

ENERGY POVERTY – PROVED OF THE EFFECTIVENESS OF THE PUBLIC HEATING SYSTEMS?

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ABSTRACT

The concept of "fuel poverty" (poverty to fuel demand), "energy poverty" (energy poverty) in Anglo-Saxon space, respectively, "précarité énergétique" in French space must be seen in correlation with the status of public service. The poverty status of a person / family / group / community is manifested by lack of resources strictly necessary for buying goods and services considered to ensure a minimum level of living in a certain period of time.

According to the public service obligations, all final customers should be able to be supplied with energy by various forms. But this requires two conditions: physical possibility (link to a power supply with electricity, gas, heat or discriminatory access to a market of coal, firewood, oil, etc.) and financial possibility to cover the cost of this service.

Under the new European regulations will be able the Romanian authorities to handle the potential increase of the number of vulnerable consumers in the context of the liberalization process of the Romanian electricity and gas markets?

Click here and insert the abstract of your work. The abstract introduces the objective and intended contribution of the research. The abstract does not substitute the introduction. each paper must be preceded by an abstract presenting the most important results and conclusions in no more than 250 words.

KEYWORDS: *energy poverty, fuel poverty, public service, vulnerable customer.*

JEL CLASSIFICATION: *H1, I38, N4, Q48.*

1. INTRODUCTION

The concept as "fuel poverty" (poverty to fuel demand), "energy poverty" (energy poverty) in Anglo-Saxon space, respectively, "précarité énergétique" in French space is very difficult to define it even if the existence of energy poverty is accepted around the world. The difficulty comes from different understanding of concepts which apparently express the same idea. Could it be put the equal sign between concept of energy poverty and income poverty or between energy poverty and fuel poverty?

In preparing this article the methodology that was used relies primarily on desk research, literature review, analysis of the main EU Directives and Regulations regarding the problem of energy poverty, previously written Romanian and European studies, but also integrates information from EU institutions, studies and publicly available databases and maps, as well as market monitoring reports published by Romania's National Energy Regulator (ANRE) or EUROSTAT. Foreign journals and local newspapers were also consulted.

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2. THE CONCEPT OF ENERGY POVERTY

According to the experts there are several different approaches to define energy poverty, each one of them having strengths and weaknesses. In the following I will try to summarize the main approaches.

Thomson (2014) analyzed the discourse on the terminology for fuel poverty and energy poverty over the years, where many official EU policy documents were assessed. Thomson found that "energy poverty" is the preferred terminology over "fuel poverty". The most recent legislative piece, namely the directive instructing Member States to define vulnerable consumers uses the term "energy poverty", but Thomson concludes that as there is no guidance from the EU level, Member States are left unsure about how to proceed as far as categorizing vulnerable consumers much less having appropriate tools to measure the extent of the issue.

Another study (Grevisse and Brynart, 2011) investigated how energy poverty is understood in Europe by looking at various indicators and aggravators of energy poverty. For the purposes of their study, they defined "energy poverty" as the impossibility (or the difficulty) for a household to gain access to the energy it needs to ensure dignified living conditions at an affordable price from the point of view of its income.

Barnes (2010) offered others approaches to define energy poverty as follows: minimum amount of physical energy necessary for basic needs (cooking, lighting); type and amount of energy that is used for those at the poverty line; households that spend more than a certain percent of their expenditure on energy; the income point below which energy use and / or expenditures remains the same (the minimum energy needs).

In Policy Report (Energy poverty and vulnerable consumers in the energy sector across the EU: analysis of policies and measures) published in May 2015, the authors consider that "energy poverty" most commonly refers to the situation where individuals are not able to adequately heat (or provide necessary energy services) in their homes at affordable cost. The issue is characterized by three key drivers in combination or isolation – low incomes, poor thermal efficiency of buildings, and high energy costs".

According to Energy Vulnerability and Urban Transitions in Europe (EVALUATE), an European Research Council funded project, Energy poverty is defined as the inability to secure a socially- and materially-necessitated level of domestic energy services (heating, lighting, cooling, and so on) (<https://energyvulnerability.files.wordpress.com/2014/06/1brief.pdf>).

According to the Energy Poverty Action initiative of the World Economic Forum, "access to energy is fundamental to improving quality of life and is a key imperative for economic development. International Energy Agency (IEA) considers that in the developing world, energy poverty is still rife since nearly 1.6 billion people still have no access to electricity.

In another study (Energy poverty: estimating the level of energy poverty in Sri Lanka) the specialist observed that in generally "energy poverty" definitions took only the minimum energy quantity required into consideration when defining energy poverty. But a different school of thought is that not only energy quantity but the quality and cleanliness of the energy used should be taken into consideration when defining energy poverty. "A person is in "energy poverty" if they do not have access to at least: the equivalent of 35 kg LPG for cooking per capita per year from liquid and/or gas fuels or from improved supply of solid fuel sources and improved (efficient and clean) cook stoves and 120kWh electricity per capita per year for lighting, access to most basic services (drinking water, communication, improved health services, education improved services and others) plus some added value to local production". (http://practicalaction.org/smoke//text/advocacy/docs/region_south_asia/energy-poverty-in-sri-lanka-2008.pdf).

Returning to the initial question, if we could put the equal sign between concepts as energy poverty and fuel poverty, one of the issues emphasized here, is that there is a difference in the terms "energy

poverty" and "fuel poverty", first one being seen as a problem of energy access whereas "fuel poverty" relates more to fuel costs and household incomes.

The different approaches regarding the definition of energy poverty hide a complex and spatially heterogeneous EU reality, with large differences existing across member states.

Another concept that comes to reunite "energy poverty" and "fuel poverty" is the "energy security" which according to International Energy Agency (IEA) is seen as the uninterrupted availability of energy sources at an affordable price.

3. THE LIBERALIZATION OF THE EUROPEAN ELECTRICITY AND GAS MARKETS

In order to achieve an internal European energy market competitive and functional, Commission and European Parliament issued the third legislative package for the construction of this legal framework. European Union's Third Energy legislative Package consisting of two Directives (Directive 2009/72/EC and Directive 2009/73/EC and three Regulations (Regulation (EC) No 713/2009; Regulation (EC) No 714/2009; Regulation (EC) No 715/2009). According to Leca (2014) "This legislative package developed by the European Commission and Parliament has several obvious advantages such as consumer power to choose, exploiting the competitive potential, strengthening of the independence of national regulators and network operators, development of specific stock exchanges, but also a series of risks and difficulties to be taken into account in the implementation process and can have serious economic and social importance" (SPOS 2013, Study no 1, 2014, p 11). The main purpose is the separation of the competition areas from those areas that constitute natural monopolies and regulated prices but also the utilization of the advantages that first can bring through optimal use of resources.

Prices for electricity and natural gas supplied to households have entered into a process of liberalization on 1 July 2007, in Romania and in other 12 EU countries.

In Romania, the deregulation of electricity prices will be carried out in six stages for industry and households in ten steps, the deadline being June 2017. Natural gas prices will be deregulated for industry and households until December 2018. In Romania, the gradual opening of the electricity market officially began in 2000. Under current legislation, the electricity market was fully liberalized since 1 July 2007 (according to Government decision no. 638/2007) when all consumers became eligible to change electricity supplier. The supply of electricity to final customers under regulated regime continued after the official liberalization of the market in 2013, 43% of final electricity consumption being regulated.

In order to accelerate the liberalization of the electricity market it was established a timetable for liberalization of the electricity purchase prices for both households and industrial users. According to the timetable for liberalization the regulated market in Romania will be changed by 2018.

Calendar of phasing out regulated prices for end customers is presented in Law no. 123/2012 electricity and natural gas. Law is, in fact, transposition into national law of European Directives 72/2009 and 73/2009 single market for electricity and gas market and, respectively, adjacent regulations.

The liberalization of the electricity and gas markets will put pressure on the final consumer of energy (whether it is domestic or non-domestic consumers) and will increase the number of vulnerable consumers and raises the issue of population affordability, another category, alongside industrial consumers, which will be directly affected. According to Leca (2014) "the electricity and gas market liberalization must take into account the low purchasing power that characterizes the Romanian population, which leads to an alarmingly high degree of vulnerability" (SPOS 2013, Study no 1, 2014, p 123).

4. VULNERABLE CONSUMERS

The key Directives which provide the framework for identifying vulnerable consumers and addressing this vulnerability are Directives concerning common rules for the internal market in natural gas (2009/73/EC) and electricity (2009/72/EC). For electricity, article 3 (7 and 8) is of most relevance (For gas, article 3 (3&4) states the same requirements as for electricity). Point 7 states that "Member States shall take appropriate measures to protect final customers, and shall, in particular, ensure that there are adequate safeguards to protect vulnerable customers. In this context, each Member State shall define the concept of vulnerable customers which may refer to energy poverty and, inter alia, to the prohibition of disconnection of electricity to such customers in critical times. Member States shall ensure that rights and obligations linked to vulnerable customers are applied. In particular, they shall take measures to protect final customers in remote areas".

In conclusion, there is a need for Member States to provide a definition of vulnerable consumers so that adequate safeguards can be applied. Point 8 states that "Member States shall take appropriate measures, such as formulating national energy action plans, providing benefits in social security systems to ensure the necessary electricity supply to vulnerable customers, or providing for support for energy efficiency improvements to address energy poverty where identified, including in the broader context of poverty. Such measures shall not impede the effective opening of the market set out in Article 33 or market functioning and shall be notified to the Commission, where relevant, in accordance with the provisions of paragraph 15 of this Article. Such notification may also include measures taken within the general social security system".

The European Commission's Communication on the Energy Union Package, released on February 25th, 2015, includes a paragraph on protecting vulnerable consumers. This paragraph starts with the mention of energy poverty. It also mentions its causes, presented as "a combination of low income and general poverty conditions, inefficient homes and a housing tenure system that fails to encourage energy efficiency".

According to the Energy Union Communication, (EC 2015, p. 12), the protection of vulnerable consumers remains the main way to operationalise the fight against energy poverty: "When phasing out regulated prices, Member States need to propose a mechanism to protect vulnerable consumers, which could preferably be provided through the general welfare system. If provided through the energy market, it could be implemented through schemes such as a solidarity tariff or as a discount on energy bills. The cost of such schemes needs to be covered by no eligible consumers collectively. Hence, it is important that such a system is well targeted to keep overall costs low and to limit the distortions deriving from regulated prices (e.g., not increase further tariff deficits in Member States)".

The EU Survey on Income and Living Conditions (EU SILC) estimates that 54 million European citizens (10.8% of the EU population) were unable to keep their home adequately warm in 2012, with similar numbers being reported with regard to the late payment of utility bills or presence of poor housing conditions. As of 2012, 25 to 45% of the population living in Eastern and Mediterranean states like Bulgaria, Cyprus, Lithuania or Greece reported living in an inadequately heated home, versus a less than 3% figure in North-Western states like Sweden, Finland, Denmark or the Netherlands.

The principal causes of these differences existing across member states are explained by the levels of welfare and monetary and material deprivation: thus, according to Energy Vulnerability and Urban Transitions in Europe (EVALUATE), countries with low GDP per capita and high percentages of population at risk of poverty and social exclusion often report a higher incidence of energy poverty as measured by EU SILC statistics. Also, combining evaluation of monetary and material deprivation indicators and energy poverty indicators it is possible to define three energy poverty regions in the EU (Figure 1): Southern member states (green), Central and Eastern European member states (red), and North-Western member states (blue). The calculation takes into account the percentage of people at risk of poverty and social exclusion vs. energy poverty index.

The energy poverty index combines the three key EU SILC energy poverty indicators and it used the average for EU member states 2003-2012.

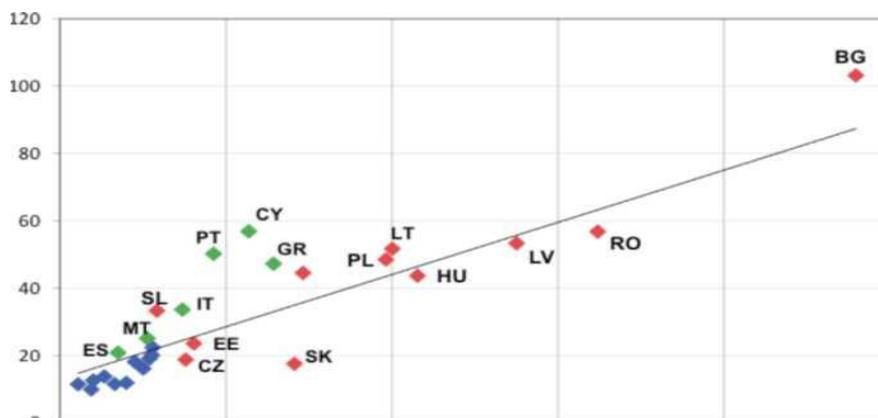


Figure 1. Three poverty regions in the EU

Source: European Research Council *Energy vulnerability trends and patterns in Europe EVALUATE project policy brief no .1*, p.2

Therefore recognizing vulnerable consumers is very important. While the definition varies by Member State, it typically includes those individuals and households at risk of energy poverty, but also a broader group of consumers who may be at a disadvantage in the purchasing and use of energy in the electricity and gas retail markets.

Romania, as Member State of EU, has transposed the European legislation. Thus, Law 123/2012 defines the concept of “vulnerable client (not consumer)” as a household client who, due to age, health, low revenues, is at risk of being socially marginalized and therefore benefits of social (financial and other) protection measures. According to Ordinance 42/2013, these social benefits are established for a limited period and the revenue level which triggers them is adjusted with each price increase for electricity and natural gas through subsequent GEOs. Vulnerable customers are defined as household consumers with low income within the limits laid down in the Ordinance 27/2013 social protection measures during the cold season.

5. MEASUREMENT INDICATORS FOR ENERGY POVERTY

Estimating the extent of energy poverty is a very difficult process in the absence of a single agreed definition of it at the EU level. But, according the specialists, general indicators can be used to provide some understanding of the status of energy poverty.

Eleven EU research initiatives (ACHIEVE, BPIE, EC-LINC, ELIH-MED, Energy Cities, Energy City, EPEE, EU Fuel Poverty Network, EVALUATE, FinSH, ReRisk) on energy poverty were reviewed to identify the objectives, methodology and the key results. Across the studies, there is a strong focus on energy efficiency in low income households as well as identifying financial mechanisms to ensure implementation of energy efficiency measures.

Romania is member of Energy Cities - a network of cities in Europe focussing on addressing various energy issues on the local level; locally led energy transition. The methodology used and the achieved outputs take into account the developing local strategies to provide sustainable solutions to eradicate the cause of energy poverty: lack of insulation, low efficient heating systems and peri-urban sprawl, ensuring social issues being part of the energy transition. The key result is the promotion of adoption of local fuel poverty action plans.

According to Leca (2014), "Romania has no quantitative indicators in place to measure the magnitude of energy poverty or its depth (the “fuel poverty gap”). It is extremely difficult to appreciate the consumers’ degree of vulnerability in the absence of any metrics to measure the “fuel

poverty gap” (Leca, A., coord., 2014. Strategy and Policy Studies SPOS 2013 *Study no 1, Gradual liberalization of energy and gas markets and the impact of this process on the Romanian economy*, European Institute of Romania, Bucharest, p 16).

Eurostat collects data about the population at risk-for-poverty (ARPE), which is defined as households with an income of 60% of the median national income.

In Policy Report published in May 2015, the authors consider that "in the absence of a single metric for energy poverty, several indicators have been used across research initiatives to assess the situation and draw conclusions about the status of energy poverty but none of these metrics stand alone to measure energy poverty since they result from various drivers, but taken together a picture of energy poverty begins to form". (Policy Report. Energy poverty and vulnerable consumers in the energy sector across the EU: analysis of policies and measures, p 10).

Thus, the most important indicators that influence affordability of energy and the risk of energy poverty are: the income; the energy consumption; the energy prices; the tenure status and other housing characteristic influences; the proxy indicators of energy poverty (well-being and material deprivation).

5.1. Income

Income is considered a vital indicator when looking at energy poverty, as it is also the key indicator to assess the share of the population at risk of poverty (Eurostat, 2012). In 2012, According to *Policy Report. Energy poverty and vulnerable consumers in the energy sector across the EU: analysis of policies and measures*, the highest share of populations at risk of poverty were found in the newer Member States (Romania (40-50%), Hungary, Croatia, Cyprus, Latvia, Lithuania (30-40%) and those hit by recent economic turmoil (Ireland, Greece (30-40%)). This is followed by countries with a 20-30% share in Poland, Italy, Malta, Spain, Portugal, Estonia, Slovakia, Belgium and the United Kingdom. (Policy Report. Energy poverty and vulnerable consumers in the energy sector across the EU: analysis of policies and measures. (May 2015), p 10).

5.2. Energy consumption

Another important indicator is energy consumption per household or capita. Higher consumption (and therefore expenditure) may increase household vulnerability to price increases. According to the specialists "the drivers of consumption are complex, and may be due to climatic factors, income drivers (affordability (due to higher incomes or lower energy prices) and standard of living) and energy efficiency of buildings and appliances". The type of energy used is also important as it can be indicative of heating systems, and applicability of measures for protecting vulnerable consumers, and tackling energy poverty. (Policy Report. Energy poverty and vulnerable consumers in the energy sector across the EU: analysis of policies and measures. (May 2015), p 11).

According to the information offered by the specialists gathered at Thermal Energy Forum 2015 organized by ARPEE (Romanian Association for Promoting Energy Efficiency) in Romania the average of heat consumption is 250-300 kWh/(sqm/year), 2 times higher than the EU average, the main causes being the building heat losses (around 40-50% of the final energy consumption), buildings age (about 75% of the buildings are old, being built 40-55 years ago) and the underinvestment in thermal rehabilitation of buildings (it needs Investment for thermal rehabilitation of buildings, almost 5 billion EUR throughout 15 years (50% by 2020, 25% by 2025, 25% by 2030).

5.3. Price of energy

Another important indicator is be the price of energy. Many factors influence price of energy (whether prices are regulated / competitive, levels of taxation, and costs of supply). For vulnerability, a key issue is how these prices change over time, particularly in dynamic markets, and the impacts on different groups in society. It is the change in price of energy combined with consumption needs that can indicate a risk of energy poverty. There are Eurostat statistics that do

show difference between Member States, including the contribution of tax in the energy price. Lowest taxes for electricity and gas are found in the UK, while Sweden, Denmark and Germany have the highest taxes for gas and electricity, respectively.

5.4. Tenure status and the dwelling type

Another important factors are the tenure status (Figure 2) and the dwelling type (Figure 3). Tenure status can impact the implementation of measures; renting can pose problems for tenants in investing in measures, particularly in the private sector. Conversely, tenants living in social housing could benefit from larger scale building retrofit efforts. Keeping track of this type of indicator highlights the importance of implementing measures to address these issues (or combination of issues).

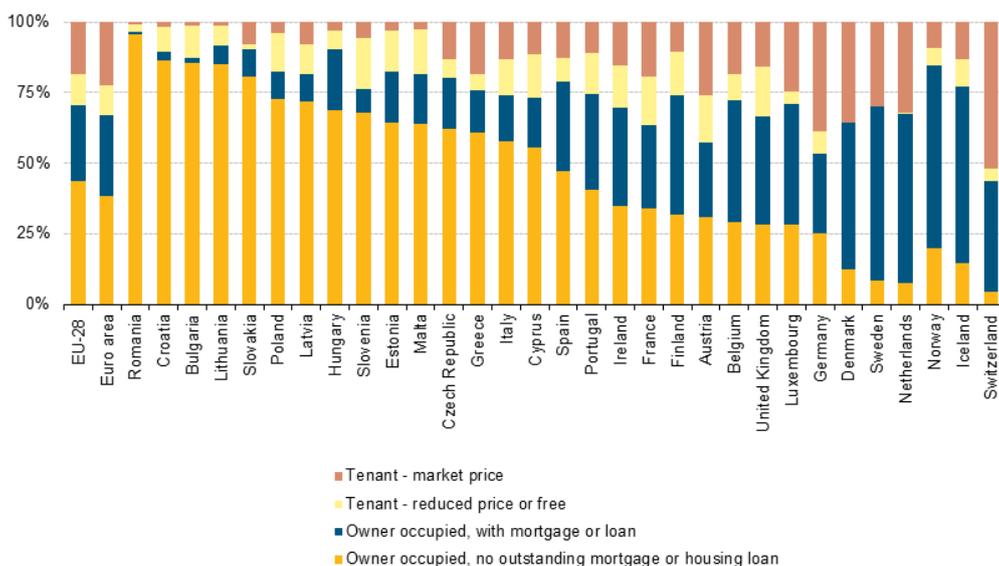
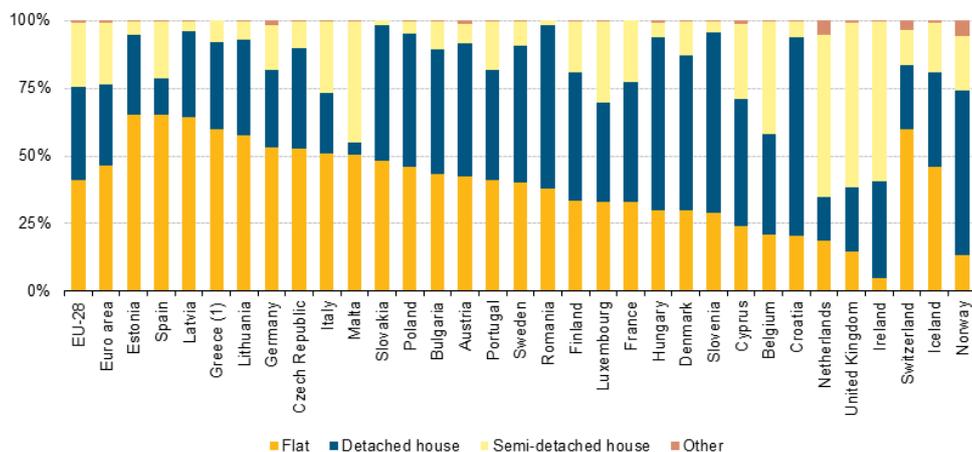


Figure 2. Tenure status
Source: Eurostat (2012)

In addition to climate, **the type of dwelling** will also influence the energy demand of the building, where detached housing will have a greater energy demand than semi-detached houses or flats. It can also have an impact on the implementation of retrofit programs and other measures associated with addressing energy use.



(¹) Not significant for 'Other' category
Break in series for all dwelling types

Figure 3. Distribution of population by dwelling type
Source: Eurostat (2012)

5.5. Type of heating system employed

A further factor influencing overall household energy demand is the type of heating system employed. The distribution of the types of heating systems as well as the share of central heating (individual, collective and district heating systems together) is given in Figure 4.

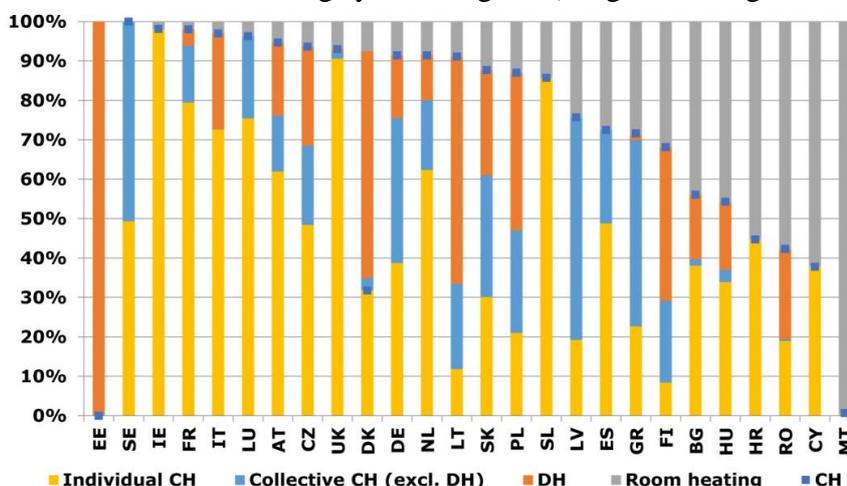


Figure 4. Share of households by heating system and share of households with central heating in the EU

Source: Policy Report. Energy poverty and vulnerable consumers in the energy sector across the EU: analysis of policies and measures. INSIGHT_E Organization. based on ENTRANZE 2015 (May 2015, p.14)

In some instances, a correlation can be found between **the share of central heating systems** and the estimated level of poverty as shown in Figure 5. Higher shares of central heating systems are generally correlated to lower levels of energy poverty (lower right area in Figure 5).

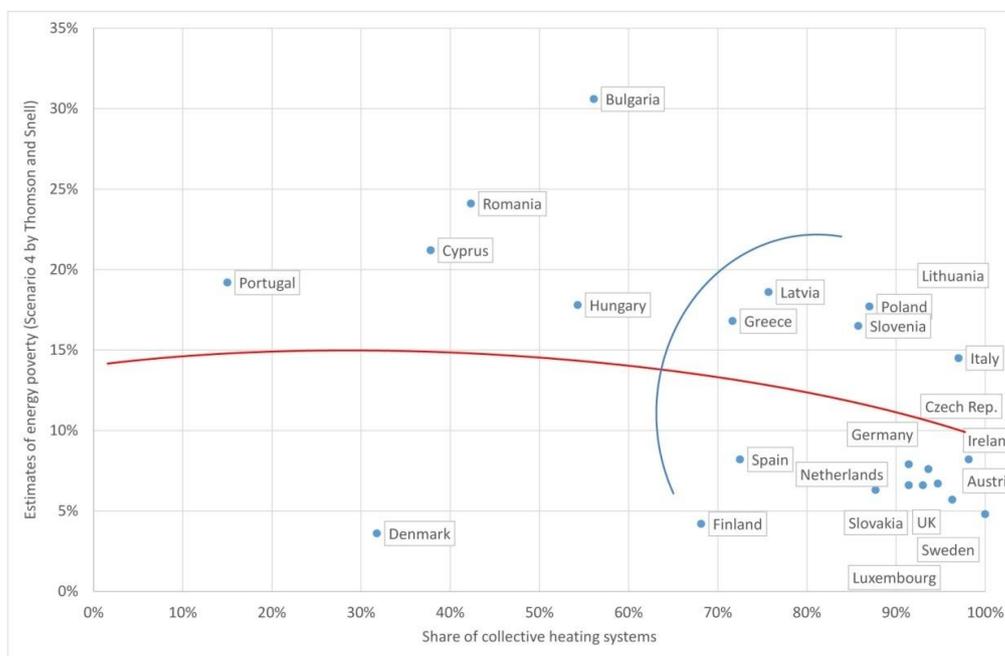


Figure 5. Comparison of estimates of energy poverty and share of population with central heating systems

Source: Policy Report. Energy poverty and vulnerable consumers in the energy sector across the EU: analysis of policies and measures. INSIGHT_E Organization. based on ENTRANZE 2015 (May 2015, p.15)

Figure 5 shows the different position of the Member States with high levels of central heating systems along the vertical axis, which can also be read in terms of income per capita. Scandinavian and Central European Member States are generally below the red line (lower energy poverty level estimates), while South-Eastern European Member States are above the red line (higher energy poverty level estimates). This highlights the important social dimension of the problem, related to income levels and energy affordability.

According to the information offered by the specialists gathered at Thermal Energy Forum 2015 organized by ARPEE (Romanian Association for Promoting Energy Efficiency), in the period 1990 – 2014, in Romania, only 70 out of 315 localities preserved the services supplying thermal energy under the form of district heating systems for population (SACET).

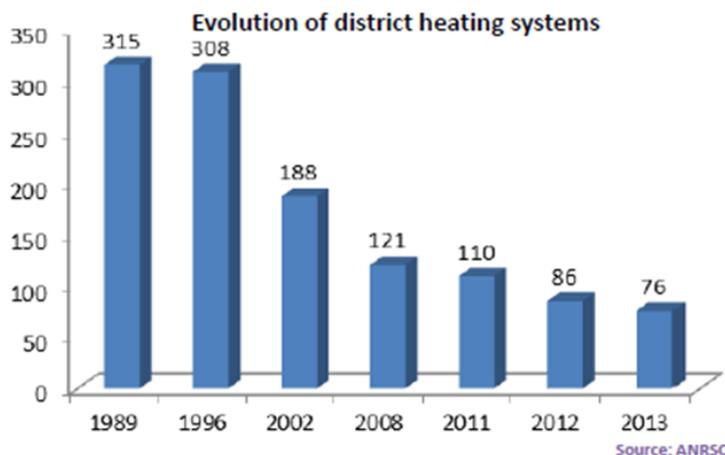


Figure 6. Evolution of district heating systems

Source: ANRSC (2014)

According to *Policy Report. Energy poverty and vulnerable consumers in the energy sector across the EU: analysis of policies and measures*, in the case of Romania (as well as, for example, Bulgaria, Poland and Hungary) the share of district heating is relevant where the penetration of the remaining central heating systems is relatively low especially in the urban areas, while the number of dwellings heated by room systems gets higher, and so do the estimated levels of energy poverty. However, a central heating system does not automatically mean that maximum efficiency is achieved. For example, the efficiency of district heating networks in Romania is very low (lower than 50%), while covering over 1.6 million dwellings, mostly blocks of flats where customers often cannot adjust the heating level.

6. MEASURES FOR PROTECTING VULNERABLE CONSUMERS AND TACKLING ENERGY POVERTY

The absence of a unitary definition of the concept of vulnerable consumers reflecting differences in problem identification and in approaches to action. The European Commission makes a number of important points concerning their implementation in a working paper (EC 2010). The first is that Member States should define vulnerable consumers based on their own particular situations, although must ensure a high degree of protection. In turn, this means that the Commission does not currently deem a European definition of energy poverty or of vulnerable customers appropriate. Secondly, Member States should focus on longer term solutions (e.g. building retrofit), and not only short term relief (e.g. bill support).

According to experts' opinion, the measures undertaken across different Member States to protect vulnerable consumers and in some cases address energy poverty the primary measures for protecting vulnerable consumers and tackling energy poverty are: social security , 40%; energy efficiency measures 30%; disconnection protection 20%; other, 10%. (*Policy Report. Energy*

poverty and vulnerable consumers in the energy sector across the EU: analysis of policies and measures. (May 2015), p 61).

These measures could be categorized under the following sub-headings: financial interventions; additional consumer protection; energy efficiency; information provision & raising awareness.

6.1. Financial interventions. Such interventions are introduced to support payment of bills. Financial interventions are crucial for addressing affordability in the short term and can be used to compliment longer term measures that address the underlying structural issues of energy poverty. In 2015, over 40% of Member States use financial intervention measures as the primary basis for support to vulnerable consumers.

At EU Member States level the most important measures are: social support (housing, energy costs) 36%; energy cost subsidies / payments 32%; social tariffs 20%; energy cost subsidies / payments (elderly) 7%; negotiated tariff w/ utility 5%.

In Romania, the subsidized system led to maintain the inefficiency Figure 7, the heat price (RON/Gcal) being much higher then in other european countries (Figure 8).

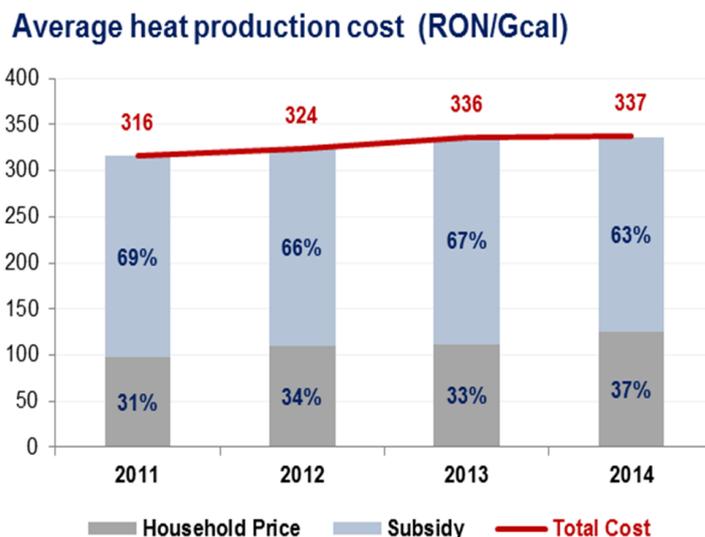


Figure 7. Average heat production cost (RON/Gcal)

Source: ANRSC cited in Thermal Energy Forum, Bucharest (2015)

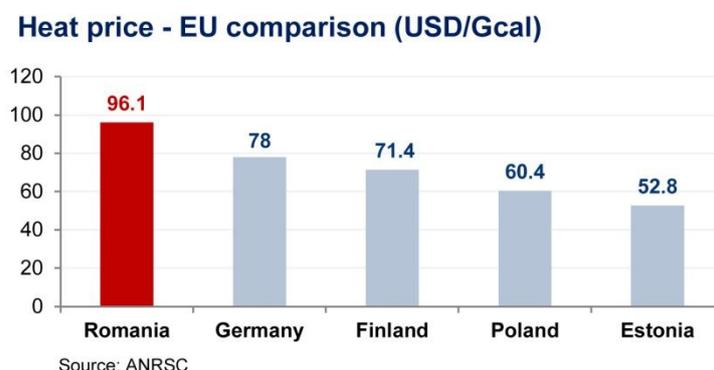


Figure 8. Heat price - EU comparison (USD/Gcal)

Source: ANRSC cited in Thermal Energy Forum, Bucharest (2015)

6.2. Additional consumer protection

These are specific measures that provide protection for consumers using the retail markets. While financial intervention is primarily led by central government, consumer protection measures are

implemented primarily by the regulator and utility companies.

Additional consumer protection measures are particularly important for vulnerable consumer protection (and access) in regulated markets.

For example, Social obligation reporting (as used in the UK) ensures that energy companies identify vulnerable consumers – and in doing so can develop a suitable service provision. This could include measures that are more focused at addressing energy poverty e.g. improving building energy efficiency.

6.3. Energy efficiency

Such programs target improvements to the efficiency of building stock, or energy using appliances (e.g. retrofit grants, loans, or tax incentives (non-targeted); retrofit grants, loans, or tax incentives (targeted); appliance grants (non-targeted); improvements social housing EE improvements; legislation; energy efficiency advice; appliance grants (targeted), etc.

The analysis of *Policy Report. Energy poverty and vulnerable consumers in the energy sector across the EU: analysis of policies and measures* shows that energy efficiency measures, particularly those focusing on building retrofit, are a key part of a strategy to address energy poverty. There are a wide range of approaches to implementation e.g. funding source, extent of targeting, implementing body. Such factors need to be considered in view of national circumstances.

According to the information offered by the specialists gathered at Thermal Energy Forum 2015 organized by ARPEE (Romanian Association for Promoting Energy Efficiency) in Romania the average of heat consumption is 250-300 kWh/(sqm/year), 2 times higher than the EU average, the main causes being the building heat losses (around 40-50% of the final energy consumption), buildings age (about 75% of the buildings are old, being built 40-55 years ago) and the underinvestment in thermal rehabilitation of buildings (it needs Investment for thermal rehabilitation of buildings, almost 5 billion EUR throughout 15 years (50% by 2020, 25% by 2025, 25% by 2030).

7. CONCLUSIONS

The main challenge that Romanian authorities will need to handle it is the potential increase of the number of vulnerable consumers being undeniable that price liberalization of the energy markets will lead to an additional number of vulnerable consumers. On the other hand, the price support as social protection is not a solution. The principle is simple: the market must be left free, and where public service can not be supported by some consumers, they must receive appropriate aid from the central budget, possibly from the local one.

There are solutions to improve this situation. Among these, the efficient use of energy to the final consumer will reduce invoice. Then, locally, a rethinking of centralized heat supply systems and promoting systems based on high efficiency technologies can reduce costs for households and hence the number of vulnerable consumers. Also, locally, it could be applied consumer-friendly pricing schemes.

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