Contribution to the chapter on experts' perspective of the EPAH full revision of energy poverty indicators

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Abstract

This paper presents the qualitative perspective of the authors on the current and future reference energy poverty (EP) metrics in the EU as a contribution for the Energy Poverty Advisory Hub's (EPAH) full revision of EP indicators.

1. Specific insights on previous indicators

Table 1 provides specific insights (Advantages/disadvantages, potential improvements, etc.) on the current energy poverty (EP) indicators proposed by EPOV.

Table 1. Specific insights on the current energy poverty (EP) indicators proposed by EPOV

Primary	Arrears on utility bills	This indicator could lead to a misestimation of the number of energy poor people because of the same nature of the question. Indeed, not all the people in arrears on utility bills are energy poor because there could be households that are not paying their energy bills for other reasons. A suggestion for improvement could be overlapping this indicator with a 'disproportionate expenditure' objective indicator, such as the 2M or MIS, to capture the income-expenditure situation of each household and eventually detect people who are in arrears because they cannot afford their energy expenditures. Moreover, in the EU-SILC (at least in the Spanish one), the delay in invoices is not limited to energy bills, so we cannot strictly assimilate it to an EP indicator. Having said all this, given that it is one of the few questions in the EU-SILC from which something can be extracted for EP, it is important to keep it, or even better, it could be expressed by a more focused question in the EU-SILC: "Have you experienced arrears on your energy bills in the last year because of economic reasons?".
	Low absolute energy expenditure (M/2)	The underconsumption approach makes it possible to detect the systematic 'false negative' cases of the 'disproportionate expenditure' indicators, i.e. households with low energy expenditure. However, the EPOV's M/2 indicator focuses only on 'relative' underconsumption that could be related to circumstances other than lack of affordability, i.e. high housing energy efficiency, because neither an income nor an energy efficiency criterion is considered. So, two improvements could be made: (1) setting an absolute threshold for

		energy expenditure (2) adding a second threshold that could help identifying people who have low energy expenditure because of energy-poverty related circumstances.
	High share of energy expenditure in income (2M)	The median share used in this indicator has been considered 'particularly useful for measuring and monitoring aspects of deprivation' (Liddell et al., 2012). The 2M indicator detects those households having abnormally high energy expenditure (Heindl, 2013) by using a single income-expenditure threshold, which make it simpler to calculate compared with double threshold metrics (e.g. LIHC). several limits on the application of the 2M have been identified: (1) difficulties in investing the 2M with normative meaning; (2) income and expenditure do not follow the same trend; (3) there are not good arguments why 2M is an appropriate threshold. A 2014 study (Schuessler, 2014) proposed that, to gain in acceptability, the 2M could be linked to 'adequate energy services'. Schuessler's proposal points to the need to set absolute thresholds, which will be discussed below.
	Inability to keep home adequately warm	This is a useful indicator to estimate the share of households that cannot keep the comfort at home during winter. Indeed, this could also be a symptom of an inefficient use of energy (because of a bad thermal insulation of the dwelling, low energy efficiency of the appliances or energy behaviour). It would also be very interesting to be able to relate this subjective indicator to an objective approach to the measurement of hidden energy poverty (see HEP proposal below).
Secondary	Fuel oil prices	All the mentioned prices' references are usually referred to the before-taxes price of the energy carrier (published by Eurostat or national statistics institutes), which are simple to collect and provide a good reference of variable price of energy. However, differences in taxes and their application could be also considered to have a more complete picture of the real energy burden in each country. One potential way to consider it could be do add an index on the average taxes on energy in each country.
	Biomass prices	
	Coal prices	
	District heating prices	
	Dwelling comfortably cool during summer time	In our opinion, these indicators could be primary indicators integrated in the annual EU-SILC (currently the cooling one is not part of this survey) and might be analysed together with other questions on the temperature of the thermostat, and with objective (e.g. HEP, see Section 3) or direct approach indicators (e.g. Measurement of temperature)
	Dwelling comfortably warm during winter time	
	Dwellings in densely and intermediately populated areas	This could be replaced with the numbers of dwellings in urban and rural areas.
	Dwellings with energy label A	In our opinion, this indicator could be complemented with the number of "Dwellings with energy label E or lower" to identify households living in inefficient dwellings.
	Energy expenses, income quintile 1 to 5	A comparison with Energy expenses, income quintile 6 to 10, would help to see the differences

		and understand the differences in energy expenditures.
	Equipped with air conditioning	These indexes could be complemented by four additional data: a. Typologies and energy carriers of the heating systems b. Age of the heating and cooling systems c. number of rooms heated during winter d. number of rooms cooled during summer
	Equipped with heating	
	Excess winter mortality/deaths	In our opinion, this indicator should be studied in depth to avoid misestimation of the actual deaths related to winter energy poverty or misinterpretation by the media. Moreover, giving the future increase in temperature forecast by several studies (e.g. IPCC studies and (Castaño-Rosa et al., 2021) and the current heat waves that the population is already experiencing, the excess of summer mortality might be added to complement the winter one.
	Household electricity prices	See the comment for the rest of energy carriers' prices. Moreover, both the energy crises and the policies implemented by the governments might be taken into account when analysing these data (Barrella, 2021).
	Household gas prices	
	Number of rooms per person, total, renters and owners	Other kinds of 'housing' (e.g. informal settlements) could be considered (see Section 3).
	Poverty risk	This is a crucial poverty index that could complement other specific EP indicators. Indeed, the AROP and AROPE indexes have been used as alternative income thresholds in several studied in the EU (Barrella et al., 2022) (see (Nicaise and Schockaert, 2014) for further information).
	Presence of leak, damp, rot	N/A

2. General insights on the approaches

2.1. Primary indicators

Subjective approach

The subjective indicators showed some limitations due to the subjective interpretation of the reality. Nevertheless, these could be meaningful metrics to suggest to the politicians to implement structural measures such as the housing energy-retrofitting in case of a high share of people unable to adequately heat their homes. Moreover, they are easy to calculate and monitor since they come from a homogeneous EU survey, i.e. EU-SILC.

Objective approach

Among the objective indicators, the 'traditional' metrics have been usually based on a disproportionate expenditure approach, which quantifies the so-called 'measured energy poverty' (Meyer et al., 2018). This term refers to households whose energy expenditure is considered too high compared to their income, i.e. households that spend too much of their disposable income on energy. On the other hand, low-income households often apply coping strategies to reduce their consumption (Brunner et al., 2012), (Anderson et al., 2012), (Lampietti and Meyer, 2002), (Stojilovska et al., 2021), such as 'switching on heating only in one room, wearing more clothes or slipping under the duvet even during daytime' (Brunner et al., 2012). Energy spending reduction was identified in (Anderson et al., 2012) as the primary strategy adopted by households to cope with the lack of financial resources. The term 'hidden energy poverty', introduced by

Meyer et al. (Meyer et al., 2018), refers to circumstances of '(self-)imposed restriction' of energy consumption, which are the most difficult to detect through existing administrative metrics and energy poverty indicators. Thus, this 'hidden face' of energy poverty has not been sufficiently reflected in measurement and policies (Meyer et al., 2018), (Charlier and Legendre, 2021).
Considering the current state of the art, using absolute thresholds (e.g. MIS and HEP indicators, described in Section 3) makes it possible to assess energy poverty rather than energy inequality, the latter being the most common outcome of metrics based on relative thresholds. However, modelling energy costs is a complex task because of the diversity of influence factors to consider and, therefore, the numerous simplifying assumptions that have to be introduced. According to Sovacool et al. (Sovacool et al., 2018), simplified theoretical models 'abstract from real-world complexities and focus on key mechanisms, either conceptually or by combining theoretical assumptions with empirical data'. In this sense, there are some European scholars who are working to enhance energy expenditure's models and integrate energy behaviour in their estimation. On the other hand, the modelling presented in (Barrella et al., 2022) have been statistically validated and provide a good picture of household's required energy expenditure without generating overcomplex models. The mentioned study could be an example of a versatile model that could be adapted to other MSs.

2.2. Secondary indicators

We believe it is absolutely necessary to continue to include these secondary indicators, but some of them could be improved or complemented by other indexes (see the proposals in Section 1 and 3).

3. Suggestions and proposals for 'new' indicators and data

3.1. Missing indicators

a. **Absolute objective indicators:** MIS as alternative indicator to the 2M and an absolute HEP indicator as alternative to the M/2.
Following Moore's proposal (Moore, 2011), the MIS-based energy poverty indicators try to overcome the main weakness of the 2M disproportionate household expenditure indicators, namely the arbitrary choice of threshold. Using the MIS as a benchmark of expenditure for a decent living in each member state seems to us to be a much more robust approach.
The main difficulty of this proposal lies in the calculation of the MIS reference for each country. Fortunately, there are countries that are already calculating it (Mariño, 2022), and some pilot projects that have obtained it for some others (ImPRoVe project and the European pilot project (Goedemé et al., 2014)).
On the other hand, among these 'underconsuming households', it is crucial to identify the ones that reduce their energy expenditure because they cannot afford basic energy services, thus suffering from hidden energy poverty. Considering the state of the art presented in Section 2.2.1.1, using absolute thresholds makes it possible to assess energy poverty rather than energy inequality, the latter being the most common outcome of metrics based on relative thresholds. (Barrella et al., 2022) proposes using a theoretical model for estimating energy consumption and expenditure as a transparent and versatile tool to serve the policy-maker or other relevant stakeholders (who hold ultimate responsibility for fixing its key parameters). According to the proposed HEP indicator, a household is in hidden energy poverty if: (1) their actual energy expenditure is below half their required energy expenditure (RENE/2), and (2) the family unit belongs to one of the five lowest equivalised income deciles. Accordingly, this metric was applied to the 2016-2019 Spanish HBS samples (a recent update calculated it in 2020 (Romero et al., 2022)), and some suggestions and simplifications are presented in (Barrella et al., 2022) to make it possible to apply the HEP indicator to other European countries. Examples of application of these two alternative indicators are provides in the following references: MIS (Romero et al., 2018), (Gómez-Navarro et al., 2021); HEP (Barrella et al., 2022).

b. **Complementary subjective indicators:** Inability to keep home adequately cool during summer. In our opinion, this indicator could be added as primary indicator using the "Dwelling comfortably cool during summer time" query already used in previous years' SILC and currently present as secondary indicator.

3.2. Missing data in current surveys (especially HBS and SILC)

a. Location of the household (exact location or at least the province, e.g. the Spanish HBS only provide open-access information on the residence region).
b. Housing Energy Efficiency Rating or Age of housing / Last retrofitting (e.g. the Spanish HBS only provide information on if the building was constructed more or less than 25
c. years ago)
d. The type of electrical appliances and thermal installations.
e. Contracted Electrical capacity/power and modality/tariff of contracting supplies (regulated or free market)

3.3. Overall comments

The HBS should be more homogenous among the MSs and both the HBS and the EU-SILC could contain more energy-poverty-related indicators. Moreover, both surveys might integrate a "wellbeing module" for each year as the one included in the 2010 Spanish HBS. Perhaps, an "energy poverty module" could be included. Ideally, an "energy poverty longitudinal analysis" on a fixed sample of households, like the one proposed by the Spanish Institute for the Diversification and Saving of Energy (IDAE), might be carried out on the basis of a specific survey carried out every year for at least 5 years to enhance the understanding of this social issue.

4. Overall proposal of energy poverty indicators

Table 2 summarises the set of indicators proposed by the authors.

Table 2. Overall proposal of energy poverty indicators

Primary	Objective disproportionate expenditure	High share of energy expenditure in income, 2M (EPOV)
		Minimum Income Standard based indicator, MIS (Romero et al., 2018)
	Objective underspending	Low absolute energy expenditure, M/2 (EPOV)
		Hidden Energy Poverty indicator, HEP (Barrella et al., 2022)
	Subjective indicators	Inability to keep home adequately warm
		Dwelling comfortably cool during summer time
		Arrears on energy bills due to financial restraints[1]
Secondary	Energy prices	Fuel oil prices
		Biomass prices
		Coal prices
		District heating prices
		Household electricity prices
		Household gas prices
	Dwelling's location and energy label	Dwellings in urban areas
		Dwelling in rural areas (Dokupilová et al., 2021)
		Dwellings with energy label E or lower
		Dwellings with energy label A
	Energy expenses	Energy expenses, income quintile 1 to 5
		Energy expenses, income quintile 6 to 10
	Thermal systems in dwellings	Equipped with air conditioning
		Equipped with heating
		Typologies and energy carriers of the heating systems
		Age of the heating systems
		Age of the cooling systems
		Number of rooms heated during winter
		Number of rooms cooled during summer
	Excess of seasonal mortality related to EP	Excess of winter mortality related to EP
		Excess of summer mortality related to EP
	Housing size and tenure status	Number of rooms per person, total, renters and owners
	General poverty	Poverty risk
	Housing condition	Presence of leak, damp, rot

[1] Based on the question "Have you experienced arrears on your energy bills in the last year because of economic reasons?".

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