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Reviewing energy poverty from Spain. Towards an enriched framework.

Revisión de la pobreza energética desde España. Hacia un marco de referencia enriquecido.

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ABSTRACT

This paper reviews the evolution of the concept of energy poverty over time. Furthermore, the paper analyzes the different indicators that are used to quantify it. In Spain, the definition and indicators are proposed in accordance with the most recent approaches to the issue. However, measures are proposed so that the managed indicators better reflect the depth of the conceptual definition. This requires enriching the framework using the different phases described in the capabilities and needs approach, with a multidimensional and multi-actor vision. Thus, the less frequent concepts of sufficiency and adequacy are introduced in the study into energy poverty along with the most frequent concepts of energy efficiency and affordability. Accessibility is also addressed, albeit more typical in developing countries. It is concluded that in order to qualify energy poverty it is necessary to carry out a specific survey that collects more data than are currently available.

Keywords: Energy poverty; Fuel poverty; Affordability and availability; Indicators; Income and expenditure; Sufficiency and adequacy.

RESUMEN

En este artículo se revisa la evolución que ha sufrido el concepto de pobreza energética a lo largo del tiempo y se analizan los distintos indicadores que se utilizan para cuantificarla. En España se plantean una definición y unos indicadores acordes con los planteamientos más recientes de la cuestión. No obstante, se proponen medidas para que los indicadores manejados recojan mejor la profundidad de la definición. Para ello es preciso enriquecer el marco de referencia, utilizando las distintas fases descritas en el enfoque de capacidades y necesidades, con un acercamiento multidimensional y de múltiples actores. Así se introducen los conceptos menos frecuentes de suficiencia y adecuación junto con los conceptos más frecuentes de eficiencia energética y asequibilidad. También se aborda la accesibilidad. Se concluye que para poder cualificar la pobreza energética es necesario realizar una encuesta específica que recoja más datos que los que actualmente están disponibles.

***Palabras clave**: Pobreza energética; Asequibilidad y disponibilidad; Indicadores; Ingresos y gastos; Suficiencia y adecuación.*

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1. INTRODUCTION

The conceptualization of energy poverty has undergone a significant evolution since its origins approximately forty years ago. There is currently no consensus definition between different countries, which makes it difficult to establish a homogeneous approach to the phenomenon (1). There is some confusion not only in the concepts that are handled, but also in the name of the problem, because of the different perspectives from which it is addressed (2).

Furthermore, it is an issue in which political interest is high. As a result of the institutional efforts carried out, the EU Energy Poverty Observatory (EPOV) launched its activity in 2017 (3).

There has also been a boom in scientific production. On July 15, 2019 Google Scholar offered more than 2,000 scientific papers published during 2019 by introducing the search terms "energy poverty" and "fuel poverty".

In Spain, since the recent approval, in April 2019, of the National Strategy against Energy Poverty 2019-2024 (NSEP) (4), institutional interest has become more evident. In addition, various civil society actors regularly publish reports on the evolution of energy poverty (5, 6, 7, 8).

The efforts are focused on quantifying the phenomenon in order to analyze the causes that give rise to it and design appropriate policies to combat it (9). But in the absence of a single criterion, the results offered by quantification attempts at the European level have a large disparity, as can be seen in figure 1.

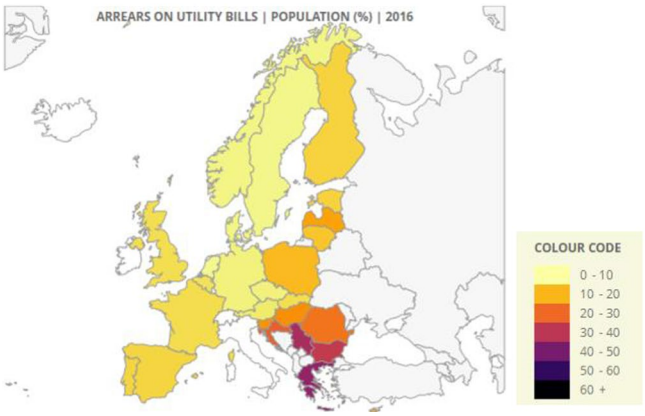

Figure 1. Arrears on utility bills / Population (%) in year 2016 (10).

Globally, we can see how, in 2015, the United Nations Member States adopted "Transforming our World: the 2030 Agenda for Sustainable Development", more commonly known as the Sustainable Development Goals (11). Energy is dealt with primarily by Sustainable Development Goal #7 (SDG7), whose overarching aim is to 'Ensure access to affordable, reliable, sustainable and modern energy for all' (12).

The consequences of energy deprivation on people can be perceived in the three basic dimensions of sustainability: social, economic and environmental.

On a social level, energy poverty has consequences for people's health and their capacity for relationships and integration. The lack of access to safe fuel in kitchens in low-income countries necessitates the burning of solid fuels, which generates extremely high levels of air pollution inside the homes. This situation multiplies the risk of pneumonia, chronic obstructive pulmonary diseases, such as chronic bronchitis or emphysema, and lung cancer, among others. (13).

The impossibility of maintaining an adequate temperature in the home, due to energy poverty, has been related to an increase in premature deaths and morbidity, mainly due to cardiovascular and respiratory diseases (14). Furthermore, it contributes to the reduction in social contacts and relationship opportunities, which gradually increases isolation and represents a risk factor of exclusion. (15).

From the economic point of view, a low level of household income, together with the high price of energy, may lead to having to choose between the "heating or eating" dilemma. Among the indirect consequences of energy poverty is its negative impact on food quality (16).

At the environmental level, the third cause that is usually attributed to energy poverty: the lack of energy efficiency (17), implies that it is necessary to have a greater energy consumption to obtain the same energy services. It implies a greater emission of greenhouse gases and contributes to the acceleration of climate change.

To fight against all of these consequences suffered by people in situations of energy poverty, the achievement of Goal #7 (SDG7) is vital.

2. DESCRIPTION OF THE PROBLEM

After analyzing the confusion caused by the issue resulting from the diversity of approaches, after confirming the interest of the topic given the current proliferation of publications, and after highlighting the importance of the issue both at national and global level, the purpose of this paper is presented.

This paper review aims to advance the implementation of a broader framework that encompasses the different approaches with which energy poverty has been addressed from both the academic world and civil society during the last decade. To achieve this, the objective is to analyze the progress that has been made as regards the definition of the term of energy poverty and the indicators used to quantify it. The aforementioned analysis, carried out from the perspective of Spain after the recent approval of the NSEP, will try to highlight the strengths and weaknesses of each approach.

The ultimate objective of advancing in a broader and more inclusive framework is to avoid omitting any aspect of a complex phenomenon, so that, by broadening the focus of attention, the policies that will be designed can become more appropriate by establishing a more accurate diagnosis.

3. STATE OF THE ART

3.1. Energy poverty definitions

Traditionally the term "energy poverty" has been used to refer to the lack of availability of domestic energy services in developing countries, while the term "fuel poverty" has been

used to refer to the lack of affordable domestic energy services in developed countries. In this paper the term EP (energy poverty) will be used to refer to the phenomenon that addresses both situations.

Below is the evolution of the concept of EP through eleven definitions that come mainly from studies carried out in developed countries:

1. Bradshaw (1983): The inability to afford adequate warmth at home (18).
2. Boardman (1991): Households whose fuel expenditure on all energy services exceeded 10% of their income (19).
3. Owen (2010): Households that would need to spend more than 10% of their income on all household fuel use and to heat the home to an adequate standard of warmth (20).
4. European Economic and Social Committee (2011): Occurs where a household finds it difficult or impossible to ensure adequate heating in the dwelling at an affordable price and having access to other energy-related services, such as lighting, transport or electricity for use of the Internet or other devices at a reasonable price (21).
5. Tirado (2012): It is the inability of a household to pay an amount of energy sufficient to satisfy their domestic needs and / or when they are forced to devote an excessive part of their income to pay the energy bill of their home (22).
6. Hills (2012): Households whose energy needs are higher than the national median and, after paying these energy costs, disposable income is below the official poverty line (23).
7. Moore (2012): Households whose equivalised household incomes, using OECD modified and companion scales, after housing and total fuel costs are deducted are under the minimum income standard (24).
8. Middlemiss (2015): The inability of certain households to acquire the energy services required to live a decent and healthy life (25).
9. Day (2016): An inability to realise essential capabilities as a direct or indirect result of insufficient access to affordable, reliable and safe energy services, and taking into account available reasonable alternative means of realising these capabilities (26).
10. García (2016): Households whose people living there do not meet the absolute energy needs, those that are related to a series of satisfiers and economic goods that are considered essential, in a certain place and time, according to social and cultural conventions (27).
11. Bouzarovski (2017): The inability to attain a socially and materially necessitated level of domestic energy services (28).

As regards studying the definition of EP, the evolution that has taken place can be observed. It quickly changes from paying attention to the warmth at home to expanding the focus of attention to other energy services: water heating, space cooling, cooking, food refrigeration, drying, lighting, electronic services, and appliance services.

At this point it should be noted how the climate where the definition originates influences the study. The initial concern on keeping the home warm arises in the continental climate countries with cold temperatures in winter and mild temperatures in summer where homes do not need refrigeration. In Mediterranean climate countries the objective is also to keep the home cool in the hot summers in the EP study. While in temperate climate countries, the energy requirements to heat or cool the house do not need such attention.

The objective of the study becomes broader and more inclusive by changing from paying attention to energy services to focusing on energy needs, which are different in each context.

It is also possible to analyze the evolution that has followed the characteristics studied. In developed countries the characteristic studied is the affordability of the expenditure. To study the expense, either the actual expenditure reflected by the household energy bills is used, or the theoretical expense necessary to maintain adequate heat conditions at first, and then access to the remaining energy services. If the real expense is characterized then the domestic energy deprivation does not emerge. Qualitative expressions are used to study the affordability, as a reasonable price or an excessive part of the income, and quantitative expressions such as 10% of income, among others.

In developing countries, the characteristic studied is accessibility to energy services.

In order to incorporate both perspectives in a single approach, the characteristic studied becomes the inability to meet energy needs, since this expression does not explicitly explain whether the cause of the disability is due to lack of accessibility or affordability.

3.2. Indicators and thresholds used to measure energy poverty

Once how EP is defined is analyzed, we proceed to analyze how EP is measured. In a way, choosing indicators and threshold levels is still a somewhat arbitrary decision. It largely depends on the possibility of obtaining the data that the indicators require. Three alternatives could be envisaged: use the data available in existing databases, incorporate the collection of new data into established periodic instruments or, finally, collect new data with new instruments.

It would be desirable that the measurement of EP would be able to compare the results obtained from different countries, at least in the near environment and to observe the evolution of the phenomenon over time.

The more complete the definition, the more complex its measurement. That is why it is more operative to measure simple conceptualizations, although the information obtained is more limited.

The most used indicators in developing countries have a multidimensional character and are mainly focused on access to energy (EDI: Energy Development Index), satisfaction with energy services (MEPI: Multi-dimensional Energy Poverty Index), the different combinations of fuel use (EPI: Energy Porverty Index), or in the use made of energy in the domestic, productive and community spheres (MTF: Multi-Tier Framework) (29).

The indicators used in developed countries can be seen in table 1.

Table 1. Indicators and their main characteristics.

Approach	Indicator		Definition	Data availability	Difficulty of obtaining
Expenditure	A10%	Ten percent actual spend	Households whose fuel expenditure on all energy services exceeded 10% of their income (19)	Household Budget Survey	Easy
	N10%	Ten percent need to spend	Households who need to spend more than 10% of their income on all household fuel use and to heat the home to an adequate standard of warmth (20)	No (in Spain) English Household Condition Survey (in UK)	Difficult
	2M	Double median actual spend	Households whose energy expenditure in relation to their income is more than double the national median (30)	Household Budget Survey	Easy
	P30%	Average spend 30% poorest	Households whose energy expenditure in relation to their income is more than the average of 30% of the poorest households (31)	Household Budget Survey	Easy
	AFCP	After Fuel Cost Poverty	Households whose income after deducting both fuel and housing costs are under 60% of median income after deducting both fuel and housing costs (23)	Household Budget Survey	Medium
	LIHC	Low income and high cost	Households who have required fuel costs that are above the median level; and were they to spend that amount they would be left with a residual income below the official poverty line (below 60% of household median income after subtracting housing expenses and equivalent modeled energy expenditures) (23)	Household Budget Survey	Medium
	MIS	Minimum Income Standard	Households who after deducting their actual housing costs, have insufficient residual net income to meet their total required fuel costs after all other minimum living costs have been met (24)	Household Budget Survey	Medium
	HEP	Hidden energy poverty	Households whose absolute energy expenditure is below half the national median (32)	Household Budget Survey	Easy
	M/2	Low absolute energy expenditure			
Consensual	Inability to keep the home adequately warm during winter (21)			Survey on perceptions and statements	Easy
	Arrears on utility bills (21)				
	Presence of a leaking roof, damp walls or rotten windows (21)				
	Inability to keep the home adequately cool during summer (35)				
Direct measurement	Home indoor temperatura (40)			No	Difficult

Expenditure approach indicators

The strength of the expenditure approach indicators lies in the ease with which they allow the number of people affected by EP to be established using the readily available statistical data source of the Household Budget Survey (HBS). Being a European-level survey, it also allows a comparison to be made between different countries in the area and monitor their evolution over time. Not only do they offer information about who suffers from EP but they also allow the EP gap to be measured.

The weaknesses of each indicator that have come to light over time have been resolved with the proposal of new indicators that, in turn, present new limitations.

The first A10% indicator is based on the actual energy expenditure that each household supports. Measuring this way does not take into account the energy deprivation suffered by households that decide to reduce their energy consumption by having difficulty paying it and therefore does not figure in their fuel expenditure. While it does include those rich households that are overconsuming energy since it does appear in its fuel expenditure.

To eliminate the influence of both energy deprivation and splurge, the actual energy expenditure is no longer considered in order to take the necessary energy expenditure into account. They are more accurate indicators, but more complex to measure. While the actual energy spend is data that is obtained from the HBS European survey, the needed energy spend is data that requires the development of a tool that allows it to be obtained. Few countries have it. This is the main difference between the indicators A10% and N10%.

On the other hand, as with the quantification of monetary poverty, there are supporters of measuring EP in absolute terms and measuring EP in relative terms. It is true that poverty has more to do with the deprivation that is reflected in absolute values, while relative values serve to measure inequality. This does not mean that it is also not important. The feeling of poverty is often related to the comparison established between people who share the same environment. Thus, the A10% indicator tries to measure the EP in abso-

lute terms, while the 2M and P30% indicators do so in relative terms, all of which coincide in measuring the actual energy spend.

The A10% indicator has been criticized for the arbitrariness of its threshold (33). To adapt the 10% threshold to the situation of each location and each moment, the 2M and P30% indicators are presented, which show the justifications which Boardman relied on to set the 10% threshold in the United Kingdom in 1993. Although it is true that using the results of these two indicators the best ones fit the situation of the place in which they are applied, it is also true that setting a threshold is an arbitrary act that needs the agreement of the actors involved.

The indicators have also been gaining in precision. They have stopped quantifying energy expenditure to measure the income that families have available to meet other needs. For this, both the housing cost and the energy cost are discounted. It is about minimizing the distortion that implies the direct cost of housing and the same energy expenditure. In addition, to be able to establish comparisons between different types of family, the word equivalised is added, which considers the disposable income differently depending on the number and characteristics of the members that make up the family. OECD criteria are usually used (34).

In this sense it would also be desirable to incorporate some other variables such as the size of the home and the hours of occupation. Some energy uses depend on the number of members and do not depend on the hours of occupation, such as domestic hot water, while others depend on the size of the home and the hours of occupation (among other parameters), such as heating.

Although it is true that as accuracy is increased, the complexity of accessing the data and of agreeing on the way of weighing them also increases.

Consensual approach indicators

In the case of the consensual approach indicators, the self-reported indicators are binary; they admit an affirmative or negative response. They are based on a readily available statistical data source: Survey on Income and Living Conditions (SILC). As it is a European-level survey, like the indicators of the expeditious approach, it allows the comparison between different European countries and monitors their evolution over time. In this case, each indicator by itself does not allow the EP gap to be quantified.

Research into EP began to be developed in countries with mild summers. When this research was transferred to countries with hot summers, the need to incorporate the fourth indicator was established. The corresponding question has not yet been incorporated into the European SILC survey. In Spain, the indicator data is obtained from the Survey on perceptions and statements from households (SPS).

As a weakness of the consensual approach, it should be noted that there are households that do not identify themselves as energy poor, even though they may be characterised as energy poor under other criteria (36). Furthermore, the concept of adequately warm is subjective. There are those who can respond affirmatively with indoor temperatures in their home below the comfort level and who can respond negatively with indoor temperatures in their home within the comfort zone (37). A household may appear poor due to their consumption preferences rather than lacking resources (38).

On the other hand, the presence of a leaking roof, damp walls or rotten windows indicator is based on the characteristics of the dwelling without analyzing the monetary and family situation of the tenants, and would result in a weak and unreliable indicator (39).

Measurement approach indicator

The indicator most used by the direct measurement approach is the home indoor temperature. It is difficult to use this approach because of how expensive it is to obtain large-scale data. In addition there is no consensus about the temperatures that should be used as threshold (40). In homes with central heating, there is often no possibility of regulating the indoor temperature, so sometimes it even reaches too high values. If its use were feasible, it would undoubtedly be the most accurate indicator of the thermal situation in which the households are.

4. METHODOLOGY

This paper is a paper review. The methodology used consists of analyzing the existing literature and comparing it with the current situation in Spain.

This analysis aims to detect the current strengths in order to put them into value and show the existing weaknesses in order to offer ways to overcome them.

5. RESULTS

5.1. Situation in Spain

Recent research includes the official definitions and indicators used by the various countries of the European Union (37, 39, 40, 41, 42).

In April 2019, after the latest research published to date, the National Strategy against Energy Poverty 2019-2024 is approved (NSEP). The EP in Spain is officially defined as "the situation in which a household is found in which the basic needs of energy supplies cannot be met, as a result of an insufficient level of income and, where appropriate, it can be aggravated by having an energy inefficient housing" (4). Although with certain nuances, it is a definition very similar to that adopted by France: "Difficulties in the accommodation in terms of energy supply related to the satisfaction of elementary needs due to the inadequacy of financial resources or housing conditions" (43).

The Spanish definition, as is the case with the most recent definitions, considers the basic needs as an object of study, which represents an advance with respect to the definitions that focus on studying energy services. It also focuses on the characteristic studied by the most recent definitions: disability, the fact of not being able to meet the needs. It is, therefore, a definition in line with the most recent scientific contributions.

In addition, the definition points to two causal determinants of the EP: insufficient income level and energy inefficiency in housing. The aforementioned definitions do not include the causes of the phenomenon being studied. The definitions do not usually explain the causes, as it is not part of its mission. The disadvantage of doing so is that it excludes the possibility of finding other causes from the definition. In fact, it does not mention the third cause to which EP has traditionally been attributed: energy price (44).

In a statement in accordance with the most recent positions, it is questionable whether to include the third cause of the more traditional approaches or not. The statement seems to want to imply that the energy price is a cause that is not necessary to address in the NSEP. In fact, it does not happen that way. The Directive (EU) 2019/944 (45) determines the pricing for the supply of electricity by Member States for the protection of households in situations of EP and thus is included in the NSEP.

The current approach that is reflected in the definition used implies the search for more causes of EP than the three causes offered by the traditional approach, although only two of them have been included in the definition. When talking about disability, the exclusive approach to affordability is overcome and the accessibility approach is included. In Spain, households that do not have an electricity supply are uncommon. However, EP is more frequent when the basic need for good health cannot be met due to the high temperatures of the home due to lack of accessibility to an adequate cooling system.

There are four indicators established in the NSEP: double median actual spend (2M), hidden energy poverty (HEP), inability to keep the home at an adequate temperature and arrears on utility bills.

By not establishing a single indicator, it quantifies EP from a multidimensional approach, as it is being proposed in other surrounding countries such as Belgium (46). This is a balanced selection of indicators, since it has two indicators from the expenditure approach and two from the consensual approach.

The two expenditure approach indicators share a single tendency. Both indicators, 2M and HEP, are based on actual spend and collect relative values. Other indicators based on need spend have been ruled out. Although they more accurately reflect EP, they are surely discarded due to the fact that they do not have available data for their assessment. Indicators that use absolute values that better reflect deprivation have also been ruled out. With the indicators chosen, which use relative values, inequality is shown better.

The first consensual approach chosen indicator, combines in a single indicator the inability to keep the home adequately warm during the winter and the inability to keep the home adequately cool during summer. It does not explain how to take both situations into account. It is understood that by fulfilling any of the two conditions, the indicator is met.

The fourth indicator of those commonly used by the consensual approach is discarded: Presence of a leaking roof, damp walls or rotten windows. This indicator, which can be obtained from the surveys carried out at the European level, has a less direct relationship with the EP, since it analyzes more the general state of conservation of housing.

Indicators from direct measurement approaches are not introduced due to the difficulty in obtaining them.

As a general assessment, it can be said that the NSEP introduces a definition and indicators consistent with the most recent approaches to the issue. With a multidimensional approach, choose indicators whose data is already collected through European surveys. Only, to adapt to the Spanish reality, it includes the exception of summer overwarming, based on data from a national survey.

The NSEP searches to respond to the most important challenge: to find a good balance between the choice of a conceptual definition that appropriately accounts for the multiple and interrelated causalities at play, and the feasibility of translating the chosen definition into operational terms (46).

5.2. Potencial expansion

However, there is room for improvement to establish a better balance. The depth of the conceptual definition may be better reflected if the following measures are carried out:

- Incorporate more indicators chosen from among those commonly used.
- Propose new indicators with the intention of better characterizing EP.
- To consider both the extent of the issue (how many households are affected) and its depth (how seriously are people affected) (19).
- To assign different weights to each indicator with the intention of obtaining a weighted single indicator that interrelates the different causes. This is how EP studies work in developing countries (29). Even in an attempt to apply this planning, Bonatz concludes that EP is higher in Germany than in China (47).

6. DISCUSSION

Aristondo says: “There is an agreement that poverty is a multidimensional phenomenon where several findings have been made in theoretical and empirical aspects. A similar situation is concerned when measuring energy poverty since it should be considered as a multidimensional concept and measured for more than one variable or dimension related with energy” (43).

The framework from which energy poverty is addressed has evolved since the origin of the concept and has become more extensive and profound over time. The warm household approach is enriched when the energy services approach is adopted (48). People do not demand energy per se but energy services like mobility, washing, heating, cooking, cooling and lighting (49). The energy service approaches have been taken a step further, and that consumption of energy services should be understood as linked to the quest for certain capabilities (26) to satisfy needs. The capabilities and needs approach focuses on what people need: “A cooked meal, a well lit room, a fast computer with an internet connection, a cold beer, a warm bed, mechanical power for pumping or

grinding" (50). This is the same approach, although it can be approached from two perspectives: needs and ability to meet these needs through the use of energy.

From this last approach, according to the conceptualizing developed by Day (26), the process by which needs are met through the use of energy consists of the following phases:

- Fuel / energy sources: oil, gas, uranium, coal, sunlight, wind, biomass.
- Domestic energy supply: electricity, energy from burned gas or biomass.
- Domestic energy services: space heating and cooling, water heating, washing and drying clothes, food refrigeration and cooking, lighting, ICTs, appliances.
- Secondary capabilities: being able to keep adequately warm or cool, being able to wash oneself and clothes, being able to keep and cook nutritious meals, having access to knowledge.
- Basic capabilities: being in good health, having social respect, maintaining relationships, being educated.

To characterize the EP, as defined in the Spanish NSEP as the situation in which a household is located in which the basic needs of energy supplies cannot be met, it would be convenient to take into account the entire process from the energy source to the basic capabilities.

From this framework, an enriched multidimensional and multiactor analysis of EP can be established. It is multidimensional not only because it covers different dimensions of a part of the process, but because it addresses all phases of the process with its different dimensions. It is multiactor because it considers the analysis of EP as a multidisciplinary work in which each part of it needs the concurrence of specialists in various fields.

Next, table 2 shows the amplified reference framework proposed to study EP considering the complete process from the energy sources to the basic capabilities. The analysis is ordered in the opposite direction than the process described by Day (26). The analysis begins by the needs to conclude by the energy sources necessary to meet those needs. It is ordered in this way to emphasize people's point of view, while the order used by Day emphasizes the energy's point of view.

Sufficiency

First, one might ask about the needs that society can and should meet. In a context of climate emergency (50) it is important to differentiate what is necessary for people's survival and well-being and what is superfluous. Questioning about social norms on everyday energy usage leads to highlighting the importance of focusing on sufficiency, rather than efficiency, in the framing and design of energy initiatives aimed at households (51).

On the other hand, it is also important to highlight the consequences of insufficiently covering basic needs. In a dual society in which half of the population is exposed to problems associated with overfeeding while the other half is threatened by lack of food, we find the same thing with energy. From this perspective, between excess and lack, it is necessary to agree socially what is considered sufficient.

Table 2. Enriched framework to study energy poverty based on conceptualization by Day.

Subject of study	Characteristic to study			Specialist	Analyzed phase
Need	Sufficiency	In a climate emergency context, what needs our society can and should meet		Sociologist	5
		Consequences of energy deprivation:	Social	Social worker	
			Sanitary	Doctor	
Demand	Adequacy	Adequate levels of temperature, domestic hot water, lighting, food, laundry…		Energy specialist	4
Possibility of covering the demand	Accessibility	Availability of the energy service		Architect	3
	Flexibility	Possibility of switching to a more adequate form of energy service supply			
Consumption	Energy efficiency	Amount of energy used to have energy available in the home or to obtain a domestic energy service			
		Infrastructures		Engineer	1 - 2
		Buildings		Architect	2 - 3
		Home appliances		Energy specialist	
		Behavior		Educator, energy specialist	
Cost	Affordability	Relationship between household income and energy expenditure		Economist	1 - 2
Possibility of making the consumption	Accessibility	Access to energy and clean and renewable alternatives		Engineer	1 - 2

Adequacy

Secondly, it is necessary to adapt the energy demand to the levels necessary to cover these basic needs. But needs are themselves closely conditioned by the social practices that inform the social expectations and settings in which energy use takes place (52). The appropriate levels of temperature, domestic hot water, lighting, food and laundry should be reviewed and agreed on a social level, also taking into account the current climate emergency context.

Accesibility to energy service and flexibility

A frequently unnoticed aspect is the possibility of covering demand, both for accessibility to the energy service and for flexibility. To ensure accessibility to the energy service, it is necessary to verify the existence of the equipment that allows its development: heating and cooling systems, lighting systems, drinking water supply, water heating systems, refrigerator, kitchen and washing machine. To guarantee flexibility, it is necessary to check whether it is possible to change to a more adequate form of energy service.

Energy efficiency

As regards energy consumption to meet the demand, the aspect of the energy efficiency of the process is usually studied more often (53). However, at this point sometimes less attention is paid to people's behavior, especially when studying it from the point of view of technologies that allow an increase in energy efficiency. It is important, not to ignore any aspect, complement the point of view that the humanities and education can offer. If participation and behavioral education are omitted, there is a risk that the so-called Jevons paradox or rebound effect will be met: when energy efficiency improves and energy prices are cheaper, energy consumption increases instead of decreasing (54).

Affordability

Cost affordability is undoubtedly the most studied aspect of EP in developed countries. At this point, it is worth highlighting the importance of having tools developed in the different countries that allow the cost of the need spend to be found out instead of using the actual spend. The affordability of actual spend is an easy data to find out. But it does not take into account all the approach that has been developed. It does not take into account sufficiency, adequacy, accessibility, flexibility, or energy efficiency. It presents important shortcomings to characterize EP with the level of depth reached by the approaches of the recent definitions of the phenomenon.

Accesibility to energy

The accessibility to energy that allows consumption is another aspect that is usually given little attention when studying EP from developed countries. Few homes do not have an energy supply in these countries. However, it is an important issue when considering the security of the supply in the current geopolitical context and when addressing climate change. So from a greater temporal perspective, the need to transition to a greater distributed production of renewable energies in order to prevent EP in the future should be considered.

7. CONCLUSIONS

In Spain, the time has come not only to quantify the number of households and people affected by EP but also to qualify how they are suffering the phenomenon. In this way, the measures adopted to combat EP can be customized according to how it is affecting each population group and will be more appropriate.

The enriched framework that has been proposed offers a useful perspective in order to contemplate the entire process from the energy sources to the basic capabilities. With this framework it is possible to characterize the parts of the process that contribute to the occurrence of EP and how strongly each part affects it.

The need to develop a tool to calculate the need spend has been highlighted. With this tool it will be possible to offer greater precision than with the current spend used so far in Spain.

A significant effort has been observed in the study of EP from the academic world and civil society that has been transferred to politics. There is a lack of further development of the bottom-up approach that allows these more academic approaches to be complemented with the point of view of people in situations of EP.

Direct work with these people is relevant. In addition to suffering from the problem, it is positive that they become part of the solution. It would be desirable to increase the educational work that enhances their energy empowerment so that they cease to be passive sufferers of EP and become active protagonists fighting for its eradication. On many occasions political measures and academic contributions are far from their vital reality.

The need we have as a society to rethink the lifestyle we lead and to agree on identifying the basic needs we have, from sufficiency approaches, and the appropriate levels to meet them, has also been evident.

Every 5 years, the Foessa Foundation publishes a Report on exclusion and social development in Spain. This is a report in which 100 researchers participate and is based on data obtained by conducting 11,500 surveys. To measure social exclusion, it uses 35 indicators that analyze 8 dimensions.

Surely social exclusion is more complex than energy poverty. But in order to better understand EP, it would be desirable not to keep the 4 indicators obtained from existing surveys at the European level. It is a positive first step in the quantification of the phenomenon. With the intention of better qualifying it, it is necessary to differentiate distinct dimensions (6 dimensions are shown in the proposed enriched framework) to then establish different indicators in each dimension and relate them to each other, so that it is better understood how it affects EP.

In this way, EP could be studied in depth, both quantitatively and qualitatively. As stated in this paper, a multidisciplinary team would be necessary to address the different dimensions. It would be a higher cost than the current method, although the excess would be offset by a greater effectiveness of the investments to be made in order to reduce energy poverty.

This in-depth study would have important political implications. It would serve to review the National Strategy against Energy Poverty and propose more appropriate measures for the different profiles of people suffering from energy poverty.

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