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Commission

EU ENERGY POVERTY Observatory

EPOV Indicator Dashboard Methodology Guidebook

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May 2020

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1 EU Energy Poverty Observatory: indicator overview

Energy poverty is a culturally sensitive, multi-dimensional concept that varies over time and by place and is thus not easily captured by a single indicator (Simcock et al. 2016). Accordingly, in practice there is a multitude of indicators currently applied to measure energy poverty in different contexts (for an overview see Trinomics et al. 2017). The pertinent literature identifies three main methods of measurement (cf. Thomson et al. 2017):

1. Expenditure – where examinations of the energy costs faced by households against absolute or relative thresholds provide a proxy for estimating the extent of domestic energy deprivation;
2. Consensual approach – based on self-reported assessments of indoor housing conditions, and the ability to attain certain basic necessities relative to the society in which a household resides;
3. Direct measurement – where the level of energy services (such as heating) achieved in the home is compared to a set standard .

Our approach to measuring energy poverty has been to use a suite of consensual and expenditure-based indicators, which should be viewed and used in combination. The selection of EPOV indicators is based on a screening of pertinent literature on the measurement of energy poverty (cf. Hills 2012; Thomson et al. 2017; Trinomics et al. 2017; Romero et al. 2018; Castaño-Rosa et al. 2019; Sareen et al. 2020). In addition to theoretical considerations, the indicator selection process has also been guided by data availability on a European level resulting in the selection of four indicators. Each indicator captures a different aspect of the phenomenon. Our intention is that these indicators should be used to give a snapshot of energy poverty issues, which can then be explored in more detail in research and action projects.

Against the background of the absence of one commonly agreed definition of energy poverty across the European Union, EPOV intends to contribute to a common understanding, but not to finally define energy poverty. All indicators have their advantages and disadvantages which are also outlined in this report – and possibly surprising results for certain EU member states in comparison to others need to be seen in their specific contexts.

On the EU Energy Poverty Observatory online platform, these “primary indicators” can be disaggregated on a national level and by “second-level indicators”.

In addition to this, the EPOV indicator dashboard features a range of additional “secondary indicators” that do not measure energy poverty itself, but are related to the issue. These secondary indicators can in the graphical display be combined with the primary indicators.

1.1 Primary Indicators

EPOV provides four different primary indicators for energy poverty, of which two are based on self-reported experiences of limited access to energy services (based on EU-SILC data) and the other two are calculated using household income and/or energy expenditure data (based on HBS data).

- Consensual-based indicators – EU-SILC Target variables
 - Ability to keep home adequately warm (HH050)¹
Format of the question: Can your household afford to keep its home adequately warm?
 - Arrears on utility bills (HS021)²
Format of the question: In the past twelve months, has the household been in arrears, i.e. has been unable to pay the utility bills (heating, electricity, gas, water, etc.) of the main dwelling on time due to financial difficulties?
- Expenditure-based indicators (long list) – HBS
 - M/2: Absolute (equivalised) energy expenditure below half the national median
 - 2M: Share of (equivalised) energy expenditure (compared to equivalised disposable income) above twice the national median

These four indicators can be displayed (for one country at a time) by second-level disaggregating variables: income deciles, tenure type, urbanisation density and dwelling type

1.2 Secondary indicators

EPOV (currently) provides a range of 19 secondary indicators that were extracted from different data sources, mainly the Eurostat (ESTAT) website, SILC and the Building Stock Observatory (BSO):

¹ This question is about affordability (ability to pay) to keep the home adequately warm, regardless of whether the household actually needs to keep it adequately warm.

² This variable has replaced the variable HS020 as defined in the EU-SILC Regulation from the 2008 operation onwards. The variable records whether the household has been in arrears in the past 12 months, that is, unable to pay on time (as scheduled) utility bills (heating, electricity, gas, water, etc..) for the main dwelling. The question refers to financial difficulties, therefore, for example, if the household was unable to pay on time once/twice or more as result of lack of money, HS021 = 1/2, otherwise (illness,...) HS021 = 3. Telephone bills should not be considered as utility bills in this item. However sewage and rubbish bills are taken into account in this item. If the household manages to pay through borrowing (from bank, relatives or friends), it is considered the same as if the household had managed to pay through its own resources.

Table 1: Overview of secondary EPOV indicators


Type	Indicator	Description*	Source
Energy prices:	Fuel oil prices	Average household prices per kWh generated from fuel oil	BSO
	Biomass prices	Average household prices per kWh generated from biomass	BSO
	Coal prices	Average household prices per kWh generated from coal	BSO
	Household electricity prices	Electricity prices for household consumers, band DC 2500-5000 kWh/yr consumption, all taxes and levies included	ESTAT
	District heating prices	Average household prices per kWh from district heating	BSO
	Household gas prices	Natural gas prices for household consumers, band 20-200GJ consumption, all taxes and levies included	ESTAT
Consensual-based	Dwelling comfortably cool in summer time	Share of population, based on question "Is the cooling system efficient enough to keep the dwelling cool?" and/or "Is the dwelling sufficiently insulated against the warm?"	SILC ad-hoc modules 2007 and 2012
	Dwelling comfortably warm in winter time	Share of population, based on question "Is the heating system efficient enough to keep the dwelling warm?" and "Is the dwelling sufficiently insulated against the cold?"	SILC ad-hoc modules 2007 and 2012
	Presence of leak, damp, rot	Share of population with leak, damp or rot in their dwelling, based on question "Do you have any of the following problems with your dwelling / accommodation?" <ul style="list-style-type: none"> • a leaking roof • damp walls/floors/foundation • rot in window frames or floor 	SILC
Expenditure-based	Share of energy expenditure in income by income quintile	Consumption expenditure for electricity, gas and other fuels as a share of income for income quintile 1-5	HBS
Building stock features	Dwellings with energy label A	Share of dwellings with an energy label A	BSO
	Dwellings in intermediately populated areas	Share of dwellings located in intermediately populated areas (between 100 and 499 inhabitants/km ²)	BSO
	Dwellings in densely populated areas	Share of dwellings located in densely populated areas (at least 500 inhabitants/km ²)	BSO
	Equipped with heating	Share of population living in a dwelling equipped with heating facilities	SILC, ad-hoc modules 2007 and 2012
	Equipped with air conditioning	Share of population living in a dwelling equipped with air conditioning facilities	SILC, ad-hoc modules 2007 and 2012
	Number of rooms per person by ownership status (renters, owners) and total	Average number of rooms per person in rented/owned/all dwellings	SILC
Poverty and health risks	Poverty risk (AROPE)	People at risk of poverty or social exclusion (% of population)	SILC
	Excess winter mortality/deaths	Share of excess winter mortality/deaths	BSO


Note: ESTAT = Eurostat data explorer, BSO = building stock observatory, SILC = EU SILC microdata provided by ESTAT, HBS = Household Budget Survey microdata provided by ESTAT (and complemented by AT and NL national statistical offices).


* For SILC questions, these are proposed wordings. Member States collecting the data are not obliged to use this wording and wordings thus differ between Member States.


Table 2: Data coverage for secondary indicators


Indicator		2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Energy prices:	Fuel oil prices															
	Biomass prices															
	Coal prices															
	Household electricity prices															
	District heating prices															
	Household gas prices															
Consensual-based	Dwelling comfortably cool during summer time															
	Dwelling comfortably warm during winter time															
	Presence of leak, damp, rot															
Expenditure-based	Share of expenditure in income by income quintile															
Building stock features	Dwellings with energy label A															
	Dwellings in intermediately populated areas															
	Dwellings in densely populated areas															
	Equipped with heating															
	Equipped with air conditioning															
	Number of rooms per person (rentners, owners and total)															
Poverty and health risks	Poverty risk															
	Excess winter mortality/deaths															


 Data available for all countries (EU28 + NO, IS, RS, CH)

 Data available for all countries in the EU28

 Data available for at least 20 countries

 Data available for between 10 and 20 countries

 Data available for less than 10 countries

 No Data available for any countries

2 Primary energy poverty indicators

Data for all primary energy poverty indicators can be displayed in the dashboard as bar charts (per country, for one year), as line graphs (per country over years) or as a map graph (for one year).

In addition, indicators can be displayed by second-level (breakdown) variables, if respective data is available: income deciles, tenure type, urbanisation density and dwelling type.

For some member states in certain cases or years, there are data issues due to the sample size and consequent sampling error, especially when calculating population shares by second-level variables. EPOV thus applies ESTAT rules for displaying small-n values: for data points with $n < 20$, values are omitted as unreliable, data points with $20 < n < 50$ are flagged as unreliable (hatched fills).

2.1 Consensual-based indicators – EU-SILC

EPOV primary indicators that are based on the EU-SILC survey microdata are calculated relatively straightforward from the share of households responding “yes”³. Outcomes are then assigned to all household members. The interpretation of outcomes is equally clear the percentage of population in energy poverty according to the respective indicator.

As the EU-SILC survey is an established EU-wide data gathering exercise, data availability is good: all EU-28 Member States are covered since 2010 and most member states since 2004 or 2005 (data availability: see section **Error! Reference source not found.**).

Preliminary data versions were calculated from the scientific use files (micro data) releases by Eurostat, however, Eurostat applies complex data treatments, which lead to data inconsistencies between EPOV and the ESTAT data explorer. As a consequence, data on EU and national levels including breakdowns by secondary variables is now directly kindly provided by Eurostat, in full compliance with Eurostat rules (see methodological guidelines⁴).

2.1.1 Inability to keep home adequately warm

The indicator covers the share of (sub-) population not able to keep their home adequately warm, based on the question "Can your household afford to keep its home adequately warm?" (proposed wording. MS are not obliged to use this wording and the wording they use differs across MS.).

³ Value 1 for HH050; values 1 or 2 for HS021

⁴ <https://circabc.europa.eu/ui/group/853b48e6-a00f-4d22-87db-c40bafd0161d/library/e9a5d1ad-f5c7-4b80-bdc9-1ce34ec828eb/details>

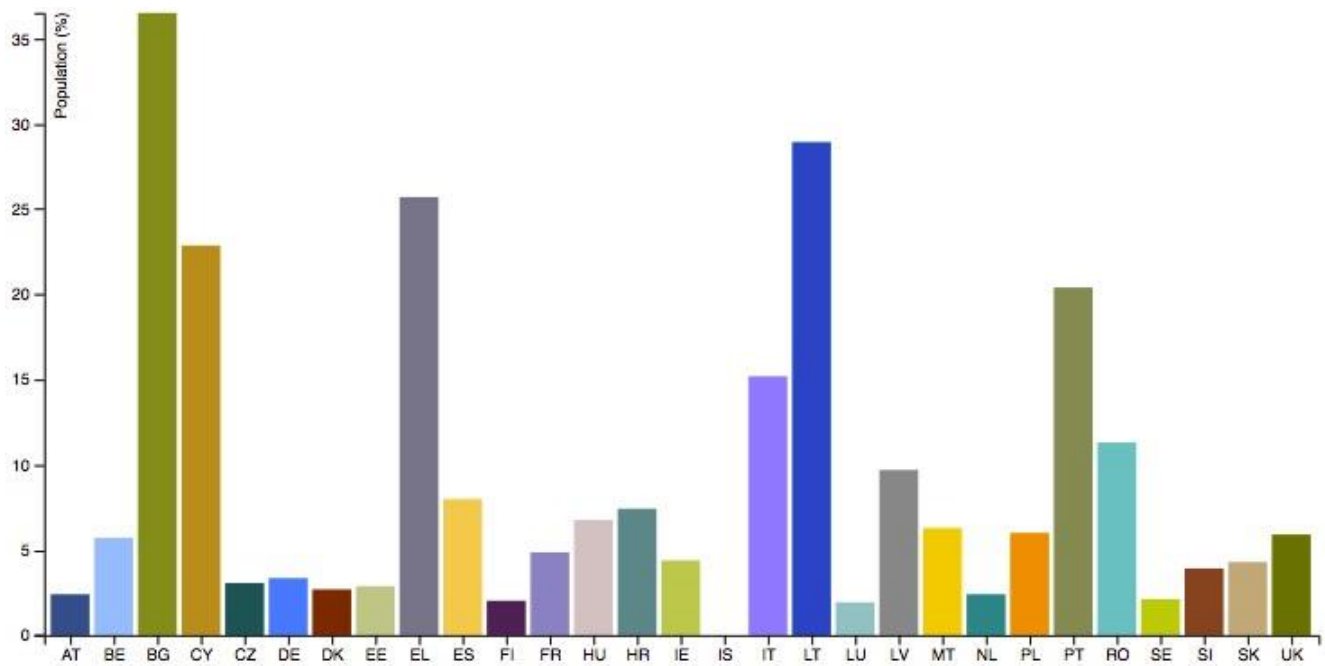


Figure 1: Share of energy poor population in European countries in 2016 according to the indicator "Inability to keep home adequately warm"

2.1.2 Arrears on utility bills

The indicator covers the share of (sub-) population having arrears on utility bills, based on question "In the last twelve months, has the household been in arrears, i.e. has been unable to pay on time due to financial difficulties for utility bills (heating, electricity, gas, water, etc.) for the main dwelling?"

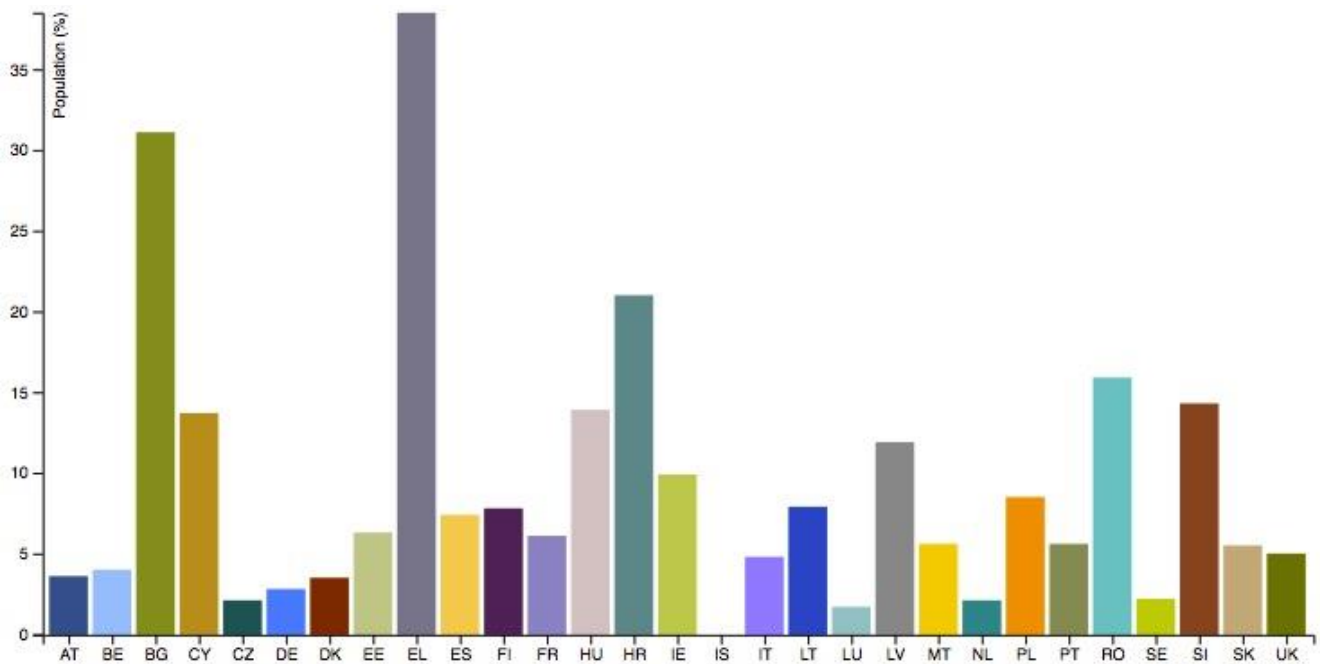


Figure 2: Share of energy poor population in European countries in 2016 according to the indicator “Arrears on utility bills”

2.2 Expenditure-based indicators – HBS

EPOV primary indicators that are based on the Household Budget Survey microdata are calculated as the share of the population whose energy expenditure falls below $(M/2)$ or whose share of energy expenditure in income exceeds $(2M)$ a specified national threshold. The indicators are based on building related energy expenditure only and do not consider mobility related expenses (see 4.1). Their aim is to capture relative underconsumption of basic energy services due to lacking financial means to do otherwise or to identify when consumption of basic energy services puts an over-proportionate financial burden on households in consideration of their disposable income. The interpretation of outcomes is however not always straight forward (see below). In general results on the chosen expenditure-based indicators have to be interpreted in consideration of national circumstances.

Interpretation of indicators

The two chosen expenditure based indicators $M/2$ and $2M$ capture different aspects of energy poverty but are also sensitive to the underlying distribution of the variables used for their calculation. Accordingly, results have to be interpreted against the background of these potential data structure related influences.

Both indicators are relative per definition (a fraction/multiplication of a median value). As the median value will change over time as a result of policy and external factors (e.g. energy prices), so will the derived threshold values. The macro indicator as % share of households beyond the threshold is thus a result of the underlying micro distribution of relevant indicator constituents. Unexpected country results can mostly be explained by this.

Data coverage to date is limited due to a lack of harmonized datasets. Only for 2010 data for most countries (except NL) is available. Accordingly, an analysis of energy

poverty trends over time using the HBS-based indicators is currently not possible. Data can be viewed as bar charts (per country, for one year) or as a map graph (for one year).

2.2.1 M/2: Low absolute energy expenditure

M/2: Absolute energy expenditure below half the national median

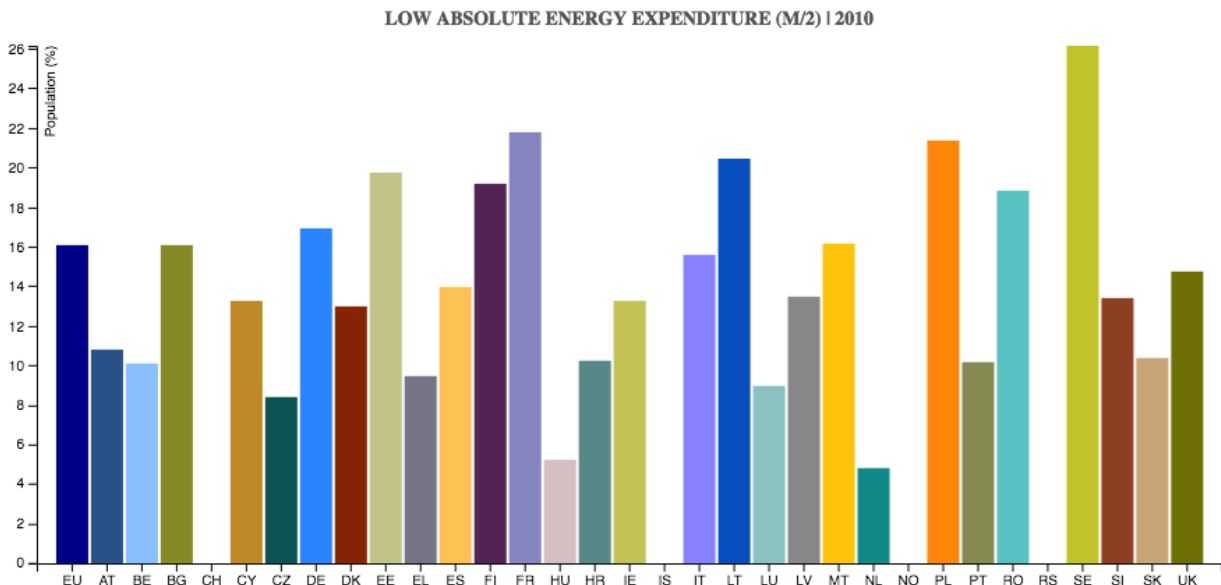


Figure 3: Share of energy poor households in the EU28 in 2010 according to the M/2 indicator

The M/2 indicator aims to capture underconsumption of energy services relative to the national median of energy expenditures. The indicator considers households whose energy expenditure is below half the national median value energy poor. Thus, country-specific results are shaped by the respective distribution of energy expenditures in the lower five deciles. Accordingly, in cases with a right-skewed distribution of values, the indicator may yield high levels of energy poverty within a country. While this in principle can reflect a real issue, there are also alternative explanations for low values of energy expenditure. First, in some countries, energy costs or a part of them are included in the rent and not captured separately. Second, comparatively lower energy expenditure of a household may also be the result of a higher energy efficiency level of the inhabited building. Hence, a part of the households considered energy poor under the M/2 definition may in fact live in highly efficient buildings that technically require less energy (expenditure) in the first place. Also in some countries (e.g. Germany) parts of energy expenditure of low income households/unemployed persons is covered by the state. Accordingly, interpretation of M/2 results requires additional information on national circumstances with regard to building sector characteristics/regulation and/or social policy.

Sweden and France are cases in which the distribution of energy expenditure within the lower five deciles of the sample is significantly right-skewed and thus exhibit a high share of energy poor households on this indicator (see Figure 4 and Figure 5). Also for Sweden, it is obvious that the significant number of households having reported no energy expenditure strongly influence the overall level of energy poverty

measured with this indicator. Countries with a significant left-skewed distribution comprise e.g. Hungary and Czech Republic (see Figure 6 and Figure 7). And again, for the Czech Republic a significant share of measured energy poverty is a result of households not reporting any energy expenditure.

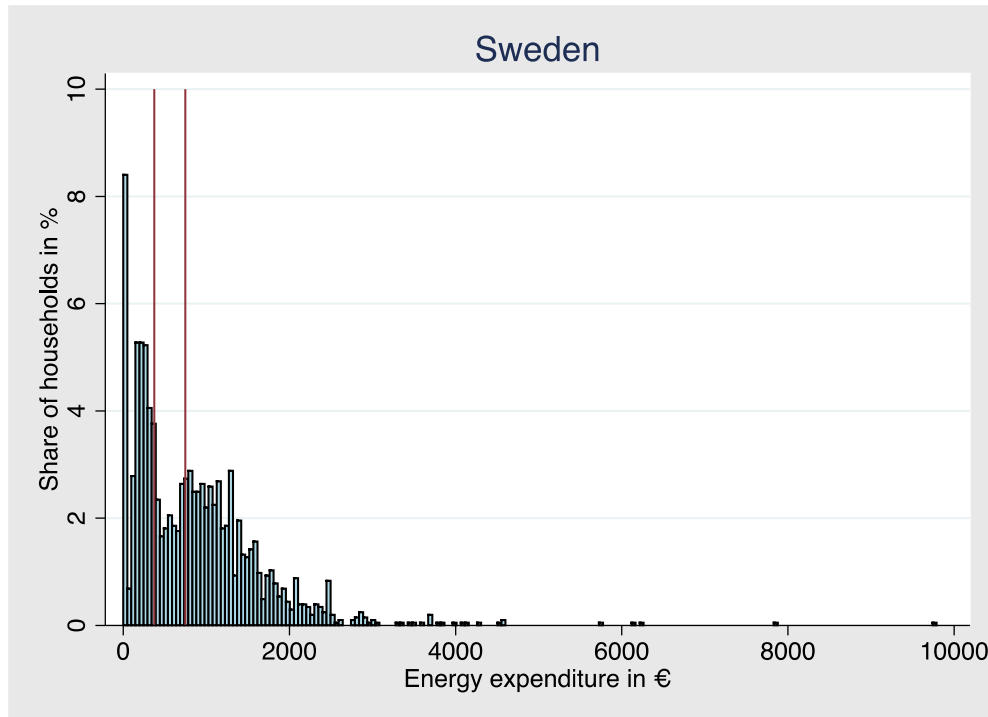


Figure 4: Distribution of energy expenditure in 2010 in Sweden

Note: red lines indicate the median value and half of the median energy expenditure

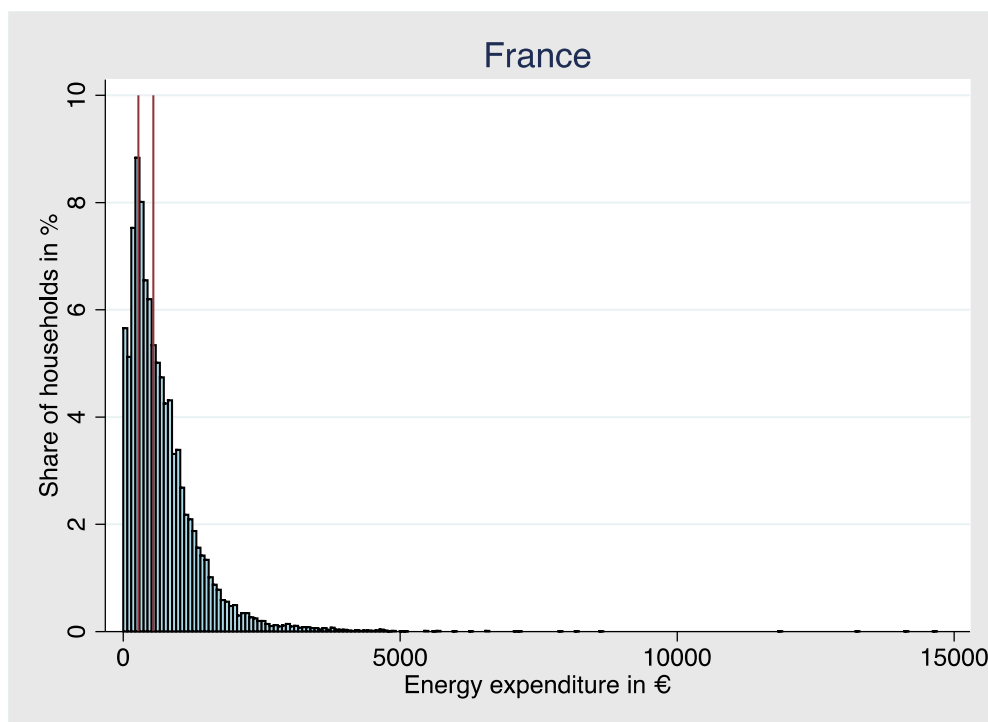


Figure 5: Distribution of energy expenditure in 2010 in France

Note: red lines indicate the median value and half of the median energy expenditure

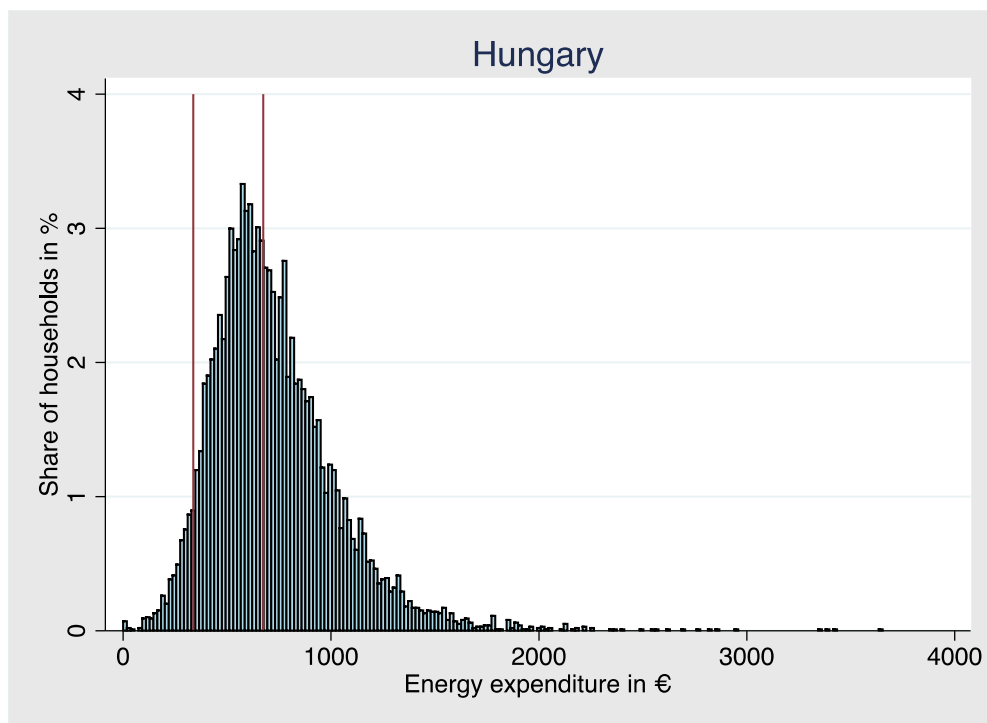


Figure 6: Distribution of energy expenditure in 2010 in Hungary

Note: red lines indicate the median value and half of the median energy expenditure

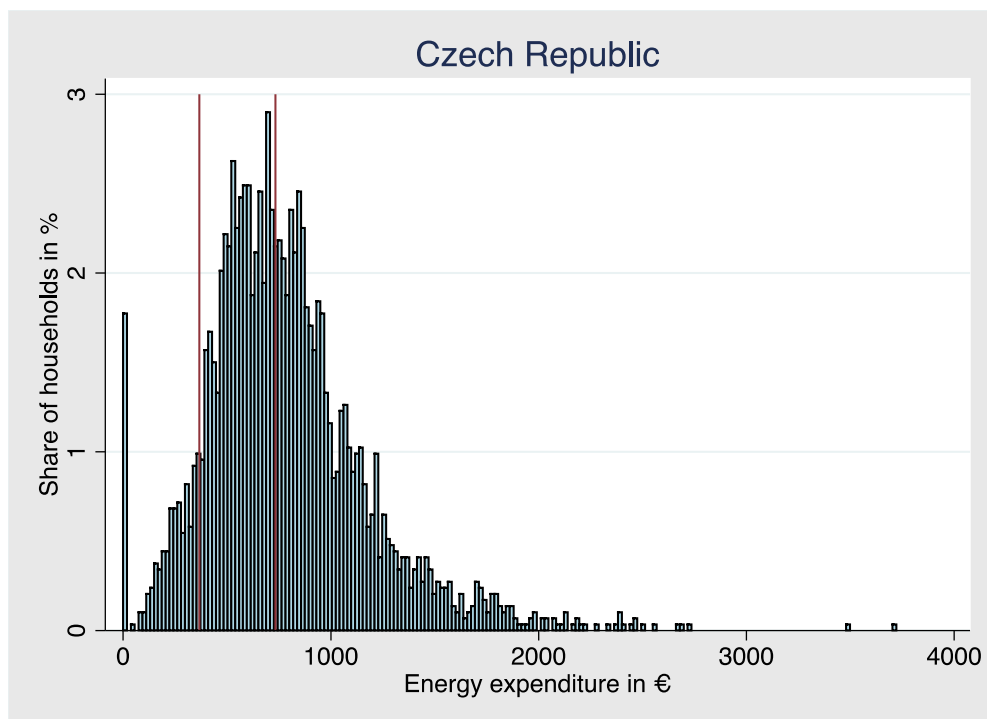


Figure 7: Distribution of energy expenditure in 2010 in the Czech Republic

Note: red lines indicate the median value and half of the median energy expenditure

2.2.2 2M: Share of energy expenditure

2M: Share of energy expenditure (compared to equivalised disposable income) above twice the national median

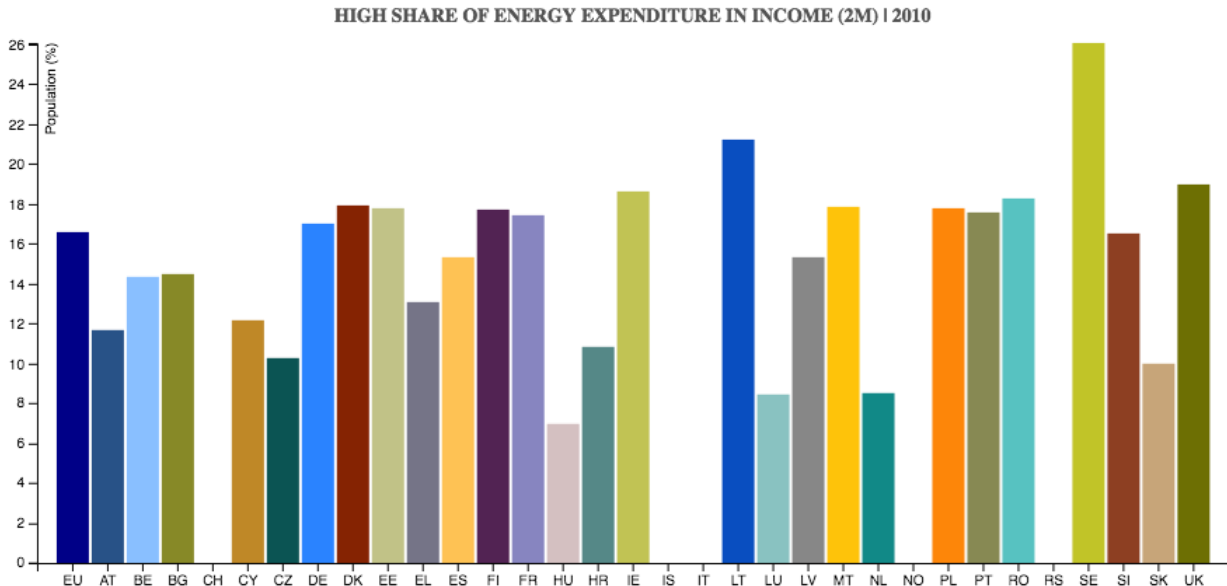


Figure 8: Share of energy poor households in the EU28 in 2010 according to the 2M indicator

The 2M indicator aims to capture the burden that energy bills put on households relative to their disposable income, using the national median as a reference point. Accordingly, whether a household is considered energy poor depends on the relation between its energy expenditure and disposable income in comparison to how this relation looks like on the macro level. Due to this, low-income households that underconsume relevant energy services such as heating may not be captured by this measure. On the other hand, high-income households are defined as energy poor according to this measure, if they have proportionally high energy expenditure. If energy poverty is defined as having limited access to energy services or – due to energy expenditure – being limited with regard to the consumption of other essential goods or services, then the latter may not fit the definition. In addition, due to its relative nature, energy poverty levels measured by this indicator alone do not reflect the actual hardship that households experience. While in countries with a high share of energy poor households such as Sweden or Finland, the burden for these households may be high only in relative terms (see Figure 9 and Figure 10) in other countries with a low share of energy poor households such as Hungary or Slovakia, the burden may be high also in absolute terms (see Figure 11 and Figure 12). Accordingly, a meaningful cross-country comparison of energy poverty levels requires knowledge of the underlying distributions and thresholds.

Similar to the M/2 indicator, the macro results of the 2M indicator depend on the distributions of its two constituents income and energy expenditures. Those drive the distribution of the 2M indicator and its median/double median value and resulting share of population beyond the threshold. And equal to the M/2 indicators, thresholds may change over time, for the 2M indicator dependent on changes in values and distributions of both underlying constituents.

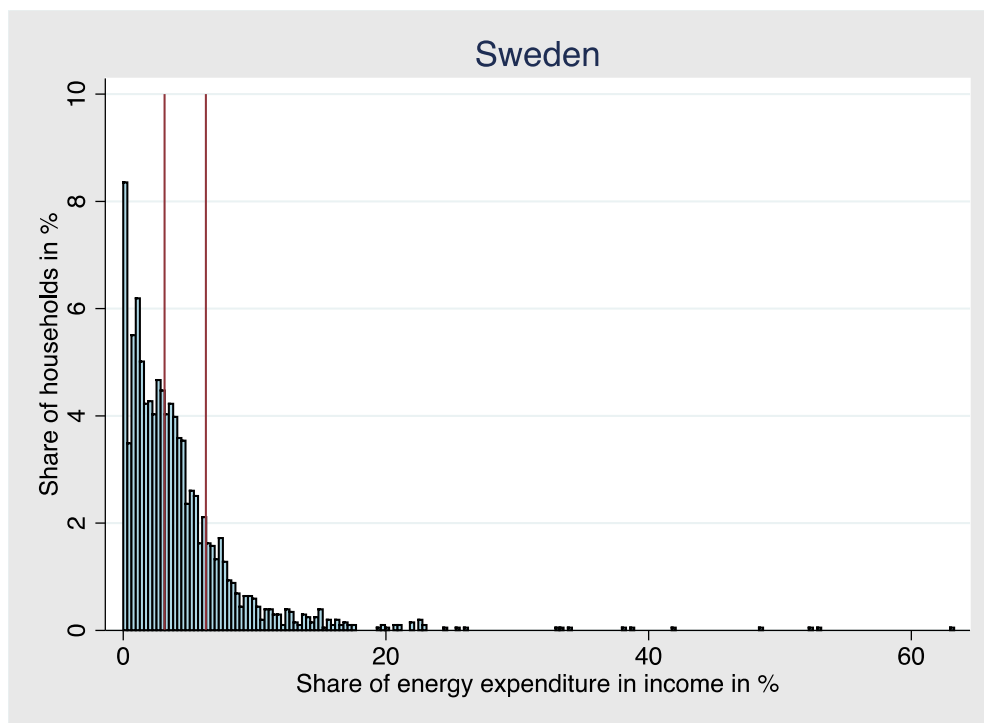


Figure 9: Distribution of shares of energy expenditure in incomes in 2010 in Sweden

Note: red lines indicate the median value and double of the median share of energy expenditure in income



Figure 10: Distribution of shares of energy expenditure in incomes in 2010 in Finland

Note: red lines indicate the median value and double of the median share of energy expenditure in income

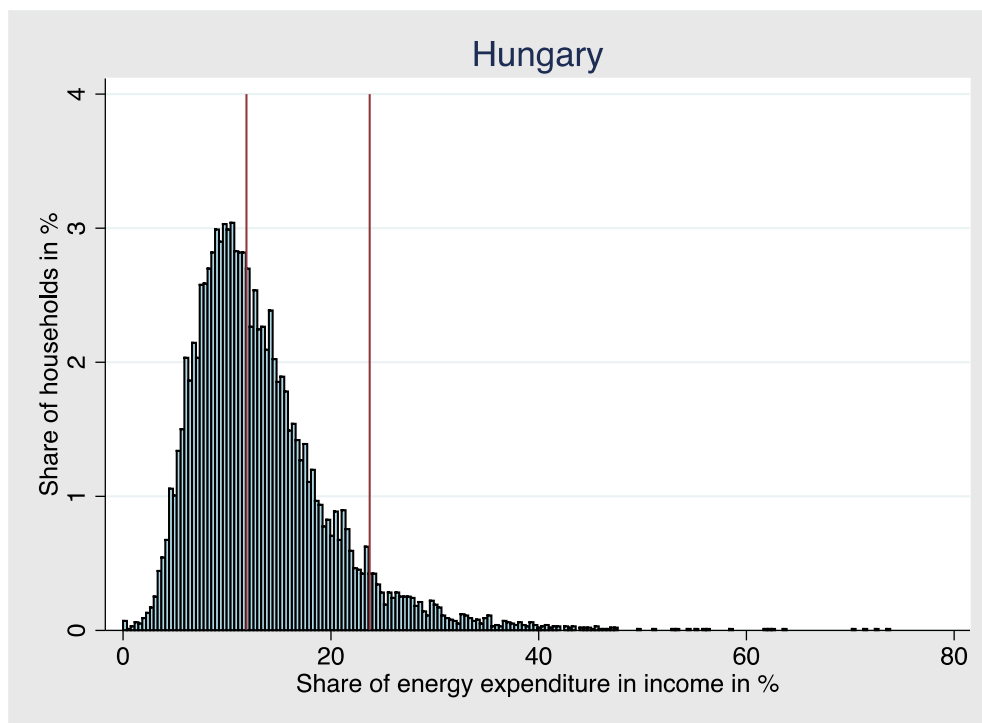


Figure 11: Distribution of shares of energy expenditure in incomes in 2010 in Hungary

Note: red lines indicate the median value and double of the median share of energy expenditure in income

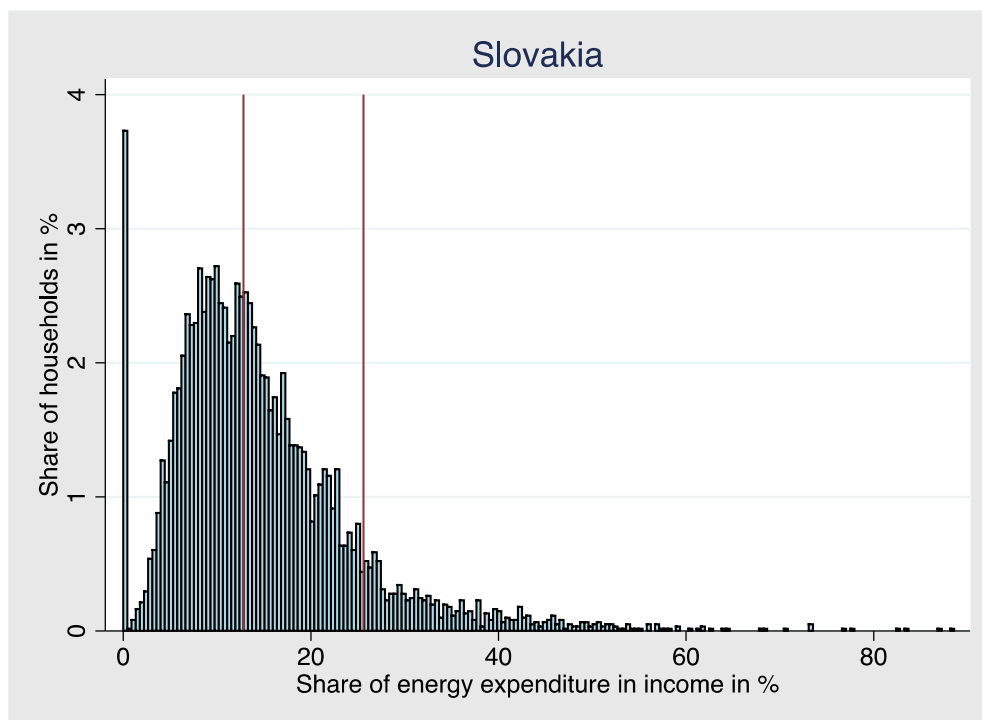


Figure 12: Distribution of shares of energy expenditure in incomes in 2010 in Slovakia

Note: red lines indicate the median value and double of the median share of energy expenditure in income

3 Primary SILC indicators: data sources and processing

3.1 Data source: EU-SILC

HH050: Ability to keep home adequately warm

Format of the question: Can your household afford to keep its home adequately warm?

Answer categories:

- yes
- no

HS020 (used until 2008), HS021 (after 2008): Arrears on utility bills

The Living conditions Working Group agreed during its 2010 meeting to suppress HS020 and to keep only HS021 starting from the 2011 operation – see footnote in methodological guidelines.

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

Answer categories:

HS020, used until (available until 2010)

- yes
- no

HS021, after 2008

- yes, once
- yes, twice or more
- no

Data source for disaggregating variables

SILC code	Content
HH020 HH021 (from 2011 onwards)	Tenure status
HY020	Total disposable household income
DB100	Degree of urbanisation
HH010	Dwelling type

3.2 Processing and recoding of SILC data by Eurostat

EU SILC data is collected based on a harmonised questionnaire throughout all EU member states.⁵ However, questions/answer categories change over time (yearly changes (in particular the yearly changing subjects of the ad hoc-modules) are decided together with data producing NSIs).

For generating the SILC-based indicators database of the Energy Poverty Observatory (EPOV), Eurostat kindly extracted and calculated respective values from the cross-sectional constantly updated production database at Eurostat. Data was provided to EPOV in CSV files including country-shares and number of observations by disaggregated values. Calculations follow standard Eurostat approaches and are directly comparable to other statistics available from the Eurostat data explorer.

3.3 Calculation of SILC-based primary indicators

Eurostat uses the constantly updated EU-SILC production database as data source for two primary Energy Poverty indicators (percentage of population “not able to keep home adequately warm” and “having arrears on utility bills”).

From the household questionnaires, yes/no responses are assigned to all household members. From these, indicator values are calculated as “% of population”.

For each country and year, the two primary indicators are calculated

- For the total population (country average, EU average⁶)
- by tenure status (owner, rented at market rate, reduced/free rent)
- by income (by country-deciles)
- by degree of urbanisation (densely/intermediate/thinly populated)
- by dwelling type (detached, semi-detached/terraced, multi-family, other)

The disaggregating variables tenure status, degree of urbanisation and dwelling type are directly taken from the SILC micro data (with some harmonisations and simplifications, see **Error! Reference source not found.**).

Income decile data were generated from the respective income variable. To this end, for each country and year, income decile categories were calculated based on household income (applying the OECD modified equivalence scale) and households assigned their respective decile category (from 1 to 10). Primary indicators were then calculated also by individual income decile per country and year. For EU-values by deciles, country-level income deciles were used to assign households to respective deciles.

⁵ [https://ec.europa.eu/eurostat/statistics-explained/index.php?title=EU_statistics_on_income_and_living_conditions_\(EU-SILC\)_methodology_%E2%80%93_sampling#Sampling_frame](https://ec.europa.eu/eurostat/statistics-explained/index.php?title=EU_statistics_on_income_and_living_conditions_(EU-SILC)_methodology_%E2%80%93_sampling#Sampling_frame)

⁶ The EPOV EU average includes the data from all EU countries available at the time of data collection. As from 2013 the correct aggregate used is EU28; from 2007 to 2012 EU27 is the aggregate of choice. However, due to limited data availability in the years 2008 to 2010 for mdes07, the aggregate “EU” is composed of available countries only; for the years 2005 and 2006 the aggregate “EU” is composed of available countries only.

3.4 Data coverage

Missing data

There are only few data gaps in the collection of the two primary SILC indicators. However, some EU member states only started EU-SILC data collection later than 2004, so the macro time series starts only later. The resulting data coverage for primary indicators is relatively good for EU member states (see Table 3).

EPOV SILC-based indicators cover (by end of 2019) the time range 2004–2017 (for some countries already 2018).

The availability of primary indicators disaggregated by second-level/disaggregating variables (tenure status, income decile, degree of urbanisation, dwelling type), depends on the availability of these variables per country and year. Coverage of these variables is very good with few exceptions (for an overview see below table).

Table 3: Data coverage for primary indicators "ability to keep home adequately warm" and "arrears on utility bills"

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
AT															
BE															
BG															
CH															
CY															
CZ															
DE															
DK															
EE															
EL															
ES															
FI															
FR															
HR															
HU															
IE															
IS															
IT															
LT															
LU															
LV															
MT															
NL															
NO															
PL															
PT															
RO															
RS															
SE															
SI															
SK															
UK															

Note: green filling indicates availability of all indicators incl. all breakdowns, grey filling indicates availability of primary indicators, but not full coverage of breakdowns.

Data source: based on data provided to EPOV by Eurostat (status 2019)

4 Primary HBS indicators: data sources and processing

4.1 Primary indicators: HBS

In order to calculate the selected expenditure-based energy poverty indicators, the following variables from the HBS are used:

EUR_HH099: Net income (total income from all sources including non-monetary components minus income taxes)

Consists of

- Monetary net income (total monetary income from all sources minus income taxes) (EUR_HH095),
- Income in kind from employment (wages and salaries in kind) (EUR_HH012)
- Income in kind from non-salaried activities (Including withdrawals from own garden, farm or enterprise for the household's private consumption) (EUR_HH023)
- Imputed rent (The owners' imputed rent and that of tenants living free of charge) (EUR_HH032)

EUR_HE045: Household expenditure for electricity, gas and other fuels

Consists of

- Household expenditure for electricity (EUR_HE0451)
- Household expenditure for gas (EUR_HE0452)
- Household expenditure for liquid fuels (EUR_HE0453)
- Household expenditure for solid fuels (EUR_HE0454)
- Household expenditure for heat energy (EUR_HE0455)

HB062: Equivalent household size (modified OECD scale)

Data source for disaggregating variables

HBS code	Content
EUR_HH099	Total disposable household income
HA09	Degree of urbanisation

For generating the database of the Energy Poverty Observatory (EPOV), the cross-sectional micro data files from the Household Budget Survey (HBS) containing information on household income and energy expenditure within EU Member States has been used. Data collection for the HBS has already started at the beginning of the 1960's. However, it being a voluntary activity without legal enforcement mechanisms, Member States' data collection efforts have differed with regard to frequency, timing, content and/or structure. Accordingly, there have been ongoing efforts to harmonize the country data files in order to produce a consistent data set with comparable information on household income and expenditure across the EU. Nevertheless, due to a multitude of associated methodological challenges, at this

point a harmonized dataset containing HBS micro data for (almost)⁷ all (present) 28 EU Member States is available only for one year/wave (2010). Thus, until release of the 2015 wave of harmonized micro data (expected to be made available in 2020), currently available information allows only for a static impression of the state of energy poverty according to expenditure-based measures across the EU.

Using the data software STATA, a do-file was written to extract the relevant variables from the country files provided by EUROSTAT and merged into one consolidated database.

The synthesised file used for the calculation of EPOV indicators includes:

- 2010 wave (consisting of data from national surveys implemented between 2008 and 2012)
- 28 EU member states
- in total 287,782 observations
- 2,047 (SE) to 53,996 (DE) observations per country

4.2 Preparation and recoding of micro data

For the relevant HBS variables, there were cases of negative, missing or implausible values in expenditure and income. These observations were excluded from the analysis. In line with EUROSTAT procedures, values of 0 were treated as actual responses indicating no income or expenditure by the household. For more information see section 4.4. Apart from this, HBS data has not been recoded.

4.3 Calculation of primary EPOV macro-indicators

The HBS micro data serves as a main data source for two primary Energy Poverty indicators:

- 2M: percentage of households whose share of (equivalised) energy expenditure in (equivalised) disposable income is above twice the national median share and
- M/2: percentage of households whose absolute (equivalised) energy expenditure is below half the national median
- a number of secondary indicators on a macro (country-) level.

The two HBS-based primary energy poverty indicators (2M and M/2) are calculated from the underlying HBS micro data as shares of households affected. To this end, the following calculation steps have been implemented:

2M:

1. Calculation of the share of (equivalised) energy expenditure in (equivalised) disposable income for each observation (household) in the dataset
2. Calculation of the (weighted) median value of this variable by country

⁷ For the Netherlands, no microdata was included in the harmonized data file and thus has to be acquired separately.

3. Generation of a new variable that assigns households whose value on this variable is above twice the national median the value 1 (i.e. energy poor) and all other the value 0 (i.e. not energy poor)
4. Calculation of the share of households considered energy poor by country

M/2:

1. Calculation of the (weighted) median (equivalised) energy expenditure by country
2. Generation of a new variable that assigns households whose (equivalised) energy expenditure is below half the national median the value 1 (i.e. energy poor) and all other the value 0 (i.e. not energy poor)
3. Calculation of the share of households considered energy poor by country

In order to account for household differences with regard to the relative burden of energy expenditure and relative utility of disposable household income, values of both variables have been equivalised (see box for further elaborations) using the OECD modified equivalence scale.

For each country and the EU in total, the two indicators are calculated

- For the total population (country average)
- by income (by country-deciles)
- by degree of urbanisation (densely/intermediate/thinly populated)

While the disaggregating variable degree of urbanisation is directly taken from the HBS micro data, income decile data had to be generated.

Rationale for equivalisation of income and expenditure

The needs of a household grow with each additional member but – due to economies of scale in consumption – not in a proportional way. Needs for housing space, electricity, etc. will not be three times as high for a household with three members than for a single person. In the same way, disposable income utility will decline with the number of persons in a household whose needs have to be met. With the help of equivalence scales each household type in the population is assigned a value in proportion to its needs. The factors commonly taken into account to assign these values are the size of the household and the age of its members (whether they are adults or children).

To this end, for each country (equivalised) income decile categories were calculated and households assigned their respective decile category (from 1 to 10). Primary indicators were then calculated also by individual income decile per country. In order to disaggregate indicators on EU level, the single country level income deciles were aggregated to EU-level deciles (i.e. all observations within the first income deciles of MS were pooled to the EU first income decile).

Table 4: Number of observations per country and total in the HBS data, before and after indicator specific data cleaning

	Observations (total)	Observations (after data cleaning for 2M indicator calculation)	Observations (after data cleaning for M/2 indicator calculation)
AT	6,534	6,427	6,427
BE	7,177	7,162	7,177
BG	2,982	2,982	2,982
CY	2,707	2,702	2,707
CZ	2,932	2,931	2,931
DE	53,996	53,926	53,996
DK	2,484	2,460	2,467
EE	3,632	3,632	3,632
EL	3,512	3,512	3,512
ES	22,203	22,184	22,203
FI	3,551	3,551	3,551
FR	15,797	15,732	15,797
HR	3,461	3,460	3,461
HU	9,937	9,936	9,937
IE	5,891	5,877	5,891
IT	22,246	0	22,246
LT	6,103	6,103	6,103
LU	3,492	3,492	3,492
LV	3,798	3,797	3,798
MT	3,732	3,730	3,732
NL*	6,001	5,977	5,996
PL	37,412	37,227	37,412
PT	9,489	9,489	9,489
RO	31,336	31,336	31,336
SE	2,047	2,036	2,047
SI	3,924	3,923	3,924
SK	6,143	6,143	6,143
UK	5,263	5,225	5,241
TOTAL	287,782	264,952	287,630

* 2012 data

4.4 Data coverage and data issues

There are some gaps or anomalies in the data required to calculate the two primary HBS indicators.

- **Income (EUR_HE099):** For IT no income data has been provided due to validity concerns following the national data collection process. Accordingly, neither the 2M-indicator nor income deciles for disaggregation purposes can be calculated for IT. Across all countries there are 247 observations for which negative income data is reported and 22,362 observations for which no income (i.e. income=0) is reported. Out of these, the majority (22,246) reflect missing data from IT, while the remaining 116 observations are treated as actual income data (i.e. households with no income). The distribution of these cases across the EU is displayed in Table 5. Furthermore, for Germany there are 69 cases in which

an income of 1 € has been reported, which were also not considered within the analysis.

- **Energy expenditure (EUR_HE045):** Across all countries there are 45 observations for which negative expenditure data is reported and 6,014 observations for which no energy expenditure (i.e. energy expenditure=0) is reported. The distribution of these cases across the EU is displayed in Table 6.

While there are possible explanations for negative income values (e.g. due to debt service exceeding annual income) or zero values for energy expenditure (e.g. if energy costs are included in the rent), it is not possible to trace back the origin of these anomalies. For the calculation of indicators, observations with negative values on either one or both of the two variables were deleted.

Table 5: Data anomalies with regard to income in the HBS data

	Negative income values	Income values of 0	Income values of 1
AT	0	0	0
BE	8	7	0
BG	0	0	0
CY	0	5	0
CZ	0	0	0
DE	0	1	69
DK	7	0	0
EE	0	0	0
EL	0	0	0
ES	0	19	0
FI	0	0	0
FR	10	55	0
HR	1	0	0
HU	1	0	0
IE	0	14	0
IT	0	22,246 **	0
LT	0	0	0
LU	0	0	0
LV	0	1	0
MT	1	1	0
NL*	19	0	0
PL	185	0	0
PT	0	0	0
RO	0	0	0
SE	8	3	0
SI	0	1	0
SK	0	0	0
UK	7	9	0
TOTAL	228	22,362	69

* 2012 data

** Missing information from the Italian micro data

Table 6: Data anomalies with regard to energy expenditure in the HBS data

	Negative energy expenditure values	Energy expenditure values of 0
AT	0	0
BE	0	0
BG	0	36
CY	0	3
CZ	1	46
DE	0	1,135
DK	17	9
EE	0	121
EL	0	1
ES	0	182
FI	0	67
FR	0	315
HR	0	25
HU	0	7
IE	0	61
IT	0	22
LT	0	91
LU	0	0
LV	0	3
MT	0	7
NL*	5	2
PL	0	2,290
PT	0	51
RO	0	841
SE	0	172
SI	0	4
SK	0	228
UK	22	297
TOTAL	45	6,014

*2012 data

The availability of the disaggregated primary indicators by second-level/disaggregating variables (income decile, degree of urbanisation), depends on the availability of these variables per country. Coverage of these variables is overall good with few exceptions:

- **Urbanisation:** For RO no data on degree of urbanisation has been collected. For MT there are no observations falling within the “thinly populated” category.
- **Income:** Since there is no income data for Italy, disaggregation of indicators could not be implemented for this Member State.

Urbanisation-related issues with primary indicator disaggregation

- There are only few observations in intermediate densely populated areas in LV (3), LT (54) and EE (73), which translates into a small n problem.

4.5 EPOV codebook of HBS-based microdata file

Table 7: EPOV codebook of HBS-based microdata file

EPOV code	Content	EPOV coding
ALL	Missings	.
weight	Household weight reflecting the inverse probability of a household to be selected into the sample	#####.#####
net_inc	Total disposable household income	€
pop_dens	Degree of urbanisation	1 densely populated 2 intermediate area 3 thinly populated
exp_EGF	Household expenditure for electricity, gas and other fuels	#####
HID	Household ID	#
year	Year of the survey	####
ctry	Country	country code (abbreviation)
HHS	Household size	#
HHS_OECD_mod	Equivalent household size (modified OECD scale)	##

5 References

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