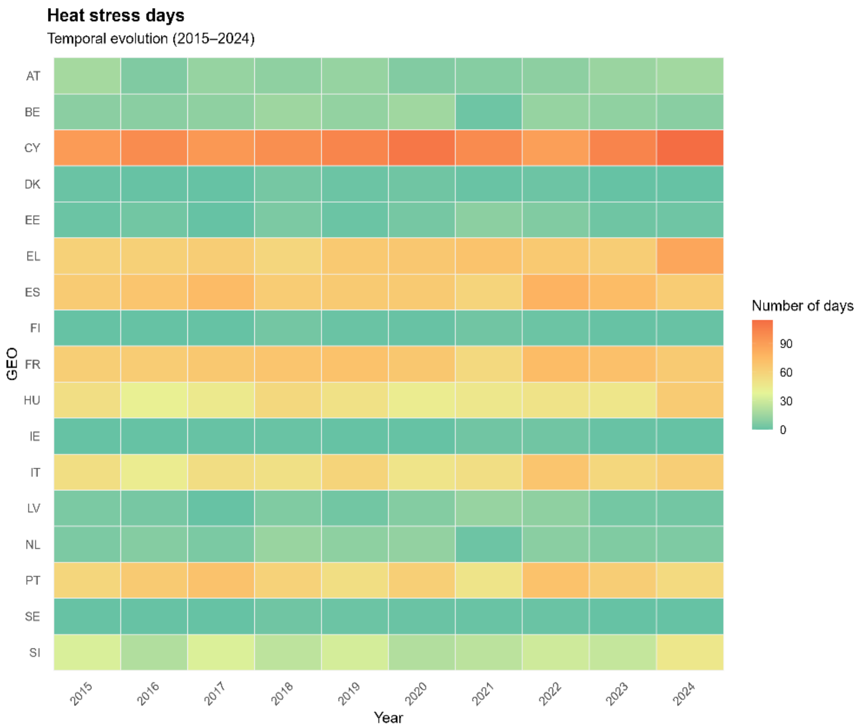
5.1. Part A: Temporal Analysis

This section presents and discusses the results obtained through the methodology described in section 2.3, covering the eight analysed indicators: "Heat stress days" (I1), "Cold stress days" (I2), "Excess mortality during summer" (I3), "Excess mortality during winter" (I4), "Inability to keep home adequately warm" (I5), "Arrears on utility bills" (I6), "Population living in a dwelling with a leaking roof, damp walls, floors or foundation, or rot in window frames or floor" (I7), and "At-risk-of-poverty rate" (I8).

i. Results

Results for the seventeen Member States included in this analysis (Austria, Belgium, Cyprus, Denmark, Estonia, Greece, Spain, Finland, France, Hungary, Ireland, Italy, Latvia, the Netherlands, Portugal, Sweden, and Slovenia) are presented as heatmaps in Tables 18 to 21, covering the ten-year period 2015 to 2024 according to data availability for each indicator. As described in section 2.3, each indicator is assessed across four parameters: minimum values, maximum values, total variation, and temporal trend. Detailed country-level results for each indicator are provided in Appendix C.

Table 19. Temporal evolution (heatmaps) – Indicators I1-I2.



Minimum values: No heat stress days for IE (2015, 2016, 2019, 2020, 2024), FI (2015-2017), SE (2017, 2023, 2024), DK (2017), and EE (2017).

Maximum values: CY (114.4 days in 2024), EL (85.8 days in 2024), ES (78.9 days in 2022), and FR (73.9 days in 2022).

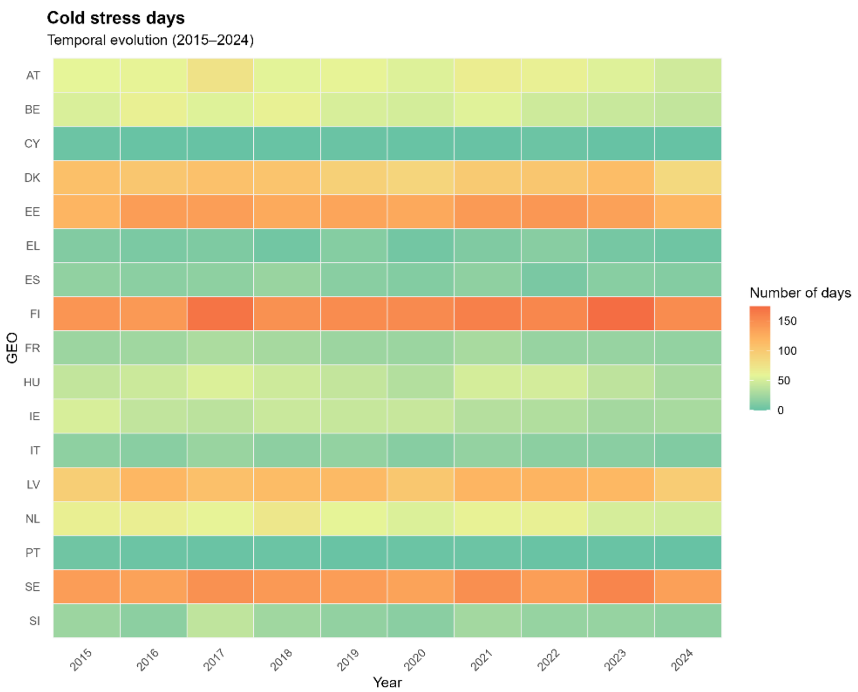
Maximum variations: EL (28.1 days), SI (26.4 days), CY (24.9 days), and IT (24.2 days).

Decreasing trend with high variability: PT.

Decreasing trend with relatively constant levels: BE, NL, DK, SE.

Increasing trend with high variability: EL, SI, CY, IT, HU, ES, FR, LV.

Increasing trend with relatively constant levels: AT, EE, FI, IE.



Minimum values: CY (0 days in 2024), PT (0.5 days in 2024), EL (3.3 days in 2024), and ES (7.4 days in 2022).

Maximum values: FI (174.0 days in 2023), SE (156.3 days in 2023), EE (142.7 days in 2022), and LV (119.5 days in 2022).

Maximum variations: FI (33.2 days), AT (30.2 days), DK (26.9 days), and EE (25.2 days).

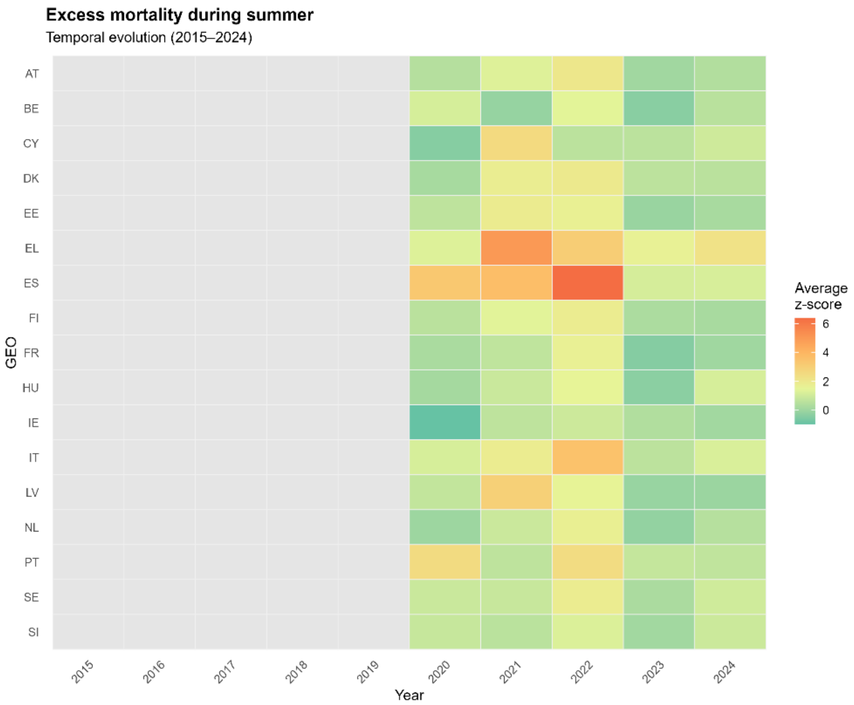
Decreasing trend with high variability: AT, DK, IE, HU, BE.

Decreasing trend with relatively constant levels: NL, SI, ES, FR, IT, EL, PT, CY.

Increasing trend with high variability: FI, EE, LV, SE.

Increasing trend with relatively constant levels: No countries.

Table 20. Temporal evolution (heatmaps) – Indicators I3-I4.



Minimum values: IE (-1.0 in 2020), FR (-0.5 in 2023), CY (-0.5 in 2020), and BE (-0.4 in 2022).

Maximum values: ES (6.4 in 2022), EL (5.0 in 2021), IT (3.5 in 2022), and LV (3.0 in 2021).

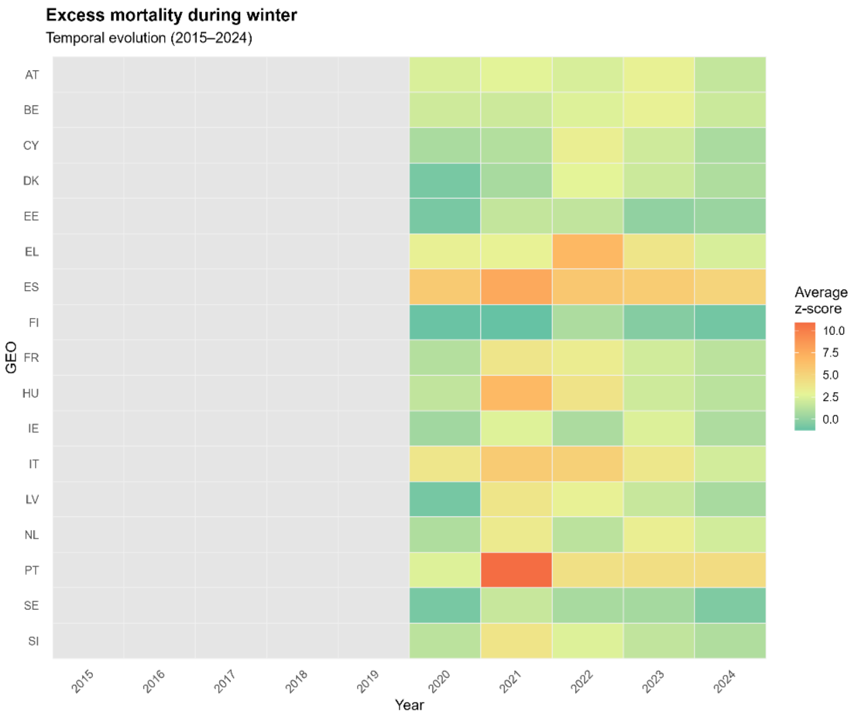
Maximum variations: ES (5.3), EL (3.7), LV (3.1), and CY (3.0).

Decreasing trend with high variability: ES, EL, LV, IT, FR, AT, EE, PT.

Decreasing trend with relatively constant levels: NL, BE, DK, FI, SE, SI.

Increasing trend with high variability: CY.

Increasing trend with relatively constant levels: IE, HU.



Minimum values: FI (-1.3 in 2021), LV, SE, DK, and EE (each with -0.8 in 2020).

Maximum values: PT (10.9 in 2021), ES (7.7 in 2021), EL (6.8 in 2022), and HU (6.8 in 2021).

Maximum variations: PT (8.4), HU (5.5), LV (4.7), and EL (4.6).

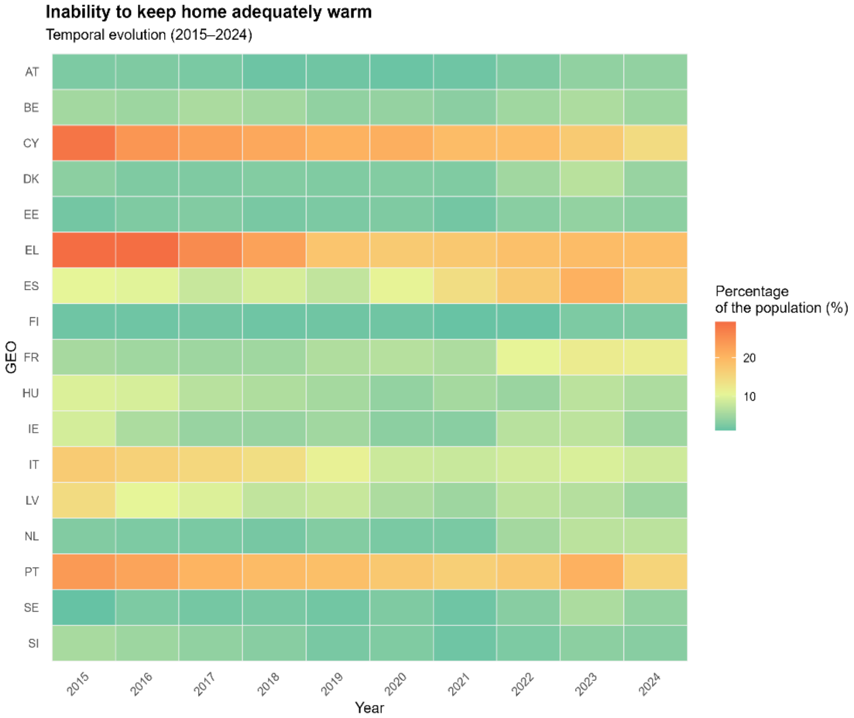
Decreasing trend with high variability: PT, HU, EL, IT, SI, FR.

Decreasing trend with relatively constant levels: ES, SE, AT.

Increasing trend with high variability: LV, DK, NL.

Increasing trend with relatively constant levels: CY, EE, IE, FI, BE.

Table 21. Temporal evolution (heatmaps) – Indicators I5-I6.



Minimum values: SE (1.2% in 2015), FI (1.3% in 2021), AT (1.5% in 2020), and SI and SE (both with 1.7% in 2021).

Maximum values: EL (29.2% in 2015), CY (28.3% in 2015), PT (23.8% in 2015), and ES (20.8% in 2023).

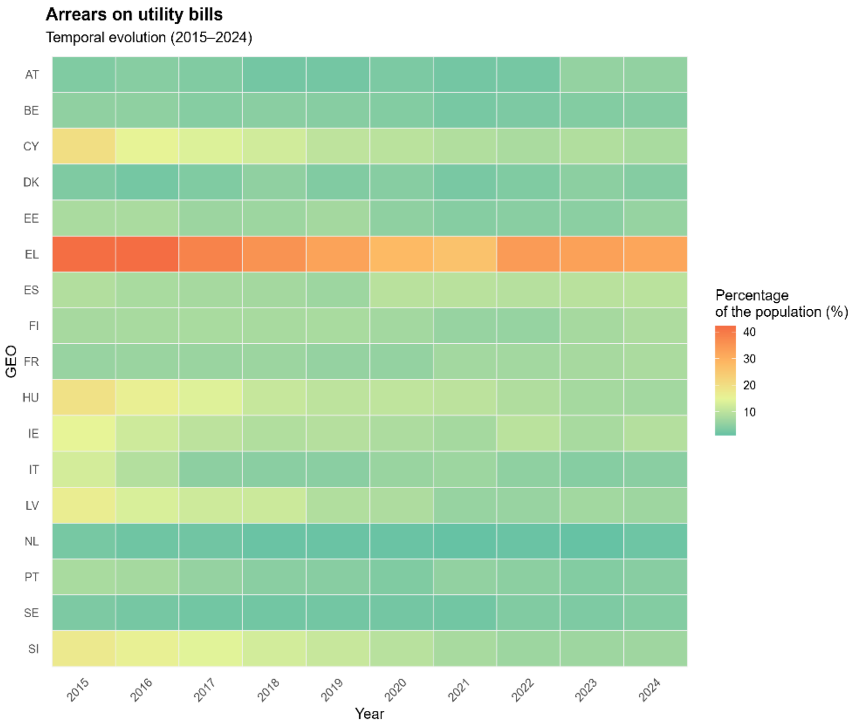
Maximum variations: CY (13.7%), ES (13.3%), EL (12.1%), and LV (9.6%).

Decreasing trend with high variability: CY, EL, LV, IT, PT, HU.

Decreasing trend with relatively constant levels: IE, SI, BE.

Increasing trend with high variability: ES, FR, NL.

Increasing trend with relatively constant levels: SE, DK, AT, EE, FI.



Minimum values: NL (1.2% in 2023), SE (2.2% in 2018), AT (2.4% in 2019), and DK (2.5% in 2016).

Maximum values: EL (42.2% in 2016), CY (20.1% in 2015), HU (19.4% in 2015), and SI (17.5% in 2015).

Maximum variations: EL (15.9%), CY (12.3%), HU (12.3%), and SI (11.0%).

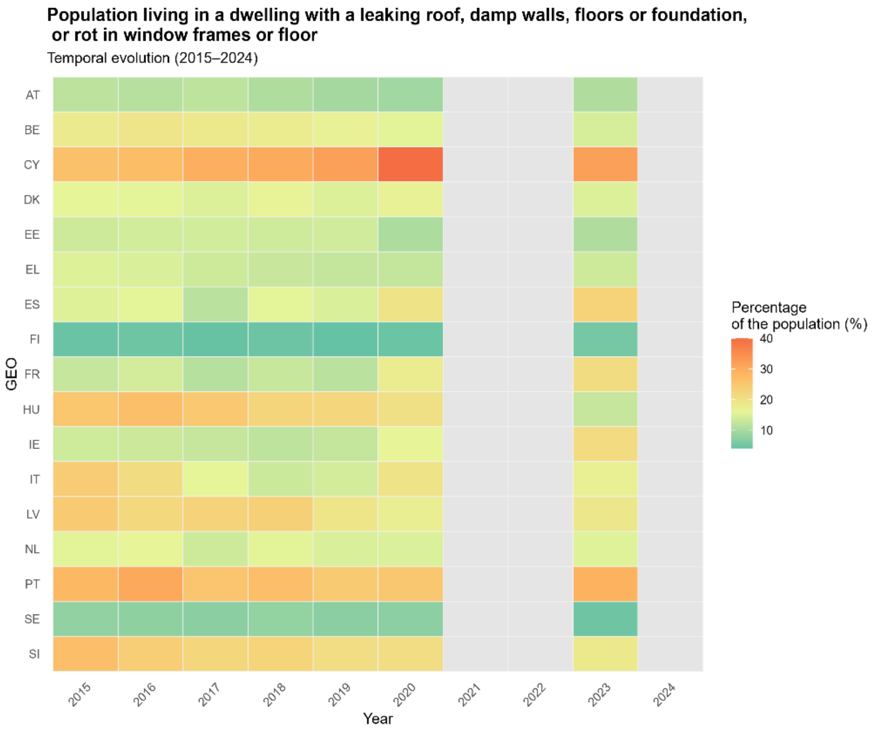
Decreasing trend with high variability: EL, CY, HU, SI, LV, IT, IE, PT, EE.

Decreasing trend with relatively constant levels: FI, BE, NL.

Increasing trend with high variability: No countries.

Increasing trend with relatively constant levels: ES, AT, DK, FR, SE.

Table 22. Temporal evolution (heatmaps) – Indicators I7-I8.



Minimum values: FI (4.1% in 2019), SE (4.8% in 2023), AT (9.1% in 2020), and EE (10.2% in 2020).

Maximum values: CY (40.0% in 2020), PT (30.5% in 2016), SI (26.9% in 2015), and HU (26.7% in 2016).

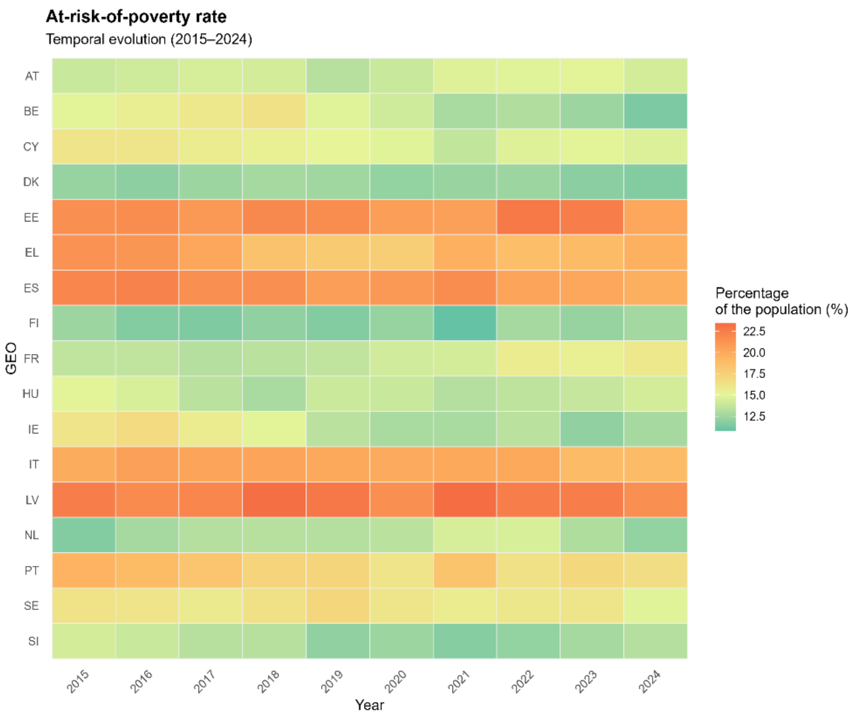
Maximum variations: HU (14.1%), CY (13.5%), ES (11.5%), and IT (10.9%).

Decreasing trend with high variability: HU, IT, SI, LV, PT.

Decreasing trend with relatively constant levels: BE, EE, SE, AT, NL, EL, DK.

Increasing trend with high variability: CY, ES, FR, IE.

Increasing trend with relatively constant levels: FI.



Minimum values: FI (10.8% in 2021), BE (11.4% in 2024), NL (11.6% in 2015), and DK (11.6% in 2024).

Maximum values: LV (23.4% in 2021), EE (22.8% in 2022), ES (22.3% in 2016), and EL (21.4% in 2015).

Maximum variations: BE (5.0%), IE (4.8%), EL (3.7%), and PT (3.3%).

Decreasing trend with high variability: BE, IE, EL, PT, EE, ES, SI.

Decreasing trend with relatively constant levels: CY, SE, HU, LV, IT, DK.

Increasing trend with high variability: NL, FR.

Increasing trend with relatively constant levels: FI, AT.

ii. Key findings

The results highlight the expected contrast between Southern European countries, associated with higher heat stress days, and Northern European countries, associated with lower heat stress conditions. Twelve of the 17 analysed Member States show an increasing trend in heat stress days, likely reflecting the effects of climate change on outdoor temperatures and the growing frequency and severity of heatwaves. This trend is concerning both in countries already recording the highest values, such as Cyprus, Greece, and Spain, and in countries with the lowest values, such as Ireland, Finland, and Estonia, where infrastructure may be less adapted to extreme heat conditions.

By contrast, Southern European countries present fewer cold stress days, or, in the case of Cyprus in 2024, none at all, while Northern European countries record the highest values. Most analysed countries (13 out of 17) show a relatively stable decreasing trend in cold stress days. Countries with the most severe cold climates, namely Finland, Estonia, Latvia, and Sweden, showed an increasing trend with high variability, likely driven by particularly severe cold spells in specific years.

Fourteen of the 17 countries showed a decreasing trend in summer excess mortality (I3). This pattern may partly reflect elevated mortality rates during 2020 to 2022 associated with the COVID-19 pandemic rather than extreme summer weather. The same factor likely influenced trends in winter excess mortality (I4), with nearly half of the countries showing a decreasing pattern. The highest winter excess mortality values were recorded in Southern European countries, particularly Portugal, Spain, and Greece.

For I5, the highest values were recorded in countries also associated with greater heat stress exposure, particularly in the first year of the analysis, notably Greece, Cyprus, and Portugal. These countries also show the sharpest declines from 2015 to 2024, which may be linked to economic recovery following the 2008 to 2009 financial crisis and to more recent national policies and programmes targeting building renovation and energy efficiency improvements.

Greece and Cyprus recorded the highest shares of the population facing arrears on utility bills (I6) but also the greatest reductions in recent years. For Greece, a reduction of nearly 16 percentage points was observed between 2016 and 2021. The Netherlands and Sweden recorded considerably lower values, at approximately 1% and 2%, respectively. Only five countries showed increasing trends, confirming an overall pattern of reduction in utility bill arrears across the 2015 to 2024 period.

For I7, the highest values were recorded in Cyprus, where four in ten residents reported living in dwellings affected by leaks, dampness, or rot in 2020, with an increasing trend over the available data period. However, 12 of the 17 countries showed decreasing trends, potentially reflecting national building renovation efforts and social housing and welfare programmes. Hungary and Spain recorded particularly notable reductions, with Hungary showing a decline of approximately 50% between 2016 and 2023.

Most countries showed decreasing trends in the at-risk-of-poverty rate (I8), with only four recording increases. Northern European countries consistently record the lowest values, particularly Finland, Belgium, the Netherlands, and Denmark, while the highest values are observed in both Baltic countries, Latvia and Estonia, and Southern European Member States, notably Spain and Greece.

5.2. Part B: Correlation Analysis

This section presents the Spearman correlation results and discusses the most relevant relationships among the eight analysed indicators, based on country-level averages for 2020 and 2023.

i. Results

The heatmap of Spearman correlation coefficients for indicators I1 to I8 is presented in Figure 29.

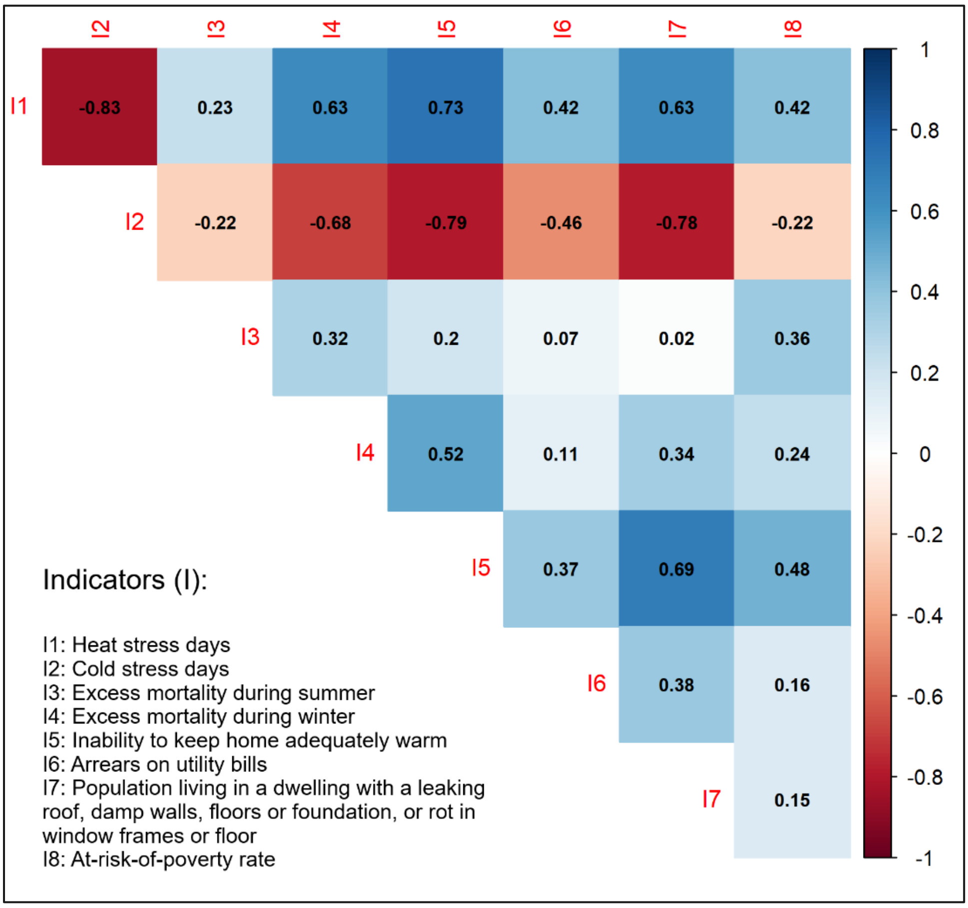


Figure 29. Spearman correlation heatmap - I1 to I8.

The following relevant relationships are identified and discussed:

- **Heat stress days (I1) and Inability to keep home adequately warm (I5) — Strong positive correlation (0.73).** Countries with a higher number of heat stress days tend to present higher shares of the population unable to keep their dwellings adequately warm. This association likely reflects structural characteristics of the housing stock in regions predominantly exposed to warmer climates, where buildings are often not designed to retain heat during colder periods and may present lower overall energy efficiency. These countries also tend to have more limited access to centralised heating infrastructure, such as district heating, which constrains the availability of cost-efficient heating solutions. As a result, households may experience indoor thermal discomfort in winter even in the absence of severe cold stress. The contrasting scenario is confirmed by a strong negative correlation between the inability to keep the home adequately warm and cold stress days (–0.79): dwellings in countries with more severe cold conditions are more likely to be designed to maximise heat retention and to have access to centralised heating, thereby supporting adequate indoor thermal comfort.

- **Excess mortality during winter (I4) and Inability to keep home adequately warm (I5) — Moderate positive correlation (0.52).** Countries with higher shares of the population unable to keep their homes adequately warm show a moderate tendency towards higher excess winter mortality. This is a plausible association, as chronic indoor thermal discomfort has been shown to affect health and well-being and may exacerbate existing morbidities. Additional factors beyond indoor thermal comfort and cold exposure should nonetheless be considered when analysing the main drivers of excess winter mortality in specific national contexts.
- **Heat stress days (I1) and Population living in dwellings with the presence of leak, damp, or rot (I7) — Strong positive correlation (0.63).** Member States with higher numbers of heat stress days tend to present higher shares of the population living in dwellings with structural deficiencies. This association likely reflects an overlap of socioeconomic and housing vulnerabilities in Southern European countries, where dwellings affected by leaks, damp, or rot are also less likely to have undergone recent energy-efficiency improvements, as indicated by the results of the indicator discussed in section 4.4. This is further supported by moderate positive correlations between heat stress days and arrears on utility bills (0.42) and between heat stress days and the at-risk-of-poverty rate (0.42). The contrasting scenario is supported by a strong negative correlation between cold stress days and dwellings with structural deficiencies (–0.78), reflecting the relatively higher rates of building renovation and energy-efficiency improvements observed in countries with greater cold exposure.
- **Inability to keep home adequately warm (I5) and Population living in dwellings with the presence of leak, damp, or rot (I7)** — Strong positive correlation (0.69). Both indicators reflect poor housing conditions, and a strong positive correlation between them is therefore expected. The presence of leaks, damp, or rot is associated with degraded insulation of the building envelope and window frames, which reduces thermal retention capacity and increases infiltration of outdoor air, directly contributing to inadequate indoor thermal comfort.
- **Inability to keep home adequately warm (I5) and At-risk-of-poverty rate (I8) — Moderate positive correlation (0.49).** Countries with greater shares of the population unable to keep their homes adequately warm are also more likely to present higher at-risk-of-poverty rates. This association reflects the relationship between lower household income and greater difficulty in meeting heating costs, resulting in more severe indoor thermal discomfort. It is important to note that the at-risk-of-poverty rate is calculated using a relative threshold, making it a better measure of within-country inequality than of absolute poverty. Cross-analysis with other indicators, including

dwelling conditions, local climate characteristics, arrears on utility bills, and the share of household income allocated to expenditure, is recommended to deepen the interpretation of national results.

ii. Key findings

The indicator "Heat stress days" shows moderate-to-strong positive correlations with mortality indicators (I3 and I4) and EED EP indicators (I5 to I8), whereas "Cold stress days" exhibits moderate-to-strong negative correlations with the same indicators. This pattern underscores the structural differences between Southern European countries, which are more exposed to severe heat stress, and Northern European countries, which are more strongly associated with cold conditions and exhibit lower values across housing and socioeconomic vulnerability indicators. The observed association between greater heat exposure and higher rates of structural housing deficiencies further highlights the relevance of summer EP conditions and reinforces the need for targeted, context-specific analysis to support policymakers.

It should be noted that these correlation results do not indicate direct causal relationships between indicators. The correlation identifies tendencies between pairs of indicators and, in the specific context of this study, is based on a single average value computed across only two years (2020 and 2023). The interpretation of Part B results should therefore be combined with those of other EP indicators to broaden the scope of analysis and reveal the main drivers of vulnerability in each national context.

5.3. Part C: Principal Component Analysis (PCA)

This section presents the results of the climate PCA and the global PCA, along with the classification of countries into climate groups and Country Vulnerability Groups (CVG) based on their respective scores. Each of the 17 countries is assigned to one climate group and one CVG. Key findings are discussed at the end of the section.

i.Results: Climate PCA

As mentioned in section 2.3, the climate PCA was conducted only with the climate-related indicators and their respective severity classes disaggregation, in a total of nine different indicators, namely “Extreme heat stress days” (I1a), “Very strong heat stress days” (I1b), “Strong heat stress days" (I1c), “Moderate heat stress days” (I1d), “Extreme cold stress days” (I2a), “Very strong cold stress days” (I2b), “Strong cold stress days” (I2c), “Moderate cold stress days” (I2d), and “Slight cold stress days” (I2e). Figure 30 presents the scree plot[25] of the climate PCA. Applying the 10% explained variance threshold, two Principal Components were identified as relevant: PC1, accounting for 60.2% of the explained

[25] A scree plot is a graph that displays the variance explained by each principal component, ordered from largest to smallest. It allows the assessment of how much of the total variance in the dataset is captured by each component.

variance, and PC2, accounting for 21.7%. As previously mentioned, it is noteworthy that PC1 to PC9 are not climate indicators itself, but components that translate the dataset's essential structure.

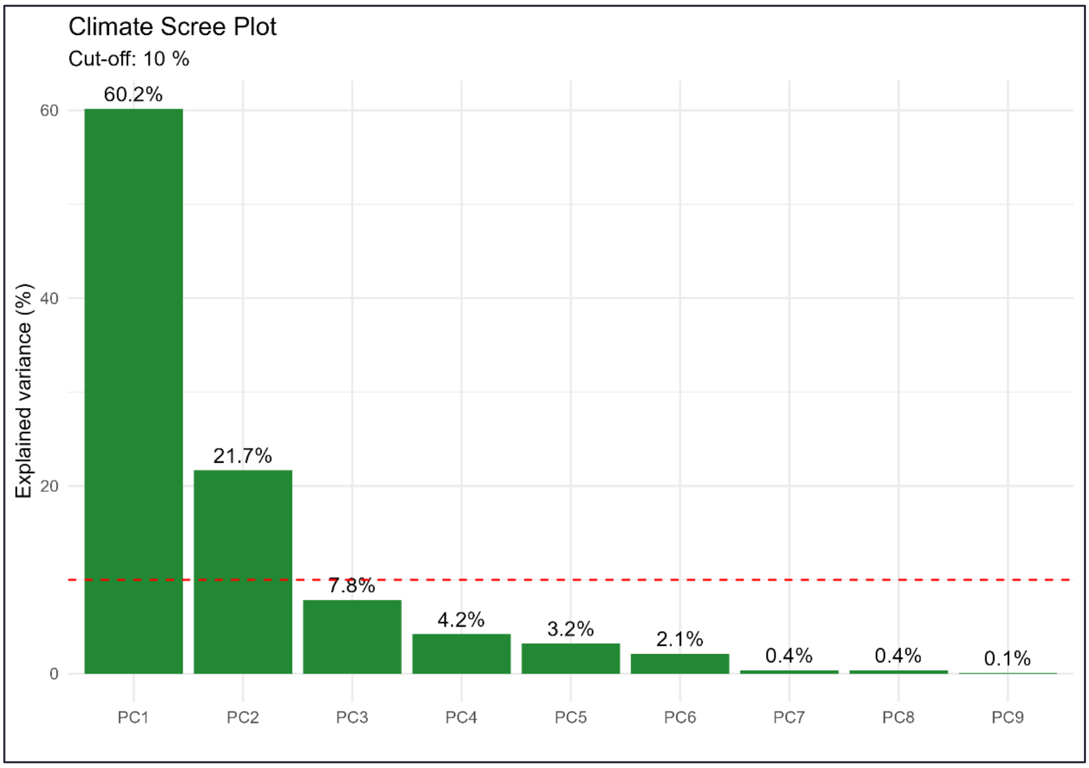


Figure 30. Climate PCA - Scree plot (10% cut-off line).

The loadings and interpretation of PC1 and PC2 are presented in Table 22. Positive significant loadings are highlighted in green and negative significant loadings in red.

Table 23. Climate PCA – Loadings obtained for PC1 and PC2.

Indicator	PC1 (Loadings)	PC2 (Loadings)
Extreme heat stress days (I1a)	0.32	0.20
Very strong heat stress days (I1b)	0.38	0.26
Strong heat stress days (I1c)	0.38	0.16
Moderate heat stress days (I1d)	0.39	0.05
Extreme cold stress days (I2a)	-0.22	0.52
Very strong cold stress days (I2b)	-0.31	0.48
Strong cold stress days (I2c)	-0.39	0.21
Moderate cold stress days (I2d)	-0.21	-0.56
Slight cold stress days (I2e)	0.34	-0.05

PC1 - Heat-Cold Axis

Gradient between relevant positive loadings associated with heat stress indicators and negative loadings associated with cold stress indicators.

Score of PC1 > 0: Heat-related country.

Score of PC1 < 0: Cold-related country.

PC2 – Thermal Severity Axis

Gradient between higher positive loadings associated with extreme and very strong climate stress and extremely low positive and negative loadings associate with more moderate thermal conditions.

Score of PC2 > 0: Country with higher thermal severity.

Score of PC2 < 0: Country with lower thermal severity.

According to the information provided by the PC1 (Heat-Cold Axis) and PC2 (Thermal Severity Axis) in Table 22, it is possible to analyse the scores of each analysed country. Since two PCs were identified as relevant, national scores can be analysed and grouped into four climate groups (CGs) of countries, defined by positive (+) or negative (-) scores for each PC, as presented in Table 23. Positive scores are highlighted in green, while negative scores are highlighted in red.

Table 24. Climate PCA – Climate Groups.

Climate Group (CG)	PC1 Score	PC2 Score
CG1	+	+
CG2	-	+
CG3	-	-
CG4	+	-

The scores for each of the 17 countries and their assigned Climate Group are presented in Table 24. Moreover, Figure 31 shows the corresponding score plot, while Figure 32 presents a map of the classification of the 17 Member States according to the obtained CGs.

Table 25. Climate PCA – Scores.

GEO	PC1 (Scores)	PC2 (Scores)	Climate Group (CG)
Austria (AT)	-0.58	-1.12	Climate Group 3 (CG3)
Belgium (BE)	-0.70	-1.43	Climate Group 3 (CG3)
Cyprus (CY)	3.60	1.68	Climate Group 1 (CG1)
Denmark (DK)	-1.94	-0.86	Climate Group 3 (CG3)
Estonia (EE)	-2.12	0.37	Climate Group 2 (CG2)
Greece (EL)	2.63	0.61	Climate Group 1 (CG1)
Spain (ES)	3.08	0.67	Climate Group 1 (CG1)
Finland (FI)	-4.04	3.72	Climate Group 2 (CG2)
France (FR)	1.02	-0.27	Climate Group 4 (CG4)
Hungary (HU)	0.11	-0.78	Climate Group 4 (CG4)
Ireland (IE)	-0.94	-1.90	Climate Group 3 (CG3)
Italy (IT)	1.74	0.04	Climate Group 1 (CG1)
Latvia (LV)	-1.66	-0.21	Climate Group 3 (CG3)
Netherlands (NL)	-1.09	-1.45	Climate Group 3 (CG3)
Portugal (PT)	3.67	0.85	Climate Group 1 (CG1)
Sweden (SE)	-3.06	1.14	Climate Group 2 (CG2)
Slovenia (SI)	0.27	-1.05	Climate Group 4 (CG4)

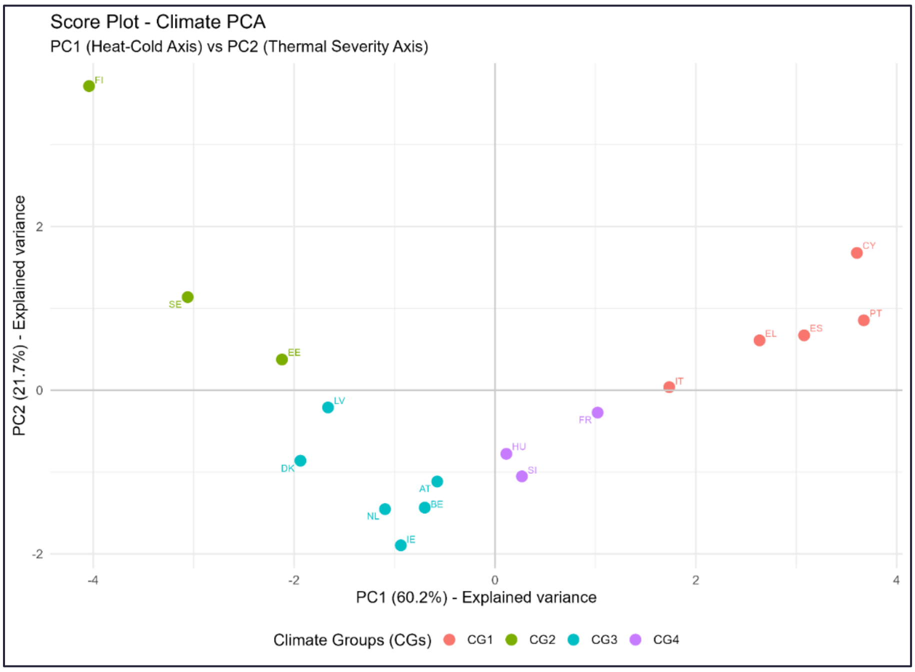


Figure 31. Climate PCA – Score plot (PC1 *vs* PC2).

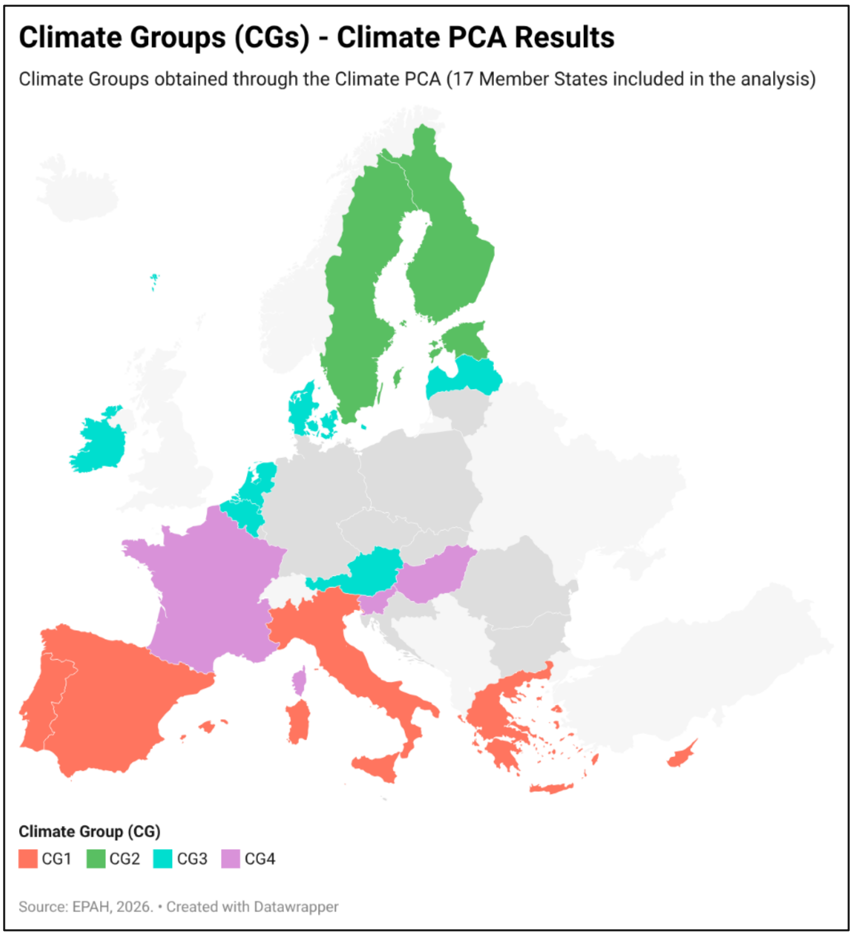


Figure 32. Climate PCA - Map of the classification of the Member States included in the analysis according to CGs.

ii.Results: Global PCA

A second PCA was conducted, identified as a global PCA, based on six previous indicators, namely "Excess mortality during summer" (I3), "Excess mortality during winter" (I4), "Inability to keep home adequately warm" (I5), "Arrears on utility bills" (I6), "Population living in dwellings with presence of leak, damp or rot (I7), "At-risk-of-poverty rate" (I8), and on the two PCs identified through the climate PCA, identified as CPCs (Climate Principal Components), namely "Heat-Cold Axis" (CPC1) and "Thermal Severity Axis" (CPC2). The aim is to identify how the dimensions of health, climate, and EP indicators articulate to explain overall vulnerability.

Figure 33 presents the scree plot of the global PCA. According to the 10% threshold for defining a relevant PC, identified in Figure 18 through the red cut-off line, four PCs were relevant for the climate PCA (PC1 accounts for 47.9% of the explained variance, followed by PC2 (19.2%), PC3 (12.3%), and PC4 (10.2%). In this context, as the groups are defined by the possible combinations of score signs (positive or negative) for the PCs identified as relevant, including four PCs would yield sixteen distinct country vulnerability groups (CVGs) for a sample of only seventeen analysed countries. Such fragmentation would considerably reduce the analytical robustness and interpretability of the grouping structure. Furthermore, given that the explained variance of PC4 (10.2%) lies only marginally above the established cut-off threshold (10%), analysing this PC would not add significant information to the analysis of vulnerability main drivers and the grouping structure of the countries. Therefore, a PC4 was not retained as a relevant component. Consequently, the global PCA results were analysed considering only PC1, PC2, and PC3.

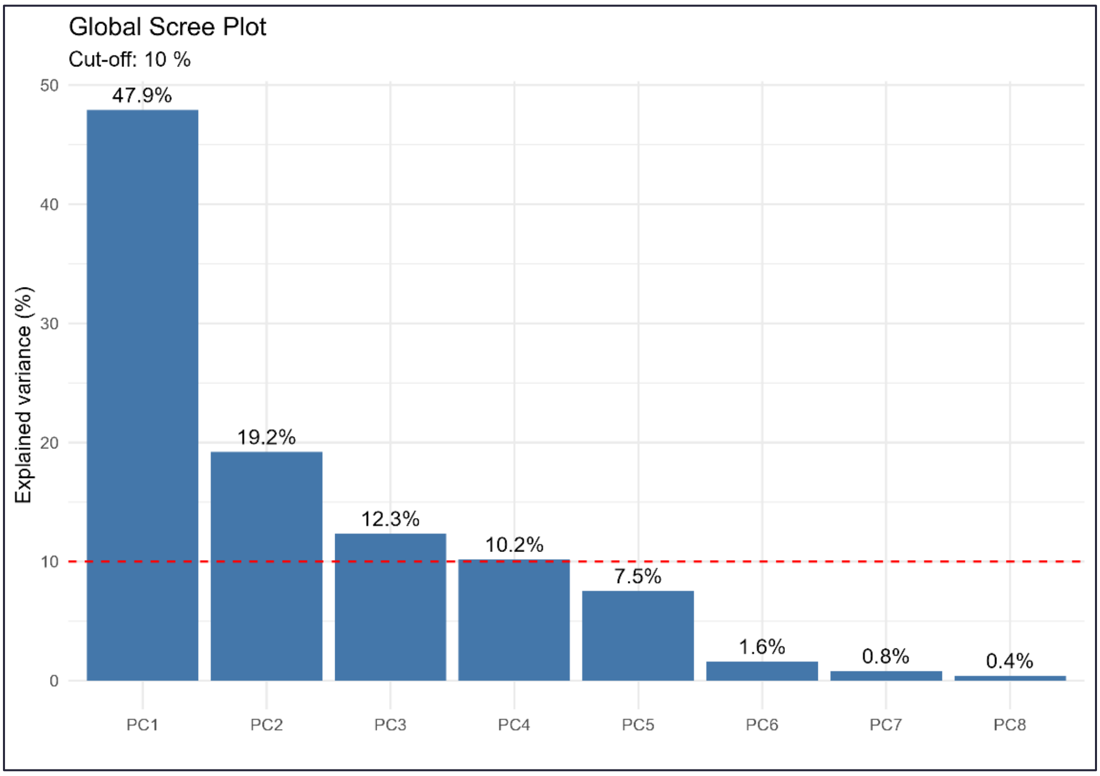


Figure 33. Global PCA - Scree plot (10% cut-off line).

The obtained loadings and the interpretation of the first three PCs (PC1, PC2, and PC3) are presented in Table 25. Positive significant loadings are highlighted in green, whereas negative significant loadings are marked in red.

Therefore, according to the obtained loadings and the interpretation of PC1, PC2, and PC3, and similarly to the process of creating the climate groups, eight different country vulnerability groups (CVGs) were defined according to the combination of the signs (positive or negative) for each of the three relevant PCs, as indicated in Table 26. Similar to the CGs reported in Table 23, positive scores are highlighted in green, while negative scores are highlighted in red.

Table 26. Global PCA – Loadings and Climate Groups.

Indicator	PC1 (Loadings)	PC2 (Loadings)	PC3 (Loadings)
Excess mortality during summer (I3)	0.38	-0.34	0.27
Excess mortality during winter (I4)	0.40	0.20	0.46
Inability to keep home adequately warm (I5)	0.48	0.00	-0.28
Arrears on utility bills (I6)	0.26	-0.27	0.04
Population living in dwellings with presence of leak, damp or rot (I7)	0.32	0.45	-0.44
At-risk-of-poverty rate (I8)	0.23	-0.39	0.31
Heat-Cold Axis (CPC1)	0.27	0.25	-0.08
Thermal Severity Axis (CPC2)	0.10	-0.60	-0.59

PC1 – Overall Vulnerability Axis

All analysed coefficients with positive loadings, most of them with relevant values.

Score of PC1 > 0: High overall vulnerability.

Score of PC1 < 0: Low overall vulnerability.

PC2 – Dwelling Conditions vs Climate-General Poverty Axis

Relevant negative loadings are observed for I3, I8, and CPC2, while a positive loading was obtained only for I7 – contrast between the dominance poor dwelling conditions and climate and general poverty conditions.

Score of PC2 > 0: Dominance of poor dwelling conditions.

Score of PC2 < 0: Dominance of climate stress and/or general poverty.

PC3 – Winter mortality/General Poverty vs Dwelling Conditions/Climate Severity Axis

Relevant positive loadings were obtained for I4 and I8, while negative relevant values are presented for I7, and CPC2.

Score of PC3 > 0: Higher relevance of winter mortality and/or general poverty levels.

Score of PC3 < 0: Higher relevance of poor dwelling conditions and/or climate severity.

Table 27. Global PCA – Country Vulnerability Groups.

Country Vulnerability Group (CVG)	PC1 Score	PC2 Score	PC3 Score
CVG1	+	+	+
CVG2	+	+	-
CVG3	+	-	+
CVG4	+	-	-
CVG5	-	+	+
CVG6	-	+	-
CVG7	-	-	+
CVG8	-	-	-

The scores of PC1, PC2, and PC3 for each of the 17 analysed countries, along with the global groups, are reported in Table 27, while Figure 34 shows the score plot (PC1 *vs* PC2 *vs* PC3) of the global PCA. Additionally, Figure 35 shows a map of the classification of the 17 Member States according to the obtained CVGs.

Table 28. Global PCA – Scores and Country Vulnerability Groups.

GEO	PC1 (Scores)	PC2 (Scores)	PC3 (Scores)	Country Vulnerability Group (CVG)
Austria (AT)	-1.08	0.51	1.15	Country Vulnerability Group 5
Belgium (BE)	-0.78	1.02	0.76	Country Vulnerability Group 5
Cyprus (CY)	2.21	1.04	-2.84	Country Vulnerability Group 2
Denmark (DK)	-1.50	0.57	-0.13	Country Vulnerability Group 6
Estonia (EE)	-1.43	-1.48	0.33	Country Vulnerability Group 7
Greece (EL)	3.27	-1.73	0.61	Country Vulnerability Group 3
Spain (ES)	3.78	-0.70	1.15	Country Vulnerability Group 3
Finland (FI)	-2.49	-2.59	-1.52	Country Vulnerability Group 8
France (FR)	-0.11	0.82	-0.55	Country Vulnerability Group 6
Hungary (HU)	-0.69	0.77	0.03	Country Vulnerability Group 5
Ireland (IE)	-1.21	1.54	0.12	Country Vulnerability Group 5
Italy (IT)	1.32	0.00	0.80	Country Vulnerability Group 1
Latvia (LV)	-0.45	-0.79	0.27	Country Vulnerability Group 7
Netherlands (NL)	-1.37	1.28	0.47	Country Vulnerability Group 5
Portugal (PT)	3.07	0.36	-0.66	Country Vulnerability Group 2
Sweden (SE)	-1.91	-1.58	-0.06	Country Vulnerability Group 8
Slovenia (SI)	-0.62	0.97	0.07	Country Vulnerability Group 5

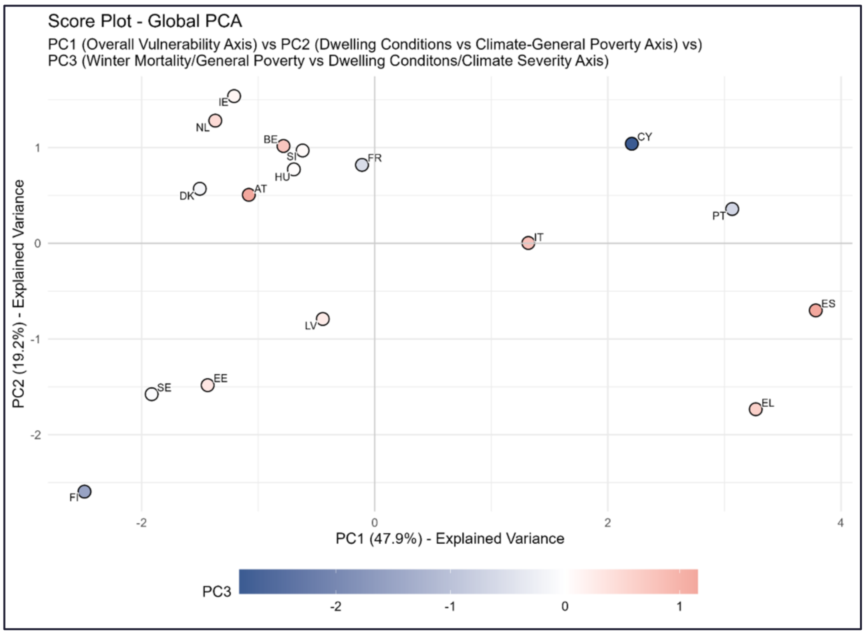


Figure 34. Global PCA – Score plot (PC1 *vs* PC2 *vs* PC3).

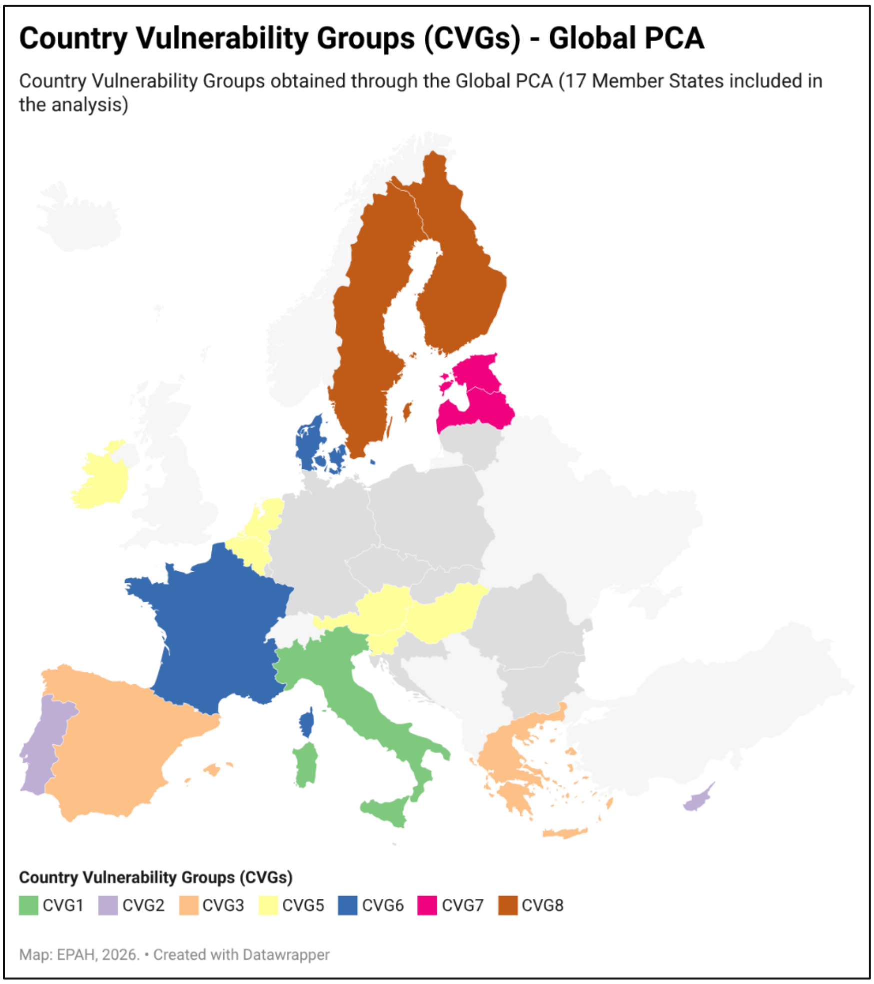


Figure 35. Global PCA - Map of the classification of the Member States included in the analysis according to CVGs.

iii.Key findings

Overview of the PCA Results

The results of both PCAs reveal distinct vulnerability profiles across the 17 analysed Member States. Grouping countries according to shared vulnerability patterns provides a structured basis for identifying targeted mitigation strategies and for tailoring policy measures. It should be noted, however, that PCA identifies gradients across indicators rather than unequivocal definitions of the main vulnerability driver in each country.

Beyond the sign of a country's score, its absolute value carries important analytical meaning: the higher the absolute value, the stronger the association between the country and the indicators loading in the same direction. Countries assigned to a group based on a score very close to zero occupy a borderline position between the two profiles. This is the case for Italy in CVG1, where a PC3 score close to zero is the only factor distinguishing it from CVG3, alongside Greece and Spain. Italy may therefore be reasonably associated with both CVG1 and CVG3. A summary of all country classifications across both PCAs is presented in Table 28.

Table 29. Overview of the classification of countries – Climate groups (CGs) and Country Vulnerability Groups (CVGs).

Climate Group (CG)	GEOs
(CG1) Countries characterised by high heat severity	CY – EL – ES – IT - PT
(CG2) Countries characterised by high cold severity	EE – FI – SE
(CG3) Countries characterised by mild cold conditions	AT – BE – DK – IE – LV - NL
(CG4) Countries characterised by mild heat conditions	FR – HU – SI
Country Vulnerability Group (CVG)	**GEOs**
(CVG1) Countries with high overall vulnerability, dominated by poor housing conditions, along with higher winter mortality levels	IT
(CVG2) Countries with high overall vulnerability, dominated by poor housing conditions and presenting relevant climate severity	CY - PT
(CVG3) Countries with high overall vulnerability, dominated by climate severity, along with relevant high winter mortality and general poverty levels	EL - ES
(CVG4) Countries with high overall vulnerability, dominated only by extreme climate conditions	-
(CVG5) Countries with low overall vulnerability, but still with relevant poor housing conditions and excess winter mortality levels, along with mild climate conditions	AT – BE – HU – IE – NL - SI
(CVG6) Countries with low overall vulnerability, but still with relevant levels of poor housing conditions, along with relevant climate severity	DK – FR

(CVG7) Countries with low overall vulnerability, dominated by climate severity, along with relevant general poverty levels	EE – LV
(CVG8) Countries with low overall vulnerability, dominated by climate severity	FI - SE

Climate Groups

The climate PCA reinforces the well-established contrast between Southern and Northern European countries. CG1 countries record the highest numbers of extreme and very strong heat stress days while presenting the lowest, and in some cases zero, values for cold stress. CG2 comprises the countries with the most severe cold conditions, located in the EU's northernmost part. CG3 and CG4 are characterised by milder thermal conditions, dominated, respectively, by moderate cold-stress and moderate heat-stress days.

Country Vulnerability Groups

CVG1 to CVG4 represent the groups in which EP mitigation efforts should be prioritised, as countries in these groups have the highest overall vulnerability levels across the analysed indicators.

Cyprus and Portugal (CVG2) are distinguished primarily by the highest shares of the population living in dwellings with leaks, damp, or rot — with average values for 2020 and 2023 of 36.0% for Cyprus and 27.1% for Portugal — combined with high levels of extreme and very strong heat stress. While Greece and Spain also experience considerable heat exposure, their lower shares of structurally deficient dwellings place them in a different group. Greece and Spain (CVG3) are instead characterised by the highest excess winter mortality values, with Spain recording the highest average and Greece the third highest, and elevated at-risk-of-poverty rates, placing them in a group where climate severity intersects with general poverty and winter health outcomes.

Italy (CVG1) occupies a borderline position, as discussed above, and shares considerable characteristics with CVG3. Its classification in CVG1 reflects a marginal PC3 score, and its vulnerability profile should be interpreted in light of both groups.

No countries were assigned to CVG4. Countries with high overall vulnerability tend to present elevated values for at least one indicator with a significant positive loading on PC2 or PC3, specifically poor dwelling conditions, general poverty, or excess winter mortality. CVG4, defined by high overall vulnerability with only extreme climate conditions as the driver, does not correspond to any of the 17 analysed countries.

Countries in CVG5 to CVG8 present lower overall vulnerability but nonetheless exhibit specific expressions of vulnerability that merit attention, often concentrated in particular population groups or territories.

CVG5 is the largest group, comprising six countries: Austria, Belgium, Hungary, Ireland, the Netherlands, and Slovenia. Despite their lower overall vulnerability, these countries have significant shares of the population living in structurally deficient dwellings — Slovenia ranks fourth and Ireland sixth among the 17 countries for this indicator — alongside notable levels of excess winter mortality, particularly in

Austria (fifth-highest average value) and Belgium (sixth-highest average value). Climate conditions in CVG5 are mild, dominated by moderate cold and heat stress rather than extreme thermal exposure.

Denmark and France (CVG6) share the characteristic of a higher share of structurally deficient dwellings, alongside more pronounced climate severity: France recorded the second-highest average number of strong heat stress days, while Denmark showed the fifth-highest values for both very strong and strong cold stress days. This combination of housing vulnerability and climate exposure distinguishes them from the CVG5 profile.

Estonia and Latvia (CVG7) are characterised by extreme cold exposure and the highest at-risk-of-poverty rates among the 17 analysed countries, creating a vulnerability profile in which severe climate conditions intersect with elevated general poverty levels. Finland and Sweden (CVG8) present the lowest overall vulnerability in the dataset across nearly all indicators, except cold stress, where they record among the highest values. Their strong socioeconomic conditions, low poverty rates, and well-developed heating infrastructure effectively mitigate the risks of extreme cold exposure, making them a relevant reference point for countries seeking to reduce vulnerability in cold climates.

In summary, countries in CVG2 (Cyprus and Portugal) and CVG5 (Austria, Belgium, Hungary, Ireland, the Netherlands, and Slovenia) show significant shares of the population living in dwellings affected by leaks, damp, or rot. Moreover, Member States in CVG3 (Greece and Spain) and CVG7 (Estonia and Latvia) exhibit high rates of general poverty and the highest excess winter mortality among the 17 analysed countries. CVG6 countries (Denmark and France) present markedly different thermal conditions, with Denmark experiencing predominantly cold exposure and France experiencing predominantly heat stress. However, both countries show notable shares of the population living in dwellings with structural deficiencies. Finland and Sweden (CVG8) present the lowest overall vulnerability among the analysed countries, as their socioeconomic and housing policy frameworks offer a useful reference point for countries facing more severe vulnerability scenarios.

The resulting CVGs reveal shared vulnerability patterns that can assist Member States in identifying priority areas for energy poverty alleviation efforts. They also highlight which Member States face similar challenges, pointing to opportunities for sharing policy approaches and experiences to more effectively mitigate energy poverty conditions.

6. Recommendations and Conclusions

The findings presented in this report, spanning updated and newly introduced EPAH indicators, cross-indicator correlation analysis, and multidimensional vulnerability profiling, provide a solid empirical basis for actionable policy guidance. In this work, EPAH expands the scope of EP measurement by incorporating new calculations, additional EU-wide datasets, and indicators spanning climate exposure, public health, housing quality, and transport access. **Connecting this technical evidence with a multidimensional analysis of EP drivers is essential for developing a socially inclusive and climate-responsive policy framework that mitigates EP conditions across the EU without deepening existing social inequalities.**

This section identifies the **key constraints in the current EU data landscape that continue to affect the depth of EP assessment possible at this stage and offers recommendations for policymakers, data providers, and statistical authorities.**

6.1. Key Data Constraints and Recommendations for Energy Poverty Measurement

Measuring energy poverty in its full complexity depends heavily on the quality, scope, and timeliness of the underlying data. Despite continued efforts to enrich the EPAH indicator framework, including updating five existing indicators and introducing nine new ones, two structural constraints in the current EU data landscape continue to limit the depth of EP assessment that is currently achievable.

Limited regional data coverage and non-annual availability of key indicators. Across the EU, only a small number of datasets relevant to EP offer disaggregation at the NUTS II or III level, constraining local and regional authorities' ability to access the granular data needed to design strategies tailored to their specific climate, socioeconomic, and cultural contexts. Moreover, regional data collection processes are typically complex and costly, requiring greater engagement from local statistical offices and potentially yielding datasets with limited representativeness of regional populations. Regional governments typically have a more precise understanding of local vulnerability drivers than national administrations, and targeted local strategies often have a greater impact than top-down national programmes. A related and equally significant constraint concerns the periodicity of data collection: key indicators for EP measurement, particularly those collected through the 2023 Eurostat EU-SILC Energy Efficiency Module, such as "Population living in dwellings comfortably cool in summer time", "Population living in dwellings comfortably warm in winter time", "Population living in a dwelling equipped with heating facilities", and "Persons living in dwellings whose energy efficiency had been improved in the last 5 years", do not have annual values collected consistently. This makes robust historical analyses aimed at identifying patterns and trends in variation, or at assessing the effectiveness of public measures and programmes, currently infeasible for these indicators. Greater investment in regional and consistent annual data collection would substantially increase the practical value delivered to local policymakers and the CoM community, while also enabling more detailed historical assessments of EP conditions.

Uneven progress in capturing summer energy poverty. Current EU-wide data collection has historically prioritised winter conditions, and while this imbalance is beginning to be addressed, coverage remains incomplete. Encouragingly, the indicator on the population living in dwellings that are comfortably cool in summer is seeing renewed, albeit optional, data collection across a growing number of Member States, reflecting increasing recognition of summer EP as a policy priority. However, this progress is not yet uniform: not all countries report national values, Eurostat does not collect them yet, and some related indicators, such as air-conditioning equipment availability, have not been updated in recent years. Member States already exposed to higher frequencies of extreme heat events, where the health and energy burdens of summer conditions are most acute, should treat the systematic collection of data on indoor thermal discomfort and excess summer mortality as a policy priority. This is particularly urgent given that robust temperature data already confirm which countries face the greatest heat-stress exposure, making the absence of corresponding indoor comfort and mortality data a critical gap. Closing this gap would enable a stronger assessment of the population-level impacts of heat stress and strengthen the evidence base for targeted national and subnational EP mitigation strategies.

By contrast, the related winter indicator on population living in dwellings comfortably warm in winter time was mandatory in the 2023 EU-SILC collection, and the inability to keep homes adequately warm indicator is updated annually and explicitly referenced in the EED. Data availability on the distinction between the reported causes of inability to maintain thermal comfort, whether related to affordability or building conditions, is also essential to enable more accurate analyses linking causes to effects in EP vulnerability assessments. As climate change accelerates heat exposure across Europe, ensuring that summer EP indicators achieve the same breadth, frequency, and national coverage as their winter counterparts should be a priority for Eurostat and national statistical offices. The growing evidence presented in this report of rising summer excess mortality, not only in Southern Europe but also, increasingly, in countries with traditionally milder climates, makes this a matter of growing urgency.

To address these constraints, the following recommendations are put forward:

- Introduce seasonal disaggregation for key EP indicators. Separating annual results into winter and summer periods would improve the identification of seasonal EP drivers and support the design of season-specific mitigation strategies. Indicators that would particularly benefit from this disaggregation include "Arrears on utility bills", where seasonal separation would enable analysis of variations between heating and cooling costs, and "Share of household income allocated to expenditure, by purpose", where it would help identify seasonal patterns in household expenditure. National statistical offices should be encouraged to implement this disaggregation as a standard feature of EP-relevant data collection, enabling more targeted and timely policy responses.

- Strengthen regional data collection and support local authorities in EP mitigation. An important step towards more effective local EP strategies is the provision of indicator data at the NUTS II or III level. Central administrations should be encouraged to collaborate with local governments, research centres, and national and regional observatories to collect data that reflects territorial disparities. This would enable both the EPAH indicators dashboard and local authorities to support the development of more accurate and geographically targeted responses to EP conditions, in line with EU and CoM objectives.

6.2. Conclusions

Energy poverty is a complex, multidimensional problem that cannot be adequately captured through a narrow or static set of indicators. **Meaningful measurement requires data that reflects the full range of vulnerability conditions, spanning climate exposure, housing quality, socioeconomic status, health outcomes, and transport access**, and must be regularly reviewed and updated to remain relevant as the EU policy context and data landscape evolve.

This report has advanced EP measurement and improved the EPAH energy-poverty indicator framework in three ways. **First, five existing indicators were updated** to reflect new definitions, revised datasets, and recently published evidence, covering excess winter mortality, heating equipment, winter and summer thermal discomfort, and household expenditure. **Second, nine new indicators were introduced** to bring previously underrepresented topics into the framework, including climate stress days, summer excess mortality, material deprivation, energy efficiency improvements in dwellings, and transport-related vulnerability. **Third, an integrated cross-analysis of eight key indicators across 17 EU Member States identified structural correlations and distinct vulnerability profiles**, grouping countries according to shared patterns of thermal stress and socioeconomic risk.

The combined results of the climate and global PCAs confirm that **EP vulnerability in Europe is shaped by a complex interplay of thermal exposure, housing conditions, socioeconomic factors, and health outcomes**. The identified Country Vulnerability Groups provide a structured, evidence-based foundation for future studies and analyses to inform targeted policy recommendations and the development of tailored strategies to mitigate EP based on the obtained CVGs.

The results also reveal **a clear contrast between Southern European Member States, characterised by higher structural vulnerability and heat severity, and Northern countries, where lower overall vulnerability coexists with cold exposure**. Within these broad patterns, the analysis identifies more granular distinctions among countries in which vulnerability is driven primarily by poor housing conditions, high poverty rates, or specific combinations of climate and socioeconomic risk that are directly relevant to the design of targeted national policies.

The analysis further underscores **the growing relevance of summer energy poverty**. The evidence presented for summer excess mortality and heat stress indicators confirms that **thermal vulnerability is no longer a predominantly winter phenomenon in Europe**, and that the data infrastructure underpinning EP assessment must evolve accordingly.

Classifying countries according to shared vulnerability profiles represents an important step towards more efficient and equitable energy poverty mitigation. These profiles do not replace national assessments but provide a structured, evidence-based starting point for developing policy frameworks that **address the underlying drivers of energy poverty rather than its symptoms alone**. As the EPAH indicator framework and associated dashboard continue to evolve, **periodic updates to the indicator set, including removing outdated measures, incorporating new data sources, and expanding into underrepresented dimensions, will be essential** for continuing to support Member States, local authorities, and CoM signatories in delivering effective, contextually appropriate EP mitigation strategies.

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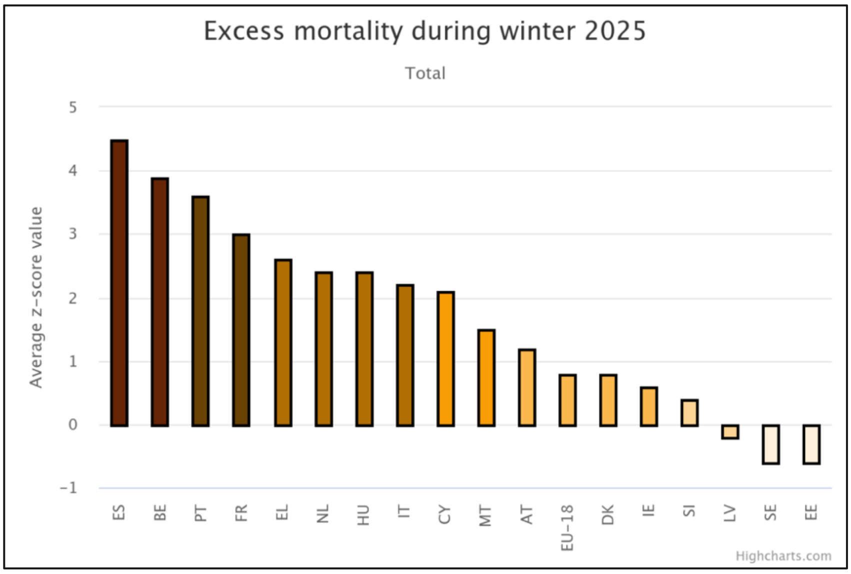
Appendix A – Restructured EPAH Indicators

A1. Excess mortality during winter

"Excess mortality during winter" – Updated data (Winter 2024/2025)

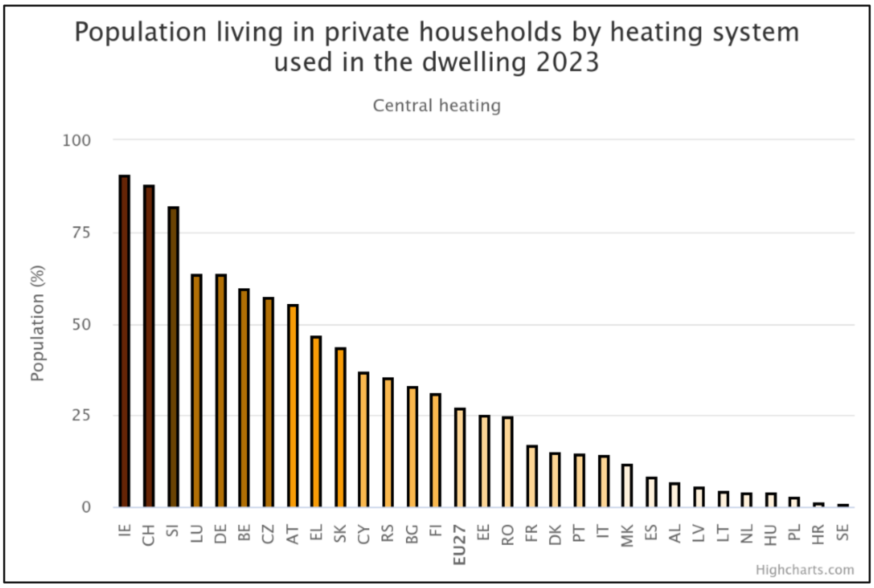


Excess mortality during winter (Average z-score)		
GEO	**Code**	**Winter 2024/2025**
Austria	AT	1.2
Belgium	BE	3.9
Cyprus	CY	2.1
Denmark	DK	0.8
Estonia	EE	-0.6
European Union - 18	EU-18	0.8
Finland	FI	-1.3
France	FR	3.0
Greece	EL	2.6
Hungary	HU	2.4
Ireland	IE	0.6
Italy	IT	2.2
Latvia	LV	-0.2
Malta	MT	1.5
Netherlands	NL	2.4
Norway	NO	0.8
Portugal	PT	3.6
Slovenia	SI	0.4
Spain	ES	4.5
Sweden	SE	-0.6
Switzerland	CH	1.9
United Kingdom	UK	0.6

Excess mortality during winter (Average z-score)
Disaggregation options
Age group: 0-14 years. 15-44 years. 45-64 years. 65-74 years. 75-84 years. 65+ years. 85+years.

A2. Population living in private households by heating system used in the dwelling

"Population living in private households by heating system used in the dwelling" – Disaggregation option by heating system ("Central Heating") - Updated data (2023)



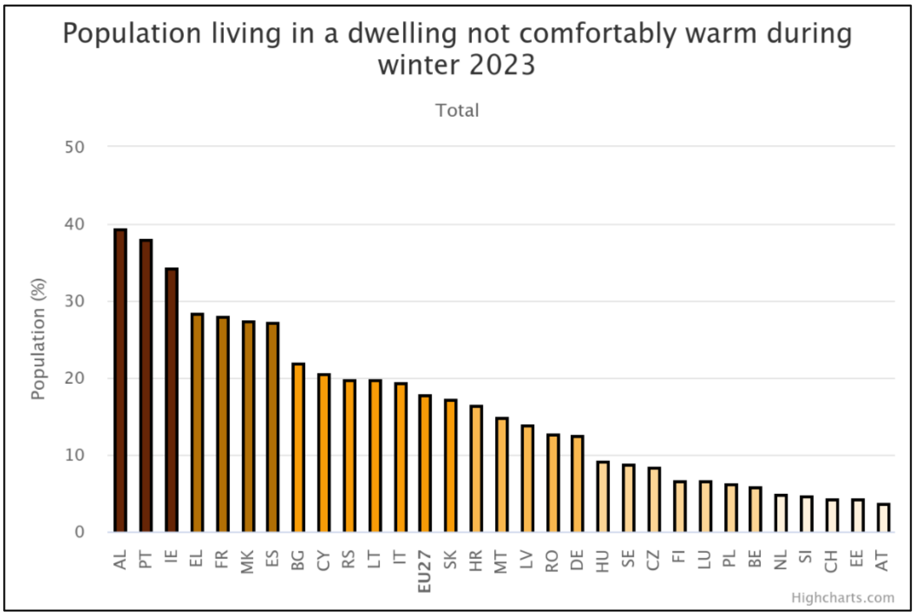
Population living in private households by heating system used in the dwelling (%) (2023)							
GEO	**Code**	**Central heating (%)**	**District heating network/ teleheating (%)**	**Individual heating (%)**	**No fixed heating (%)**	**No heating (%)**	**Unknown (%)**
Albania	AL	7.3	10.2	54.2	24.7	2.4	1.2
Austria	AT	56.0	26.4	17.0	0.0	0.7	0.0
Belgium	BE	60.2	0.5	38.5	0.7	0.0	0.0
Bulgaria	BG	31.7	17.4	48.6	2.2	0.1	0.0
Croatia	HR	1.6	6.0	91.5	0.8	0.0	0.1
Cyprus	CY	32.4	0.0	39.8	26.7	1.1	0.0
Czechia	CZ	57.0	38.4	4.5	0.0	0.0	0.0
Denmark	DK	22.6	64.9	12.5	0.0	0.1	0.0
Estonia	EE	23.8	51.7	22.8	1.7	0.1	0.0
European Union - 27	EU-27	27.1	12.6	52.8	3.6	3.1	0.8
Finland	FI	38.4	48.5	13.1	0.0	0.0	0.0
France	FR	14.1	2.3	80.0	0.8	2.8	0.0
Germany	DE	64.3	13.7	19.5	0.2	0.1	2.2
Greece	EL	46.6	0.4	47.9	4.4	0.8	0.0
Hungary	HU	5.5	12.7	81.5	0.3	0.1	0.0
Ireland	IE	91.2	0.6	7.1	0.7	0.4	0.0
Italy	IT	15.3	2.3	76.5	3.8	1.5	0.7
Latvia	LV	6.3	50.8	42.5	0.3	0.0	0.1
Lithuania	LT	4.2	52.7	41.8	0.4	0.0	1.0
Luxembourg	LU	69.9	6.0	18.5	0.1	0.1	5.5
Malta	MT	0.0	0.0	50.8	37.4	11.1	0.7
Netherlands	NL	2.1	7.8	86.7	0.5	0.1	2.7
North Macedonia	MK	11.0	6.0	80.4	1.8	0.6	0.1
Norway	NO	6.5	5.5	85.5	1.2	0.1	1.1
Poland	PL	3.1	31.1	64.0	1.7	0.0	0.1
Portugal	PT	13.5	2.3	33.5	23.5	26.9	0.3
Romania	RO	23.1	10.9	65.2	0.6	0.1	0.1
Serbia	RS	31.9	19.6	46.8	1.5	0.1	0.0
Slovakia	SK	44.9	24.8	30.2	0.2	0.0	0.0
Slovenia	SI	78.7	11.7	9.0	0.5	0.0	0.1
Spain	ES	8.7	0.8	56.4	17.1	16.4	0.5
Sweden	SE	1.4	59.5	35.7	0.3	0.1	3.0
Switzerland	CH	89.2	8.7	1.8	0.1	0.0	0.2

Population living in private households by heating system used in the dwelling (%)		
Disaggregation options:*		
Type of heating system:	**Sex:**	**Household composition:**
Central heating.	Female.	One single male.
District heating network/teleworking.	Male.	One single female.
Individual heating.		One adult.
No fixed heating.	**Risk of poverty or social exclusion:**	One adult with dependent children.
Unknown.	At risk of poverty or social exclusion.	Two adults with dependent children.
	Not at risk of poverty or social exclusion.	Two adults with three or more dependent children.
Age group:		Two or more adults with dependent children.
16-29 years.	**Level of disability:**	Two or more adults without dependent children.
16-44 years.	No disability.	Three or more adults.
16-64 years.	Some disability.	Three or more adults with dependent children.
25-34 years.	Some or severe disability.	Household with dependent children.
35-44 years.	Severe disability.	Household without dependent children.
45-64 years.		One adult younger than 65 years.
65 years or over.		One adult 65 years or over.
		Two adults younger than 65 years.
		Two adults, at least one aged 65 years or over.

* For the degree of urbanisation, household composition, and level of disability disaggregation options, data only available for the population aged 16 years or over. Additionally, for the options related to degree of urbanisation and household composition, no data is available for Albania. For the options related to the level of disability, no data for Luxembourg.

A3. Population living in a dwelling not comfortably warm during winter

"Population living in a dwelling not comfortably warm during winter" – Updated data (2023)



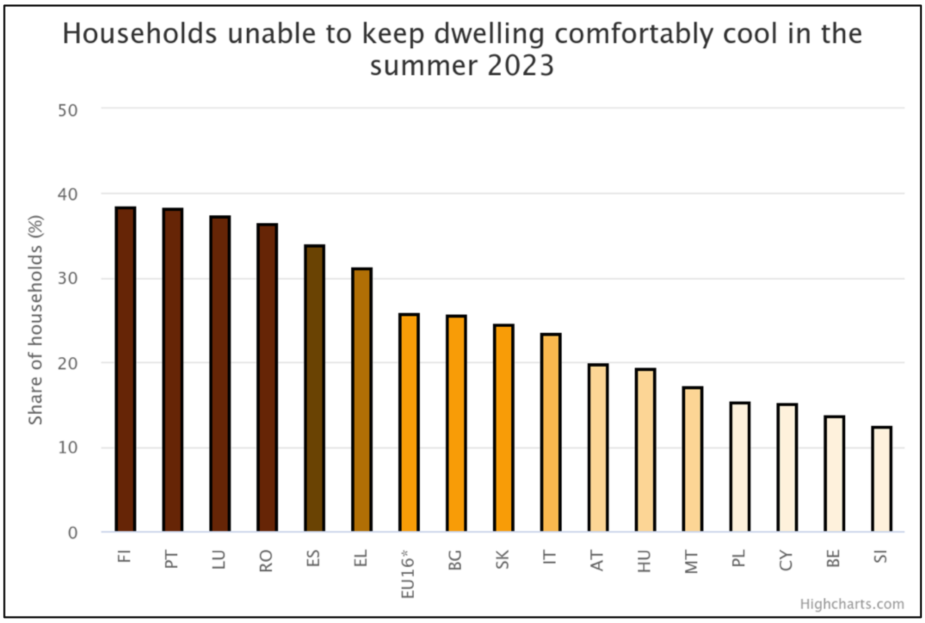
Population living in a dwelling not comfortably warm during winter (%) - 2023		
GEO	**Code**	**2023 (%)**
Albania	AL	39.4
Austria	AT	3.7
Belgium	BE	5.8
Bulgaria	BG	22.0
Croatia	HR	16.5
Cyprus	CY	20.5
Czechia	CZ	8.5
Estonia	EE	4.3
European Union 27	EU-27	17.9
Finland	FI	6.7
France	FR	28.1
Germany	DE	12.6
Greece	EL	28.5
Hungary	HU	9.2
Ireland	IE	34.3
Italy	IT	19.4
Latvia	LV	14.0
Lithuania	LT	19.9
Luxembourg	LU	6.6
Malta	MT	14.9
Netherlands	NL	4.9
North Macedonia	MK	27.4
Norway	NO	17.4
Poland	PL	6.3
Portugal	PT	38.0
Romania	RO	12.8
Serbia	RS	19.9
Slovakia	SK	17.3
Slovenia	SI	4.7
Spain	ES	27.3
Sweden	SE	8.9
Switzerland	CH	4.3

Population living in a dwelling not comfortably warm during winter (%)		
Disaggregation options:*		
Degree of urbanisation Cities. Towns and suburbs. Rural areas. **Sex:** Female. Male.	**Risk of poverty or social exclusion:** At risk of poverty or social exclusion. Not at risk of poverty or social exclusion. **Level of disability:** No disability. Some disability. Some or severe disability. Severe disability.	**Household composition:** One single male. One single female. One adult. One adult with dependent children. Two adults with dependent children. Two adults with three or more dependent children. Two or more adults with dependent children. Two or more adults without dependent children. Three or more adults. Three or more adults with dependent children. Household with dependent children. Household without dependent children. One adult younger than 65 years. One adult 65 years or over. Two adults younger than 65 years. Two adults, at least one aged 65 years or over.

* For the degree of urbanisation, household composition, and level of disability disaggregation options, data only available for the population aged 16 years or over. Additionally, for the options related to degree of urbanisation and household composition, no data is available for Albania. For the options related to the level of disability, no data for Luxembourg.

A4. Households unable to keep dwelling comfortably cool in the summer

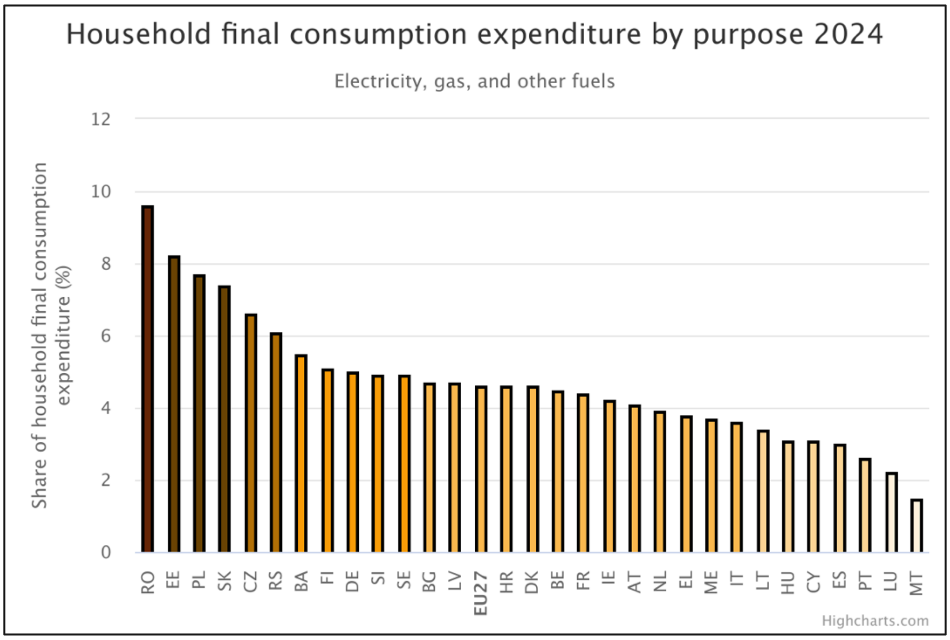
"Households unable to keep dwelling comfortably cool in the summer" – Updated data (2023)



Share of households unable to keep dwelling comfortably cool in the summer (%) - 2023		
GEO	Code	2023 (%)
Austria	AT	19.8
Belgium	BE	13.7
Bulgaria	BG	25.7
Cyprus	CY	15.2
European Union - 16	EU-16	25.1
Finland	FI	38.5
Greece	EL	31.2
Hungary	HU	19.4
Italy	IT	23.4
Luxembourg	LU	37.4
Malta	MT	17.1
Poland	PL	15.3
Portugal	PT	38.2
Romania	RO	36.4
Slovakia	SK	24.6
Slovenia	SI	12.4
Spain	ES	34.0

A5. Household final consumption expenditure by purpose

"Household final consumption expenditure by purpose – Disaggregation option by cost category ("electricity, gas, and other fuels")" – Updated data (2024)



Share of household final consumption expenditure by purpose				
GEO	Code	2024 (%)		
		Food and non-alcoholic beverages (%)	Housing, water, electricity, gas and other fuels (%)	Health (%)
Austria	AT	10.2	23.0	4.0
Belgium	BE	11.0	24.2	7.6
Bulgaria	BG	20.1	16.6	6.8
Croatia	HR	17.6	14.4	5.4
Cyprus	CY	12.5	17.8	2.4
Czechia	CZ	13.6	32.1	2.6
Denmark	DK	11.8	28.5	2.9
Estonia	EE	18.8	25.4	3.6
European Union 27	EU-27	13.2	23.6	4.5
Finland	FI	12.7	29.6	4.2
France	FR	12.1	27.5	3.8
Germany	DE	11.2	23.3	5.9
Greece	EL	15.8	21.8	3.9
Hungary	HU	16.8	21.5	3.4
Ireland	IE	9.8	25.0	4.3
Italy	IT	14.7	22.8	3.4
Latvia	LV	20.1	15.8	4.8
Lithuania	LT	18.6	16.2	5.2
Luxembourg	LU	9.3	19.9	4.4
Malta	MT	11.6	15.2	5.0
Montenegro	ME	22.8	10.9	2.3
Netherlands	NL	11.3	22.1	3.3
Poland	PL	18.1	20.8	5.8
Portugal	PT	18.2	16.6	5.5
Romania	RO	23.1	27.1	4.2
Serbia	RS	23.6	18.2	4.2
Slovakia	SK	19.7	27.6	2.7
Slovenia	SI	14.3	18.0	2.6
Spain	ES	12.4	20.9	4.1
Sweden	SE	13.1	24.9	3.0
Switzerland	CH	8.9	27.0	17.1
Türkiye	TR	21.7	15.9	2.5

Share of household final consumption expenditure by purpose
Disaggregation options
Expenditure classes of "Housing, water, electricity, gas, and other fuels":
Actual rental payments.
Rental payments for housing.
Maintenance, repair and security of the dwelling.
Water supply and miscelaneous services related to the dwelling.
Electricity, gas, and other fuels.

Appendix B – New EPAH indicators

B1. Overview of the new EPAH indicators

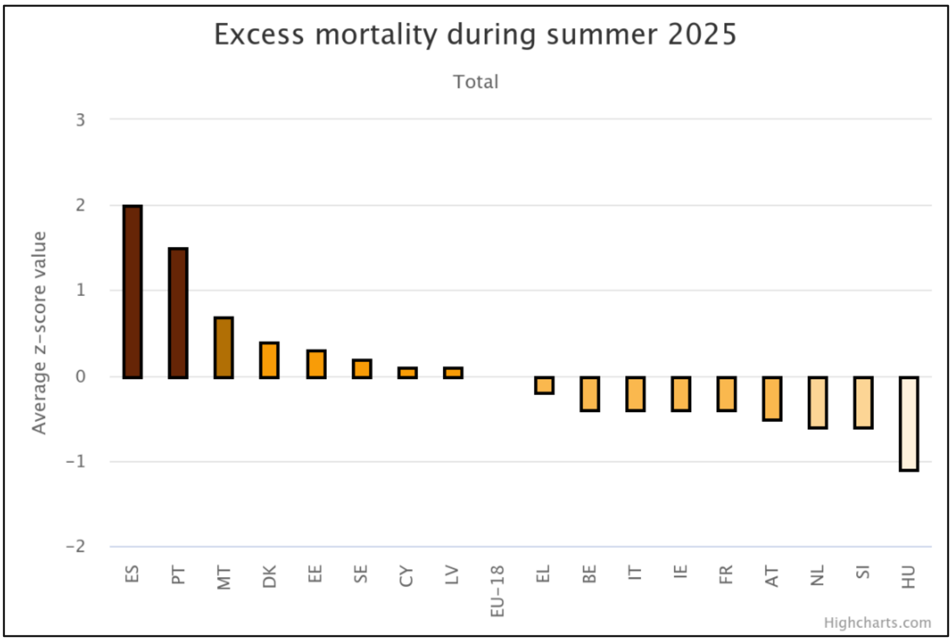
List of Indicators											
I1: Excess mortality during summer (average z-score) I2: Cold stress days (number of days) I3: Heat stress days (number of days) I4: Population living in dwellings whose energy efficiency improved in the last 5 years (share of the population) I5: At-risk-of-poverty rate (share of the population)* I6: Population that is materially and socially deprived (MSD) and owns a car (share of the population) I7: Household final consumption expenditure allocated to transport costs (share of household final consumption expenditure) I8: Population who cannot afford a personal car (share of the population)** I9: Population using or not public transport (share of the population) * Data available for 2025 for only 4 GEOs (Bulgaria, Estonia, Germany, and Latvia). ** Data available for 2025 for only 2 GEOs (Bulgaria and Estonia).											
Code	GEO	Number of indicators with available data	I1	I2	I3	I4	I5	I6	I7	I9	I9
	Last Update		2025	2024	2024	2023	2024	2022	2024	2024	2024
AL	Albania	5	No	Yes	Yes	Yes	No	No	No	No	Yes
AT	Austria	9	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
BA	Bosnia and Herzegovina	2	No	Yes	Yes	No	No	No	No	No	No
BE	Belgium	9	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
BG	Bulgaria	8	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CH	Switzerland	7	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes
CY	Cyprus	9	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CZ	Czechia	8	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

DE	Germany	8	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
DK	Denmark	8	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes
EE	Estonia	9	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
EL	Greece	9	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ES	Spain	9	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
EU27	EU 27 (2020)	4	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
EU28	EU 28	0	No	No	No	No	No	No	No	No	No
FI	Finland	9	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
FR	France	9	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
GE	Georgia	2	No	Yes	Yes	No	No	No	No	No	No
HR	Croatia	8	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
HU	Hungary	9	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
IE	Ireland	9	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
IS	Iceland	2	No	Yes	Yes	No	No	No	No	No	No
IT	Italy	9	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
LI	Liechtenstein	0	No	No	No	No	No	No	No	No	No
LT	Lithuania	8	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
LU	Luxembourg	8	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
LV	Latvia	9	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
MD	Moldova	2	No	Yes	Yes	No	No	No	No	No	No
ME	Montenegro	3	No	Yes	Yes	No	No	No	Yes	No	No
MK	North Macedonia	4	No	Yes	Yes	Yes	No	No	No	No	No
MT	Malta	7	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes
NL	Netherlands	9	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
NO	Norway	6	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes
PL	Poland	8	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
PT	Portugal	9	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
RO	Romania	8	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
RS	Serbia	6	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes

SE	Sweden	9	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
SI	Slovenia	9	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
SK	Slovakia	8	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
TR	Turkey	5	No	Yes	Yes	No	Yes	No	Yes	Yes	Yes
UA	Ukraine	2	No	Yes	Yes	No	No	No	No	No	No
UK	United Kingdom	3	Yes	Yes	Yes	No	No	No	No	No	No
XK	Kosovo	2	No	Yes	Yes	No	No	No	No	No	No
Total			*22*	*40*	*40*	*32*	*32*	*28*	*32*	*32*	*33*

B1. Excess mortality during summer

"Excess mortality during summer" – Updated data (Summer 2025)

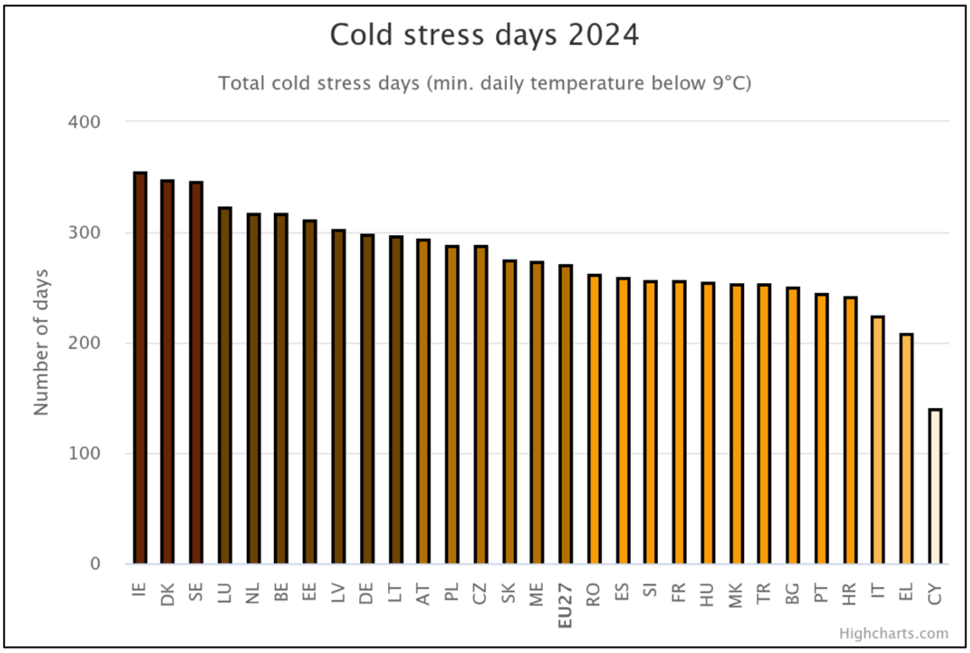


Excess mortality during summer (Average z-score)		
GEO	**Code**	**Summer 2025**
Austria	AT	-0.5
Belgium	BE	-0.4
Cyprus	CY	0.1
Denmark	DK	0.4
Estonia	EE	0.3
European Union - 18	EU-18	0.0
Finland	FI	-0.1
France	FR	-0.4
Greece	EL	-0.2
Hungary	HU	-1.1
Ireland	IE	-0.4
Italy	IT	-0.4
Latvia	LV	0.1
Malta	MT	0.7
Netherlands	NL	-0.6
Norway	NO	0.3
Portugal	PT	1.5
Slovenia	SI	-0.6
Spain	ES	2.0
Sweden	SE	0.2
Switzerland	CH	0.1
United Kingdom	UK	-0.6

Excess mortality during summer (Average z-score)
Disaggregation options
Age group: 0-14 years. 15-44 years. 45-64 years. 65-74 years. 75-84 years. 65+ years. 85+years.

B2. Cold Stress Days

"Cold stress days" – Total cold stress days - Updated data (2024)

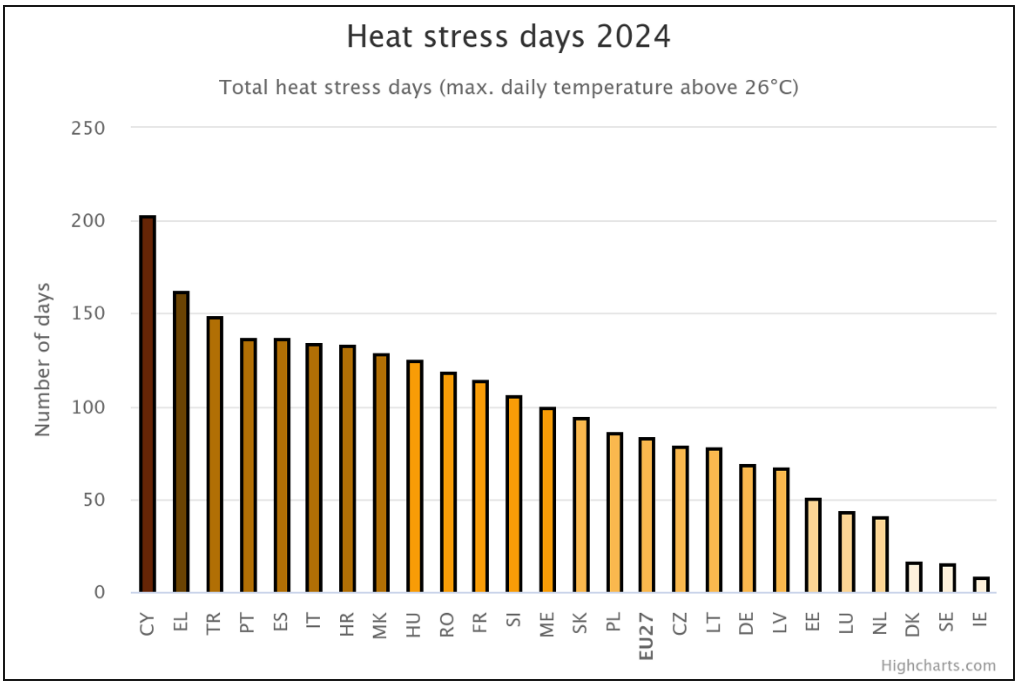


Cold stress days - 2024						
GEO	Code	2024				
		Extreme	Very Strong	Strong	Moderate	Slight
Albania	AL	0.0	0.2	7.7	103.2	114.5
Austria	AT	0.0	1.2	45.0	147.3	100.5
Belgium	BE	0.0	0.5	39.3	146.8	130.4
Bosnia and Herzegovina	BA	0.0	0.3	19.1	130.6	109.0
Bulgaria	BG	0.0	0.4	18.4	136.0	96.0
Croatia	HR	0.0	0.0	13.5	119.3	108.9
Cyprus	CY	0.0	0.0	0.0	15.5	124.7
Czechia	CZ	0.0	1.5	48.9	143.3	95.0
Denmark	DK	0.0	6.8	77.8	155.8	107.9
Estonia	EE	2.8	18.0	96.8	110.1	84.2
EU-27	EU-27	0.2	4.9	41.3	119.2	104.9
Finland	FI	1.7	41.2	108.3	94.0	79.6
France	FR	0.0	0.1	17.8	119.2	119.4
Georgia	GE	0.0	3.1	50.4	132.6	93.3
Germany	DE	0.0	0.4	39.0	141.4	117.6
Greece	EL	0.0	0.1	3.2	75.0	130.4
Hungary	HU	0.0	0.7	27.2	138.3	88.1
Iceland	IS	6.6	65.2	140.6	123.5	29.8
Ireland	IE	0.0	0.0	27.5	172.9	155.2
Italy	IT	0.0	0.3	9.8	100.3	114.8
Kosovo	XK	0.0	0.0	15.5	136.3	102.5
Latvia	LV	0.5	13.1	83.7	118.0	87.7
Lithuania	LT	0.0	9.3	76.2	123.4	88.5
Luxembourg	LU	0.0	1.0	53.5	145.9	123.3
Moldova	MD	0.0	3.2	32.5	138.6	78.8
Montenegro	ME	0.0	0.5	31.5	132.0	109.7
Netherlands	NL	0.0	0.9	46.6	141.9	128.6
North Macedonia	MK	0.0	0.3	11.7	134.3	107.6
Norway	NO	7.7	39.8	106.1	118.5	80.8
Poland	PL	0.0	3.3	56.4	136.2	93.1
Portugal	PT	0.0	0.0	0.5	77.8	166.3
Romania	RO	0.0	1.1	27.0	147.3	87.2
Serbia	RS	0.0	0.0	18.5	138.9	95.8
Slovakia	SK	0.0	1.7	31.2	149.1	93.0
Slovenia	SI	0.0	0.2	15.8	129.4	111.4
Spain	ES	0.0	0.0	11.3	113.1	135.2
Sweden	SE	0.7	25.5	108.9	115.5	95.0
Switzerland	CH	0.0	2.5	46.8	154.8	108.6
Türkiye	TR	0.0	1.6	24.3	128.9	99.0
Ukraine	UA	0.2	7.1	61.6	126.1	73.6
United Kingdom	UK	0.0	0.4	53.3	172.2	126.5

Cold stress days (Number of days)
Disaggregation options
Cold severity class: Extreme cold stress. Very strong cold stress. Strong cold stress. Moderate cold stress. Slight cold stress.

B3. Heat Stress Days

"Heat stress days" – Total heat stress days - Updated data (2024)

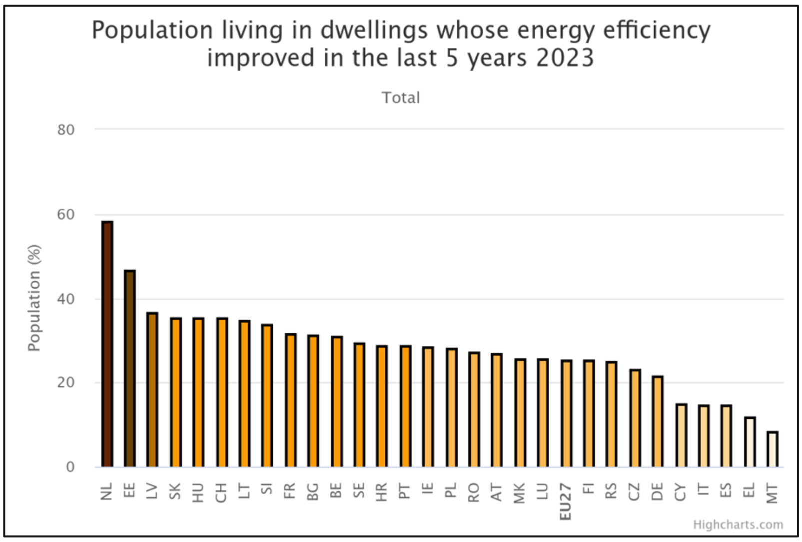


Heat stress days - 2024					
GEO	Code	2024			
		Extreme	Very Strong	Strong	Moderate
Albania	AL	0.0	10.6	59.9	80.2
Austria	AT	0.0	0.6	15.6	56.8
Belgium	BE	0.0	0.2	8.7	36.1
Bosnia and Herzegovina	BA	0.0	7.5	44.3	68.6
Bulgaria	BG	0.0	11.0	56.0	64.7
Croatia	HR	0.0	15.2	53.3	64.5
Cyprus	CY	0.0	30.5	83.9	88.2
Czechia	CZ	0.0	0.2	23.3	55.7
Denmark	DK	0.0	0.0	0.1	16.1
Estonia	EE	0.0	0.0	2.0	48.8
EU-27	EU-27	0.0	5.5	26.5	50.9
Finland	FI	0.0	0.0	0.4	28.6
France	FR	0.0	10.9	54.4	48.8
Georgia	GE	0.0	2.8	26.5	68.3
Germany	DE	0.0	0.1	17.8	51.1
Greece	EL	0.0	16.8	69.0	75.9
Hungary	HU	0.0	13.7	51.2	60.4
Iceland	IS	0.0	0.0	0.0	0.5
Ireland	IE	0.0	0.0	0.0	8.2
Italy	IT	0.0	14.2	48.3	71.3
Kosovo	XK	0.0	10.4	50.3	64.2
Latvia	LV	0.0	0.0	3.2	63.4
Lithuania	LT	0.0	0.0	6.8	71.0
Luxembourg	LU	0.0	0.0	7.1	36.0
Moldova	MD	0.0	10.4	50.1	61.0
Montenegro	ME	0.0	0.9	31.8	66.6
Netherlands	NL	0.0	0.2	5.8	34.5
North Macedonia	MK	0.0	9.7	48.1	70.6
Norway	NO	0.0	0.0	0.0	7.4
Poland	PL	0.0	0.1	20.0	65.5
Portugal	PT	0.0	14.0	41.0	81.8
Romania	RO	0.0	11.4	43.5	63.5
Serbia	RS	0.0	18.1	50.4	64.2
Slovakia	SK	0.0	2.5	32.7	58.7
Slovenia	SI	0.0	2.4	44.8	58.5
Spain	ES	0.1	20.6	43.4	72.8
Sweden	SE	0.0	0.0	0.0	15.6
Switzerland	CH	0.0	0.0	10.5	48.5
Türkiye	TR	0.5	17.4	51.4	79.2
Ukraine	UA	0.0	5.3	36.9	63.0
United Kingdom	UK	0.0	0.0	0.6	11.3

Heat stress days (Number of days)
Disaggregation options
Heat severity classes: Extreme heat stress. Very strong heat stress. Strong heat stress. Moderate heat stress.

B4. Population living in dwellings whose energy efficiency had been improved in the last 5 years

"Population living in dwellings whose energy efficiency had been improved in the last 5 years" – Updated data (2023)

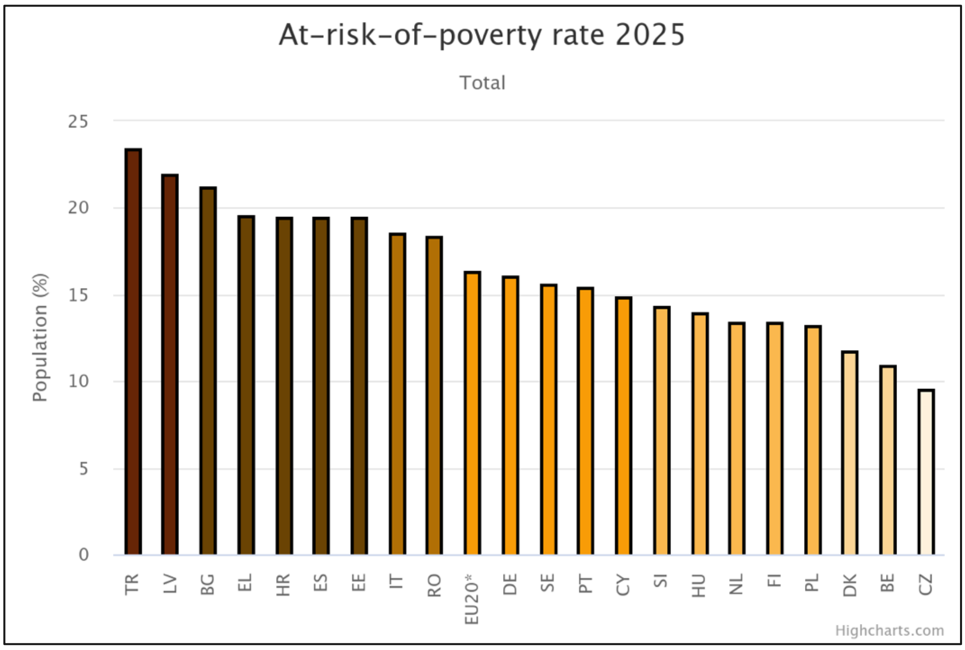


Population living in dwellings whose energy efficiency improved in the last 5 years (%) - 2023		
GEO	**Code**	**2023 (%)**
Albania	AL	29.0
Austria	AT	27.1
Belgium	BE	31.1
Bulgaria	BG	31.4
Croatia	HR	28.9
Cyprus	CY	15.2
Czechia	CZ	23.3
Estonia	EE	46.7
European Union 27	EU-27	25.5
Finland	FI	25.3
France	FR	31.8
Germany	DE	21.6
Greece	EL	11.9
Hungary	HU	35.4
Ireland	IE	28.4
Italy	IT	14.7
Latvia	LV	36.7
Lithuania	LT	34.9
Luxembourg	LU	25.6
Malta	MT	8.4
Netherlands	NL	58.5
North Macedonia	MK	25.6
Norway	NO	25.6
Poland	PL	28.3
Portugal	PT	28.8
Romania	RO	27.4
Serbia	RS	25.0
Slovakia	SK	35.5
Slovenia	SI	34.0
Spain	ES	14.6
Sweden	SE	29.5
Switzerland	CH	35.3

Population living in dwellings whose energy efficiency had been improved in the last 5 years		
Disaggregation options		
Age group:	**Risk of poverty or social exclusion:**	**Household composition:**
16-29 years.	At risk of poverty or social exclusion	One single male.
16-44 years.	Not at risk of poverty or social exclusion	One single female.
16-64 years.		One adult.
16 years or over.	**Degree of urbanisation:**	One adult with dependent children.
25-34 years.	Towns and suburbs.	Two adults.
35-44 years.	Rural areas.	Two adults with dependent children.
45-64 years.	Cities.	Two adults with three or more dependent children.
65 years or over.		Two or more adults with dependent children.
	Level of disability:	Two or more adults without dependent children.
Sex:	No disability.	Three or more adults.
Female.	Some or severe disability.	Three or more adults with dependent children.
Male.		Household with dependent children.
		Household without dependent children.
		One adult younger than 65 years.
		One adult 65 years or over.
		Two adults younger than 65 years.
		Two adults, at least one aged 65 years or over.

B5. At-Risk-of-Poverty Rate

"At-risk-of-poverty rate" – Updated data (2025)

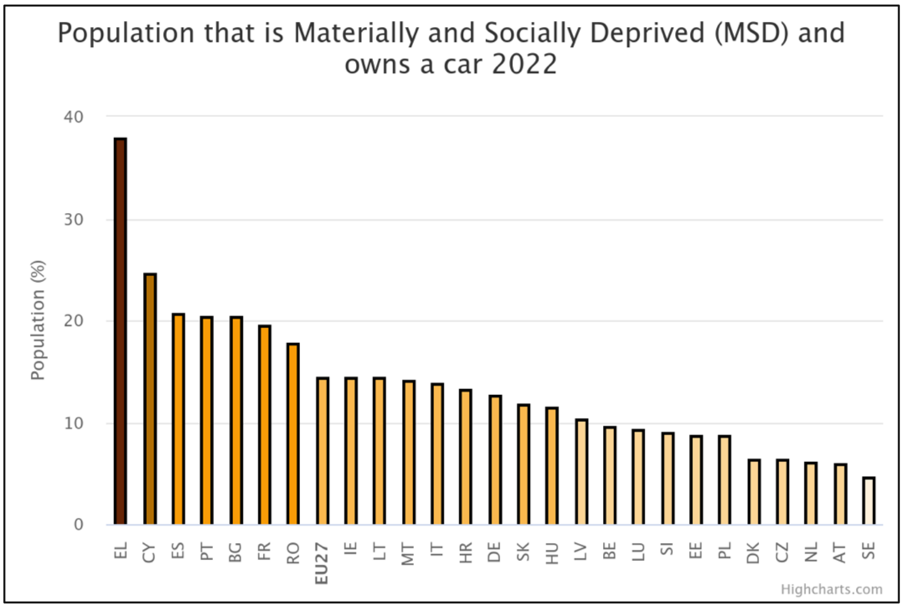


At-risk-of-poverty rate (2025)		
GEO	**Code**	**2025 (%)**
Belgium	BE	10.9
Bulgaria	BG	21.2
Croatia	HR	19.5
Cyprus	CY	14.9
Czechia	CZ	9.6
Denmark	DK	11.8
Estonia	EE	19.5
European Union - 20	EU20	16.35
Finland	FI	13.4
Germany	DE	16.1
Greece	EL	19.6
Hungary	HU	14
Italy	IT	18.6
Latvia	LV	22
Netherlands	NL	13.4
Poland	PL	13.2
Portugal	PT	15.4
Romania	RO	18.4
Slovenia	SI	14.3
Spain	ES	19.5
Sweden	SE	15.6
Türkiye	TR	23.4

At-risk-of-poverty rate	
Disaggregation options	
Age group: Less than 6 years. From 6 to 11 years. From 12 to 17 years. From 15 to 19 years. From 15 to 24 years. From 15 to 29 years. Less than 16 years. From 16 to 19 years. From 16 to 24 years. From 16 to 29 years. From 16 to 64 years. 16 years or over. Less than 18 years. From 20 to 24 years. From 20 to 29 years. From 25 to 29 years. From 25 to 49 years. From 25 to 54 years. From 50 to 64 years. Less than 60 years. 60 years or over. Less than 65 years. From 65 to 74 years. 65 years or over. Less tan 75 years. 75 years or over.	**Poverty threshold** At risk of poverty rate (cut-off point: 40% of the median equivalised income). At risk of poverty rate (cut-off point: 50% of median equivalised income). At risk of poverty rate (cut-off point: 60% of median equivalised income after social transfers). At risk of poverty rate (cut-off point: 70% of median equivalised income). At risk of poverty rate (cut-off point: 40% of mean equivalised income). At risk of poverty rate (cut-off point: 50% of median equivalised income). At risk of poverty rate (cut-off point: 60% of mean equivalised income). **Sex:** Female. Male.

B6. Population that is materially and socially deprived (MSD) and owns a car

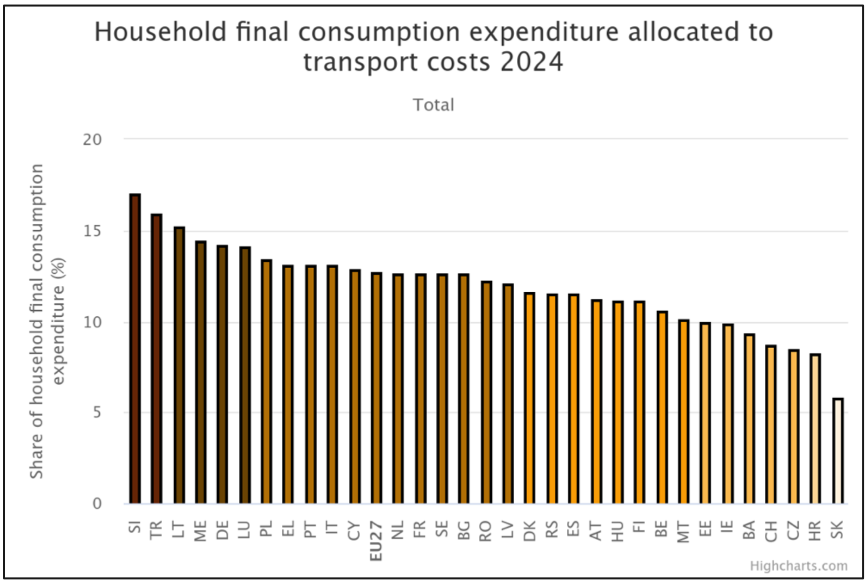
"Population that is materially and socially deprived (MSD) and owns a car" – Updated data (2022)



Share of the population that is materially and socially deprived and owns a car (2022)		
GEO	**Code**	**2022 (%)**
Austria	AT	6.0
Belgium	BE	9.7
Bulgaria	BG	20.4
Croatia	HR	13.3
Cyprus	CY	24.7
Czechia	CZ	6.4
Denmark	DK	6.4
Estonia	EE	8.8
European Union 27	EU-27	14.5
Finland	FI	6.9
France	FR	19.5
Germany	DE	12.7
Greece	EL	37.9
Hungary	HU	11.5
Ireland	IE	14.5
Italy	IT	13.8
Latvia	LV	10.4
Lithuania	LT	14.4
Luxembourg	LU	9.3
Malta	MT	14.2
Netherlands	NL	6.2
Poland	PL	8.7
Portugal	PT	20.5
Romenia	RO	17.8
Slovakia	SK	11.8
Slovenia	SI	9.1
Spain	ES	20.7
Sweden	SE	4.6

B7. Household Final Consumption Expenditure Allocated to Transport Costs

"Household final consumption expenditure allocated to transport costs" – Updated data (2024)



Share of household final consumption expenditure allocated to transport costs		
GEO	**Code**	**2024 (%)**
Austria	AT	11.2
Belgium	BE	10.6
Bulgaria	BG	12.6
Croatia	HR	8.2
Cyprus	CY	12.9
Czechia	CZ	8.5
Denmark	DK	11.6
Estonia	EE	10.0
European Union 27	EU-27	12.7
Finland	FI	11.1
France	FR	12.6
Germany	DE	14.2
Greece	EL	13.1
Hungary	HU	11.4
Ireland	IE	9.9
Italy	IT	13.1
Latvia	LV	12.1
Lithuania	LT	15.2
Luxembourg	LU	14.1
Malta	MT	10.1
Montenegro	ME	14.4
Netherlands	NL	12.6
Poland	PL	13.4
Portugal	PT	13.1
Romania	RO	12.2
Serbia	RS	11.5
Slovakia	SK	5.8
Slovenia	SI	17.0
Spain	ES	11.5
Sweden	SE	12.6
Switzerland	CH	8.7
Türkiye	TR	15.9

Share of household final consumption expenditure allocated to transport costs
Disaggregation options
Type of transportation cost:
Purchase of vehicles.
Operation of personal transport equipment.
Passenger transport services.
Transport services for goods.

B8. Population Who Cannot Afford a Personal Car

"Population who cannot afford a personal car" – Updated data (2024)

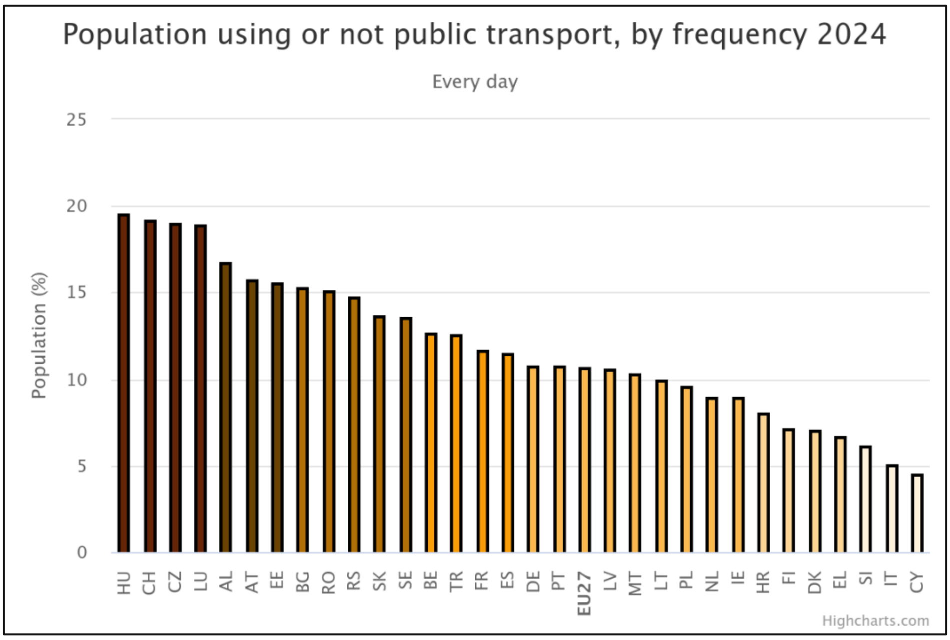
At-risk-of-poverty rate (2025)		
GEO	**Code**	**2025 (%)**
Belgium	BE	10.9
Bulgaria	BG	21.2
Croatia	HR	19.5
Cyprus	CY	14.9
Czechia	CZ	9.6
Denmark	DK	11.8
Estonia	EE	19.5
European Union - 20	EU20	16.35
Finland	FI	13.4
Germany	DE	16.1
Greece	EL	19.6
Hungary	HU	14
Italy	IT	18.6
Latvia	LV	22
Netherlands	NL	13.4
Poland	PL	13.2
Portugal	PT	15.4
Romania	RO	18.4
Slovenia	SI	14.3
Spain	ES	19.5
Sweden	SE	15.6
Türkiye	TR	23.4

Population who cannot afford a personal car (2025)		
GEO	**Code**	**2025 (%)**
Türkiye	TR	20.2
Finland	FI	11.3
Hungary	HU	10.4
Bulgaria	BG	10
Denmark	DK	8.3
Romania	RO	8.1
Latvia	LV	7.9
Greece	EL	7.3
Estonia	EE	7
Germany	DE	6.6
Sweden	SE	5.9
European Union - 20	EU20	5.75
Belgium	BE	5.7
Netherlands	NL	5.7
Spain	ES	5.4
Czechia	CZ	4.7
Portugal	PT	4.5
Italy	IT	4
Poland	PL	3.4
Croatia	HR	2.6
Slovenia	SI	1.7
Cyprus	CY	1.6

Population who cannot afford a personal car (2025)
Disaggregation options
Household composition: One single male. One single female. One adult. One adult with dependent children. Two adults with dependent children. Two adults with three or more dependent children. Two or more adults with dependent children. Two or more adults without dependent children. Three or more adults. Three or more adults with dependent children. Household with dependent children. Household without dependent children. One adult younger than 65 years. One adult 65 years or over. Two adults younger than 65 years. **Risk of poverty threshold:** Below 60% of the median equivalised income. Above 60% of the median equivalised income.

B9. Population using or not public transport, by frequency

"Population using or not public transport, by frequency" – Every day use – Updated data (2024)



GEO	Code	2024				
		Every day (%)	Every week (%)	Every month (%)	Less than once a month (%)	Never (%)
Albania	AL	16.8	20.4	20.9	11.6	30.2
Austria	AT	15.8	16.4	10.5	22.3	34.9
Belgium	BE	12.7	13.1	11.5	18.5	44.1
Bulgaria	BG	15.3	11.8	7.6	9.8	55.5
Switzerland	CH	19.2	24.6	18.1	23.3	14.9
Cyprus	CY	4.5	4.3	2.9	3.3	85.0
Czechia	CZ	19.0	13.8	15.3	20.1	31.8
Germany	DE	10.8	11.4	9.1	20.5	48.2
Denmark	DK	7.1	10.1	17.6	33.0	32.2
Estonia	EE	15.6	18.2	17.4	22.2	26.6
Greece	EL	6.7	13.3	8.1	10.7	61.3
Spain	ES	11.5	14.3	13.6	22.1	38.4
European Union 27	EU-27	10.7	11.6	10.0	17.1	50.6
Finland	FI	7.2	15.1	13.6	35.3	28.8
France	FR	11.7	8.0	6.4	8.8	65.1
Croatia	HR	8.1	10.0	11.3	12.0	58.6
Hungary	HU	19.6	12.4	12.0	21.2	34.8
Ireland	IE	9.0	13.5	10.3	21.2	46.1
Italy	IT	5.1	8.3	6.8	11.8	68.0
Lithuania	LT	10.0	15.7	11.6	20.6	42.1
Luxembourg	LU	18.9	23.1	17.2	25.1	15.7
Latvia	LV	10.6	19.2	12.5	16.9	40.7
Malta	MT	10.3	9.1	7.3	15.4	58.0
Netherlands	NL	9.0	14.0	12.8	32.4	31.9
Norway	NO	15.5	14.7	16.0	33.0	20.8
Poland	PL	9.6	13.2	11.0	10.0	56.2
Portugal	PT	10.8	6.8	7.1	7.5	67.8
Romania	RO	15.1	16.5	14.5	18.6	35.4
Serbia	RS	14.8	13.5	13.9	12.7	45.1
Sweden	SE	13.6	15.9	14.0	29.8	26.7
Slovenia	SI	6.2	7.3	8.9	16.0	61.6
Slovakia	SK	13.7	14.8	15.9	13.4	42.3
Türkiye	TR	12.6	18.4	37.4	8.9	22.7

Population using or not public transport, by frequency (%)
Disaggregation options
Age group: 16 years or over. From 16 to 29 years. From 30 to 64 years. 65 years or over. **Sex:** Female. Male. **At risk of poverty or social exclusion:** At risk of poverty or social exclusion. Not at risk of poverty or social exclusion.

Appendix C – Cross-Analysis of Climate, Health, and the EED EP Indicators

C1. Part A: Temporal analysis

In this section, the parameters obtained through the historical analysis are presented for the eight analysed indicators. Results of each indicator are reported in tables according to the following parameters: minimum value (A), maximum value (B), mean value (C), median value (D), standard deviation (E), total variation (difference between maximum and minimum values) (F), linear trend slope (linear coefficient obtained through the linear regression) (G), median of the standard deviation (obtained according to all GEOs) (H), and median of the absolute value of the linear trend slope (obtained according to all GEOs) (I).

Heat stress days (I1)

GEO	A	B	C	D	E	F	G	H	I
AT	6.35	17.07	11.41	11.57	3.67	10.72	0.10	3.82	0.31
BE	1.92	15.49	10.57	10.74	3.80	13.58	-0.11	3.82	0.31
CY	89.53	114.40	100.19	99.73	7.85	24.87	1.37	3.82	0.31
DK	0.00	3.75	1.15	0.86	1.21	3.75	-0.06	3.82	0.31
EE	0.00	9.84	3.52	2.46	3.00	9.84	0.31	3.82	0.31
EL	57.63	85.78	66.10	64.65	7.69	28.15	1.73	3.82	0.31
ES	58.81	78.87	67.76	65.26	6.09	20.06	0.24	3.82	0.31
FI	0.00	3.25	0.90	0.36	1.15	3.25	0.05	3.82	0.31
FR	55.59	73.85	66.53	67.02	5.08	18.26	0.40	3.82	0.31
HU	41.53	64.87	49.96	48.56	6.77	23.34	0.83	3.82	0.31
IE	0.00	2.62	0.63	0.09	1.04	2.62	0.12	3.82	0.31
IT	43.87	68.05	55.02	53.05	6.96	24.18	1.50	3.82	0.31
LV	0.24	12.91	5.64	4.56	3.82	12.66	0.33	3.82	0.31
NL	1.67	13.49	7.69	7.11	3.51	11.82	-0.10	3.82	0.31
PT	48.74	70.36	60.56	61.27	7.08	21.62	-0.38	3.82	0.31
SE	0.00	2.40	0.68	0.52	0.76	2.40	-0.02	3.82	0.31
SI	20.89	47.27	29.53	28.41	7.97	26.38	0.77	3.82	0.31

Cold stress days (I2)

GEO	A	B	C	D	E	F	G	H	I
AT	46.14	76.31	59.32	59.14	8.16	30.17	-1.21	7.58	0.72
BE	39.81	62.98	51.20	50.86	7.58	23.17	-1.88	7.58	0.72
CY	0.00	2.13	0.87	0.70	0.72	2.13	-0.10	7.58	0.72
DK	84.60	111.50	100.43	102.90	8.88	26.90	-1.24	7.58	0.72
EE	117.57	142.74	131.63	133.24	8.64	25.16	0.20	7.58	0.72
EL	3.33	12.95	8.07	8.46	3.34	9.62	-0.31	7.58	0.72
ES	7.42	20.52	14.09	14.15	3.66	13.11	-0.72	7.58	0.72
FI	140.81	174.03	154.65	151.93	10.56	33.22	1.57	7.58	0.72
FR	17.92	29.27	22.87	21.89	3.72	11.34	-0.67	7.58	0.72
HU	27.94	52.49	41.70	42.16	7.61	24.55	-1.03	7.58	0.72
IE	25.37	50.41	37.22	37.86	7.78	25.04	-2.16	7.58	0.72
IT	10.14	20.51	15.32	15.14	2.98	10.37	-0.43	7.58	0.72
LV	95.56	119.45	109.98	113.05	8.70	23.89	0.42	7.58	0.72
NL	47.55	71.95	59.14	60.15	7.50	24.40	-1.70	7.58	0.72
PT	0.50	3.47	1.66	1.70	0.84	2.96	-0.22	7.58	0.72
SE	132.88	156.31	140.90	137.81	7.63	23.43	0.61	7.58	0.72
SI	14.02	38.27	20.99	19.16	7.11	24.25	-0.73	7.58	0.72

Excess mortality during summer (I3)

GEO	A	B	C	D	E	F	G	H	I
AT	0.04	2.05	0.84	0.43	0.82	2.01	-0.14	0.81	0.14
BE	-0.40	1.41	0.50	0.53	0.79	1.81	-0.14	0.81	0.14
CY	-0.45	2.59	0.85	0.57	1.11	3.05	0.08	0.81	0.14
DK	0.17	1.97	1.01	0.58	0.81	1.80	-0.05	0.81	0.14
EE	-0.11	1.89	0.86	0.63	0.90	2.01	-0.29	0.81	0.14
EL	1.27	4.97	2.65	2.27	1.47	3.70	-0.14	0.81	0.14
ES	1.10	6.38	3.13	3.31	2.18	5.28	-0.69	0.81	0.14

FI	0.18	1.83	0.84	0.54	0.73	1.65	-0.18	0.81	0.14
FR	-0.48	1.67	0.42	0.22	0.81	2.16	-0.15	0.81	0.14
HU	-0.36	1.52	0.65	0.85	0.76	1.89	0.08	0.81	0.14
IE	-0.98	0.91	0.20	0.36	0.73	1.89	0.18	0.81	0.14
IT	0.57	3.54	1.66	1.19	1.14	2.97	-0.12	0.81	0.14
LV	-0.13	2.99	1.01	0.70	1.30	3.11	-0.47	0.81	0.14
NL	-0.22	1.74	0.57	0.47	0.78	1.96	-0.01	0.81	0.14
PT	0.62	2.53	1.41	0.75	1.00	1.91	-0.36	0.81	0.14
SE	0.24	1.84	0.95	0.86	0.57	1.59	-0.03	0.81	0.14
SI	0.07	1.25	0.71	0.80	0.44	1.18	-0.03	0.81	0.14

Excess mortality during winter (I4)

GEO	A	B	C	D	E	F	G	H	I
AT	1.58	3.07	2.39	2.34	0.55	1.48	-0.11	1.18	0.13
BE	1.82	3.06	2.24	1.96	0.53	1.24	0.09	1.18	0.13
CY	0.73	3.24	1.54	1.03	1.07	2.51	0.09	1.18	0.13
DK	-0.77	2.73	1.08	0.90	1.32	3.50	0.45	1.18	0.13
EE	-0.75	1.56	0.49	0.20	1.01	2.32	0.03	1.18	0.13
EL	2.28	6.85	3.83	3.11	1.78	4.57	-0.08	1.18	0.13
ES	5.02	7.73	5.97	5.66	1.03	2.71	-0.34	1.18	0.13
FI	-1.25	0.82	-0.58	-0.91	0.85	2.07	0.13	1.18	0.13
FR	1.06	3.85	2.33	2.01	1.25	2.78	-0.14	1.18	0.13
HU	1.27	6.78	3.09	1.92	2.33	5.50	-0.53	1.18	0.13
IE	0.43	2.53	1.40	0.84	1.00	2.10	0.07	1.18	0.13
IT	2.10	5.64	4.11	3.80	1.41	3.54	-0.53	1.18	0.13
LV	-0.83	3.91	1.70	1.71	1.88	4.74	0.08	1.18	0.13
NL	0.90	3.57	2.22	2.06	1.18	2.67	0.20	1.18	0.13
PT	2.49	10.90	5.29	4.35	3.24	8.41	-0.26	1.18	0.13
SE	-0.78	1.70	0.31	0.57	1.01	2.48	-0.08	1.18	0.13
SI	0.92	3.98	2.03	1.49	1.23	3.06	-0.32	1.18	0.13

Inability to keep home adequately warm (I5)

GEO	A	B	C	D	E	F	G	H	I
AT	1.50	4.00	2.49	2.50	0.90	2.50	0.14	1.81	0.37
BE	3.50	6.00	4.84	4.90	0.79	2.50	-0.02	1.81	0.37
CY	14.60	28.30	20.89	20.80	3.83	13.70	-1.22	1.81	0.37
DK	2.70	6.90	3.70	3.00	1.39	4.20	0.29	1.81	0.37
EE	2.00	4.10	2.82	2.70	0.69	2.10	0.16	1.81	0.37
EL	17.10	29.20	21.61	19.10	4.76	12.10	-1.29	1.81	0.37
ES	7.50	20.80	12.58	10.75	4.55	13.30	1.22	1.81	0.37
FI	1.30	2.70	1.87	1.75	0.46	1.40	0.07	1.81	0.37
FR	4.90	12.10	7.39	6.10	2.94	7.20	0.84	1.81	0.37
HU	4.10	9.60	6.43	6.05	1.81	5.50	-0.37	1.81	0.37
IE	3.40	9.00	5.47	5.00	1.76	5.60	-0.12	1.81	0.37
IT	8.10	17.00	11.68	10.30	3.55	8.90	-1.06	1.81	0.37
LV	4.90	14.50	7.98	7.30	2.95	9.60	-0.83	1.81	0.37
NL	2.20	7.10	3.74	2.75	1.98	4.90	0.51	1.81	0.37
PT	15.70	23.80	19.29	19.15	2.62	8.10	-0.66	1.81	0.37
SE	1.20	5.90	2.78	2.45	1.37	4.70	0.33	1.81	0.37
SI	1.70	5.60	3.39	3.30	1.16	3.90	-0.24	1.81	0.37

Arrears on utility bills (I6)

GEO	A	B	C	D	E	F	G	H	I
AT	2.40	5.50	3.50	3.30	1.17	3.10	0.13	1.42	0.36
BE	2.80	5.10	4.05	4.05	0.72	2.30	-0.17	1.42	0.36
CY	7.80	20.10	11.42	9.90	3.98	12.30	-1.20	1.42	0.36
DK	2.50	5.10	3.74	3.55	0.78	2.60	0.09	1.42	0.36
EE	4.10	7.90	5.96	6.00	1.42	3.80	-0.37	1.42	0.36
EL	26.30	42.20	34.43	33.50	5.30	15.90	-1.27	1.42	0.36
ES	6.50	9.70	8.53	9.00	1.19	3.20	0.24	1.42	0.36
FI	5.70	8.30	7.28	7.60	0.86	2.60	-0.07	1.42	0.36
FR	5.50	8.00	6.53	6.25	0.85	2.50	0.22	1.42	0.36
HU	7.10	19.40	11.37	10.15	3.98	12.30	-1.23	1.42	0.36
IE	7.30	15.20	9.65	9.05	2.35	7.90	-0.56	1.42	0.36
IT	4.10	12.60	6.14	4.90	2.68	8.50	-0.59	1.42	0.36
LV	5.80	16.70	9.57	8.50	3.64	10.90	-1.10	1.42	0.36
NL	1.20	2.70	1.71	1.50	0.47	1.50	-0.10	1.42	0.36
PT	3.50	7.80	5.11	4.60	1.43	4.30	-0.36	1.42	0.36
SE	2.20	3.80	2.78	2.50	0.63	1.60	0.11	1.42	0.36
SI	6.50	17.50	10.83	10.30	4.09	11.00	-1.32	1.42	0.36

Population living in a dwelling with a leaking roof, damp walls, floors or foundation, or rot in window frames (I7)

GEO	A	B	C	D	E	F	G	H	I
AT	9.10	11.90	10.60	10.50	1.08	2.80	-0.24	2.22	0.59
BE	14.40	19.20	17.23	17.90	1.69	4.80	-0.59	2.22	0.59
CY	26.50	40.00	31.03	30.20	4.51	13.50	1.09	2.22	0.59
DK	14.90	16.80	15.71	15.90	0.78	1.90	-0.07	2.22	0.59
EE	10.20	13.90	12.76	13.60	1.66	3.70	-0.48	2.22	0.59
EL	12.50	15.10	13.53	13.50	1.03	2.60	-0.24	2.22	0.59
ES	11.50	23.00	16.56	15.90	3.72	11.50	1.08	2.22	0.59
FI	4.10	5.30	4.54	4.50	0.40	1.20	0.09	2.22	0.59
FR	11.10	21.10	14.43	12.70	3.73	10.00	1.09	2.22	0.59
HU	12.60	26.70	22.07	22.50	4.71	14.10	-1.67	2.22	0.59
IE	11.90	21.20	14.47	13.30	3.30	9.30	0.97	2.22	0.59
IT	13.20	24.10	17.87	17.10	3.92	10.90	-0.63	2.22	0.59
LV	17.50	24.40	21.17	21.90	2.63	6.90	-0.78	2.22	0.59
NL	13.50	16.30	15.17	15.40	0.93	2.80	-0.05	2.22	0.59
PT	24.40	30.50	27.09	26.90	2.22	6.10	-0.12	2.22	0.59
SE	4.80	7.80	6.97	7.10	1.01	3.00	-0.31	2.22	0.59
SI	18.50	26.90	22.19	22.00	2.68	8.40	-0.92	2.22	0.59

At-risk-of-poverty rate (I8)

GEO	A	B	C	D	E	F	G	H	I
AT	13.30	14.90	14.26	14.30	0.49	1.60	0.08	0.84	0.14
BE	11.40	16.40	14.13	14.45	1.65	5.00	-0.48	0.84	0.14
CY	13.70	16.20	15.12	15.00	0.76	2.50	-0.20	0.84	0.14
DK	11.60	12.70	12.19	12.25	0.34	1.10	-0.05	0.84	0.14
EE	20.20	22.80	21.47	21.65	0.84	2.60	-0.02	0.84	0.14
EL	17.70	21.40	19.38	19.25	1.27	3.70	-0.22	0.84	0.14
ES	19.70	22.30	21.12	21.25	0.86	2.60	-0.25	0.84	0.14
FI	10.80	12.70	11.96	12.10	0.59	1.90	0.05	0.84	0.14
FR	13.20	15.90	14.28	13.90	1.00	2.70	0.29	0.84	0.14
HU	12.80	14.90	13.83	13.85	0.63	2.10	-0.05	0.84	0.14
IE	12.00	16.80	14.06	13.40	1.68	4.80	-0.50	0.84	0.14
IT	18.90	20.60	19.92	20.10	0.57	1.70	-0.14	0.84	0.14
LV	21.60	23.40	22.42	22.50	0.65	1.80	-0.01	0.84	0.14
NL	11.60	14.50	13.14	13.20	0.89	2.90	0.10	0.84	0.14
PT	16.20	19.50	17.59	17.25	1.14	3.30	-0.29	0.84	0.14
SE	14.80	17.10	16.05	16.10	0.58	2.30	-0.10	0.84	0.14
SI	11.70	14.30	12.89	12.95	0.85	2.60	-0.17	0.84	0.14

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