VIRTUAL ECONOMICS

2018 Volume 1 Number 1 (October)

ISSN 2657-4047 *(online)*

DIVERSIFICATION OF ENERGY POVERTY IN CENTRAL AND EASTERN EUROPEAN COUNTRIES

Joanna Mazurkiewicz and Piotr Lis

Abstract. Household energy security, and in particular affordability of energy services and the energy poverty issue, is a debated topic both at the EU level and at the level of individual countries. The aim of the paper is to investigate the energy poverty diversity in the Central and Eastern European countries. The energy poverty index that aggregates three aspects: availability and affordability of energy services, as well as household energy efficiency, has been presented. This framework allows for comparison between countries and discloses the diversity of their energy poverty profiles. Analysis of energy poverty indicates diversification of level and dynamics of this phenomenon in the studied countries. Among countries of Central and Eastern Europe, there are both countries, where the problem of energy poverty is the highest, and the lowest in Europe. Almost all studied group is characterized by decreasing level of energy poverty in that particular period. Analysis of index components indicates diversification of energy poverty profiles. Important factor shaping the ability to acquire energy services was also the consequence of economic crisis, especially lowering the level of incomes and the increase of energy prices as a result of increasing tax burdens imposed on energy carriers.

Keywords: energy poverty, energy services affordability, households
JEL Classification: E00, O52, R00

Author(s):

Joanna Mazurkiewicz
Poznań University of Economics and Business, Al. Niepodległości 10, 61-875 Poznań, Poland
E-mail: Joanna.Mazurkiewicz@ue.poznan.pl
https://orcid.org/0000-0002-6607-5270

Piotr Lis
Poznań University of Economics and Business, Al. Niepodległości 10, 61-875 Poznań, Poland
E-mail: Piotr.Lis@ue.poznan.pl
https://orcid.org/0000-0001-7942-2668

Citation: Mazurkiewicz, J., & Lis, P. (2018). Diversification of energy poverty in Central and Eastern European countries. *Virtual Economics, 1*(1), 26-41. https://doi.org/10.34021/ve.2018.01.01(2)

Received: July 12, 2018. Revised: September 7, 2018. Accepted: September 17, 2018.

1. Introduction

Energy markets in the EU countries are undergoing strong changes having two factors as their catalysts: technological progress and political decisions taken by the member countries and on the supranational level. The consequences of these processes are among others the introduction of market mechanisms to a strongly regulated sector, the reduction of access barriers to it and the increase of competition among entities operating on the energy markets, changes in the structure of energy supply resulting from the stricter environmental requirements. These changes have an influence on the functioning of households. On the one hand, they gained the possibility of active participation in the energy market, free choice of energy service suppliers or even participation in the market as prosumers. On the other hand, households have been put at higher risk due to the fluctuation of energy prices. Demand for energy is characterized by low price flexibility, and with the lack of substitutes or efficient possibilities to store energy, when the prices increase, expenses for energy services become a significant and difficult to control component of household budgets.

In this light, energy security of households must be considered in a wider sense, than only in the category of stability and continuity of energy supplies. It is especially important to pay attention to the ability of households to purchase energy services as well as to the problem of energy poverty. In the last decade these issues became the subject of interest, both by science and economic policy as well as for market regulators in the EU countries (Bouzarovski et al., 2012; Dagoumas and Kitsios, 2014; European Economic and Social Committee, 2010, 2013).

The aim of the following report is to analyze the energy poverty in the selected EU countries. The report proposes the energy poverty index, considering accessibility to energy services, the ability of households to purchase energy services as well as the level of energy efficiency in households The analysis will be conducted for six countries of Central and Eastern Europe (Bulgaria, Czech Republic, Poland, Rumania Slovakia, Hungary) and the Baltic States (Lithuania, Latvia and Estonia). The subsequent parts of the report will present the definition of energy poverty and the methods of measuring it, together with the concept of energy poverty measure, which will be then estimated for an indicated group of countries.

2. The idea of energy poverty

Energy poverty is a phenomenon of the lack of access of households to modern and safe energy services provided in an undisturbed, safe and ecologically responsible way with the aim of providing economic development (Pachauri and Spreng, 2011). Energy services were originally defined as access to energy and other sources of energy designed for the realization of elementary needs, mainly for the preparation of meals (International Energy Agency, 2002, 2010). Currently energy services are understood wider, as transforming the carriers of primary energy into the diversified streams of final energy provided to consumers: electric energy, heat, coolness, transport fuels. The types of energy services and the access to them for households can then differ depending on the level of economic development, accessible sources of energy or energy policy of a particular country, nevertheless the catalogue of

household needs realized due to the access to energy is relatively stable (lightning, keeping the right temperature at home, preparation of meals, transport, communication).

The above presented definition of energy poverty shows the features that should characterize energy systems. The first is the necessity to apply an adequate technology, which ensures seamless, undisturbed access to energy services with prices that are not a significant access barrier for households. Simplifying this, we could say that energy technologies should be as cheap as possible in conditions accessible for a particular society.

In relation with the above, we can indicate the existence of dependence between the wealth of society and the forms and diversification of used sources of energy (González-Eguino, 2015). Generally, wealthier countries are characterized by more diversified energy baskets, whereas the poorer countries have relatively small number of available energy sources, with a significant predominance of solid fuels (including biomass). At the same time, the increase in wealth of households results in replacing solid fuels by cleaner sources of energy. This dependency indicates abandoning cheaper and worse quality fuels (wood, wastes, kerosene) and choosing more efficient, modern sources of energy (electric power, liquid fuels) together with the increase in the wealth of households (Van der Kroon et al., 2013; Cook et al., 2005). The factor conditioning the choice of energy technologies is also the minimalization of the negative influence on the natural environment – intensive transformation of the natural environment for the needs of energy production, dedication of agricultural land for energy aims and the emission of greenhouse gasses.

Finally, the definition of energy poverty refers to the aim of providing access to energy services, which is an economic development. We should indicate at the same time, that this development is not understood only as reaching a suitable level of income (or in this case the size of energy consumption *per capita*). Nowadays the access to energy services is conditioned by meeting both the lower and the higher orders. Thereby the lack of access to suitable energy services leads not only to the deprivation in the scope of elementary needs of existence (such as: no possibility to keep the right temperature at home, to heat the water etc.), but also the elements necessary for self-development, such as: education, communication, participation in social life.

Reasons for the existence of energy poverty phenomenon can be twofold. Firstly, energy poverty can be the result of the physical lack of energy availability. Secondly, the impossibility to realize elementary energy needs can be caused by relatively high prices of energy services, which create economic barriers to access to them. The first mentioned reason relates to a greater extent to the countries with a lower level of development, whereas the problems with economic availability of energy can be also observed in highly developed countries. In order to underline the dissimilarity of the problem – physical access to energy services in developing countries and economic access to energy services in developed countries – while studying the second group, the term of fuel poverty will be applied simultaneously (Boardman, 2012; Healy and Clinch, 2002, 2004; Karpenko et al., 2018; Li et al., 2014; Moore, 2012; Tvaronavičienė, 2016).

3. Methodology of the study. Measures of energy poverty

Economic availability of energy is directly influenced by the factors that can be classified into three groups: price factors, income factors and factors conditioning the level of energy consumption in households. Among the price factors, besides 1) the level of prices for energy carriers and 2) diversification of tariffs for using energy, the significant factors are also 3) fiscal and environmental policies of the state, which decide on the rate of taxes and fees imposed on energy and 4) the scope of regulation of energy prices. The factors, which influence the burden of household budgets with energy costs are also 5) the types of used fuels and 6) the possibility to substitute them in order to lower the fuel costs.

The second group constitutes the income factors, the most important of which are as follows: 1) the sources and the amount of income obtained by households and 2) the amount of social transfers connected with the use of energy. The third group should include the factors determining the level of energy consumption and energy efficiency of households. Among the most important here are: 1) the type and energy consumption of the devices, which are used in households, 2) energy efficiency of the inhabited buildings and 3) customs and consumption patterns.

Among the factors indirectly influencing the level of energy poverty we should mention above all: 1) the size and the structure of a household that shape the specific energy needs of the household, 2) the legal right to the occupied property, conditioning the scope of decisions taken with the aim of improving energy efficiency and 3) the level of liberalization of energy market, influencing the diversification of energy offer and the possibility of active management for energy demand by the households.

Large quantity of factors shaping the level of energy poverty allows for the classification of households experiencing limited accessibility to energy services. In the first group of households the energy poverty is connected with the income poverty. Limitations of access to a wide range of energy services and high contribution of expenses on energy in the household budget are in this case the result of a low level of the obtained income. At the same time, it is worth noticing, that not every household with relatively low incomes will be immediately energy poor. High level of energy efficiency of such a household can simply counter negative influence of the income factors.

The second group made up of the households, which are not poor in the category of obtained income, nevertheless they experience energy poverty. The reason for such condition can be a high level of energy price, low level of energy efficiency of these households or the existence of both these factors at the same time.

Presently, both the social sciences and the economic practice, have not yet elaborated comprehensive and universal factor that will enable monitoring and international comparison of energy poverty level. Energy poverty is measured with the use of three alternative, supplemental methods. The first method underlines the necessity to provide access to

modern energy services. Energy poverty is measured here by the percentage of population without the access to electricity and using the most traditional sources of energy (wood, biomass, charcoal) to prepare meals. This concept was complemented by widening the scope of measured energy services by the use of household goods and services serving education, entertainment and communication. The above described indicators show the access of households to energy sources, but do not reflect costs connected with the consumption of energy and their energy efficiency.

The level of energy poverty can be also determined in relation to the minimal amount of energy that is necessary for meeting the elementary needs of the poorest households and the types of fuels used by these households. This way of measuring enables for a greater documentation of household diversity and consideration of the specificity of the examined community.

Finally, the level of fuel poverty can be measured by the level of expenses incurred by the households on energy services. It is assumed then, that the energy poor households are those that spend 10-15% of all incomes on energy services.

In international, comparative studies of energy poverty, the most commonly used estimation is, due to the lack of other measures, the answer to the question concerning the existence of difficulties in maintaining the adequate level of heat in the place of living, which is given to the household owners in the scope of study about conditions of life of EU-SILC citizens conducted by Eurostat. It seems, though, that for the needs of international comparisons, these estimations should be supplemented by at least data reflecting differences in burdens, which represent expenses for electricity and heat in household budgets. Due to this fact, in the following parts of this report, energy poverty is measured by the index that includes availability of energy services and the capability of households to purchase them, as well as the energy efficiency of the studied entities (Fig. 1). Merit of the index constitutes the sum of partial measurement (availability of energy services, capability to purchase energy services, energy efficiency), which were given equal weight (33.33%). The measurement is conducted with the use of data concerning: difficulties in maintaining adequate level of heat in the place of living, existing delays in housing payments, percentage of costs of housing maintenance in household budgets, consumption of energy in households and energy efficiency of buildings (measured by the percentage of population inhabiting places with leaking roofs, wet walls, floors and fundaments or not tight windows).

Energy poverty can be examined on a macro-, meso-, and microeconomic scale depending on the aim of the analyses and the level of aggregation of available data (Table 1). International comparisons of countries belonging to the EU are possible thanks to data collected by Eurostat and IEA (International Energy Agency). A significant source of information is the research on living conditions (EU-SILC). However, this data cannot be compared in a direct way. This is mainly due to the diversification of countries in terms of factors determining the level of energy poverty, including: structure of households and their budgets, energy and fiscal policy tools, sources of energy used in households, prices of energy, profile of housing substance

(including the structure of ownership). Additionally, the available data is both quantitative and qualitative.

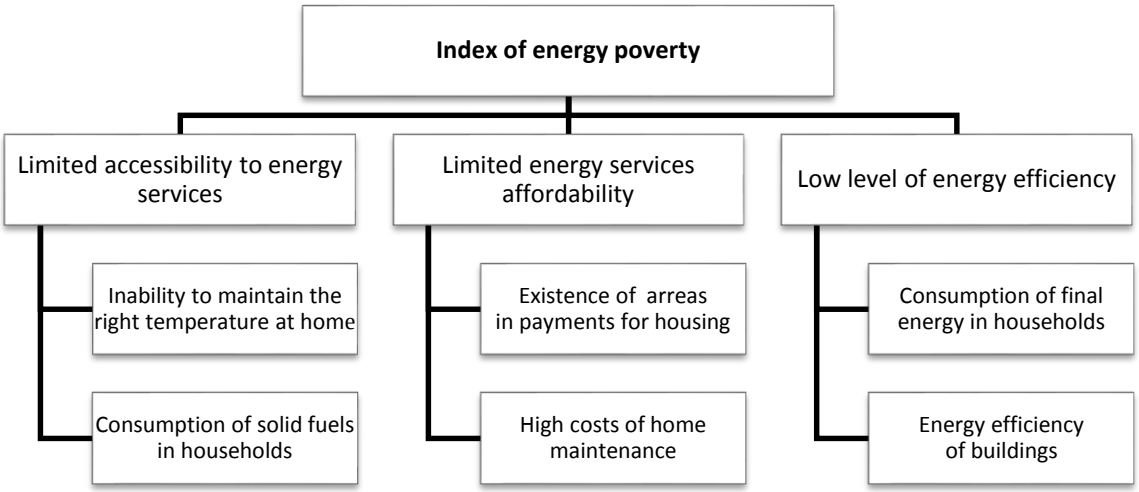

Figure 1. Construction of energy poverty index
Source: own research.

Table 1. Observation levels of energy poverty phenomenon

Scale	Data sources	Aim of analysis
Macroeconomic level (international)	Macroeconomic data bases and international questionnaire research	International comparisons, observation of long-term trends
Macroeconomic level (national)	National statistics of household types and their budgets, living conditions, consumption of energy, deprivation forms of households	Description of types of energy poor households and tools of national economic policy designed to limit this phenomenon
Mesoeconomic level (sectorial or regional)	Regional and local data bases	Description of specificity of energy poor households of a particular region and tools of regional and local policy with the aim to limit the energy deprivation
Microeconomic level	Households data	Description of energy efficiency level of a household and methods to limit or prevent the problem of energy poverty

Source: Dubois, U., & Meier, H. (2016). Energy affordability and energy inequality in Europe: Implications for policymaking. *Energy Research & Social Science*, 18, 21-35. https://doi.org/10.1016/j.erss.2016.04.015

Due to the above mentioned, the accepted study proceeding is the analysis of the distance to the countries with the highest level of such indicator. This method is used in international comparative studies, among others as a tool to evaluate regulatory practices. In the case of energy poverty, the highest observed level of the indicator relatively specifies the highest level

of this phenomenon. In the construction of the index, this means 100. The results for other countries are calculated in relation to the country that was characterized by the highest level of the observed phenomena. This enables for a more precise plotting of the relative position of the countries than ranking. The index values below 100 obtained by a certain country means, that this country did not reach the highest point values in all studied criteria. Referential values for each of the studied variables were calculated with the consideration of all member countries of the EU.

Time range of the analysis covers the years 2007-2016, and the study was conducted for the Central and Eastern European countries as well as the Baltics, for which the EU-SILC data is available. The scope of this analysis is conditioned by the availability and completeness of the data.

4. Analysis of energy poverty in selected EU countries

In the studied group of countries (with the exception of Lithuania) it was possible to observe the improvement of the situation in the scope of energy poverty (Table 2), though against all the EU countries, there are the economies, where the problem of energy poverty is particularly significant, which is indicated by the position in the ranking in all studied timespan. Exceptions are Slovakia, Czech Republic and Estonia, where the level of energy poverty is the lowest. Among the studied countries, the highest level of energy poverty in all the timespan can be observed in Bulgaria, which records the highest level of energy poverty in all EU.

Table 2. Energy poverty index for selected EU countries

	2007	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
Bulgaria	67% (1)*	70% (1)	61% (1)	54% (1)	56% (1)	58% (2)	57% (2)	54% (2)	52% (2)	54% (2)
Czech	34% (9)	34% (13)	32% (14)	32% (17)	35% (17)	34% (17)	33% (15)	32% (16)	31% (17)	29% (18)
Estonia	28% (19)	28% (19)	32% (16)	33% (16)	36% (16)	35% (14)	32% (17)	30% (18)	28% (21)	26% (21)
Hungary	41% (4)	45% (5)	38% (8)	46% (6)	50% (5)	53% (4)	50% (3)	46% (4)	42% (6)	41% (4)
Lithuania	35% (8)	35% (10)	35% (10)	39% (10)	47% (6)	44% (8)	42% (8)	39% (10)	41% (7)	39% (6)
Latvia	41% (6)	42% (6)	46% (4)	50% (3)	55% (2)	53% (3)	50% (4)	46% (5)	43% (5)	35% (11)
Poland	66% (2)	56% (2)	52% (2)	53% (2)	53% (3)	51% (5)	49% (5)	46% (3)	45% (4)	43% (3)
Romania	49% (3)	52% (3)	49% (3)	48% (5)	45% (7)	47% (7)	44% (7)	36% (13)	35% (13)	34% (12)
Slovakia	30% (16)	21% (24)	26% (22)	24% (25)	25% (26)	24% (26)	22% (28)	22% (26)	21% (26)	17% (27)

* In brackets there are the positions in the ranking of EU-28 countries; due to availability of data in 2007-2009 without Croatia, 2014-2016 without Malta.

Source: own research on the basis of Eurostat data (Eurostat Energy Statistics and EU-SILC).

4.1. Changes in the scope of energy services availability

The biggest difficulties in providing access to energy services existed in three countries: Bulgaria, Poland and Lithuania (Table 3, Fig. 2). Bulgaria is the country, where the highest percentage of population unable to maintain the right temperature of houses was recorded. This percentage in the studied period decreased significantly (from 67.4% in 2007 to 39.2 in 2016), however it still remained the highest both in the studied group of countries, and in the EU-28.

In the case of Poland the value of the indicator reflecting the availability of energy services results from a high contribution of solid fuels in the consumption of final energy. The data indicate specifically shaped structure of energy sources used in households, where the contribution of solid fuels reaches 34%, which is a tenfold of the average of EU-28, which amounts to 3.4%. For comparison, in Ireland and the Czech Republic, which are the next when it comes to the consumption of solid fuels, this indicator in 2016 stood at 14.7% and 12.5% respectively.

The level of consumption of hard coal by Polish households results from the widespread use of solid fuels for heating purposes. Almost half of all domestic households, that is 49.2%, use heating installations (to heat rooms) which use solid fuels, among which the most common fuels were hard coal and fuelwood. In cities, solid fuels are used by one third of households (28%), and in the country by almost all households (92.8%). Coal and wood were usually used simultaneously or alternatively in the same installations. Reversible boilers used by 47.7% and single-purpose boilers used by 29.3% of households were heated by solid fuels and almost all households (97% and 93.3% respectively) used them as basic installations. Moreover, 15.3% of households used the most traditional heating installations, such as stoves in rooms (mainly tiled stoves), and the further 7% of households using solid fuels used fire places, mostly with closed input. These installations provided the fundamental source of heating rooms in 83.3% and 19.7% of households, respectively. Such shaped structure of using fuels results from the structure of prices for energy carriers for the households, where hard coal remains the cheapest fuel.

Decreasing availability of energy services in Lithuania also deserves our attention, In the case of this country, percentage of population declaring difficulties with maintaining the right temperature at homes increased over twofold in the studied period (from 33.2% in 2007 to 74.7% in 2016). What is interesting, between 2010 and 2013, in the period of the greatest growth of the indicator, the consumption of solid fuels in households in Lithuania also increased. The percentage of solid fuels in the total consumption of energy till 2009 was at the level of 3.3%, in 2010 it increased to 4.4%, and in 2013 it amounted to 5.1%. This phenomenon is in accordance with the previously presented concept, according to which households experiencing difficulties with access to energy services (here: heating) use solid fuels to a larger extent.

Table 3. Changes of indicator limiting accessibility to energy services in selected EU countries between 2007 and 2016

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Bulgaria	68%	66%	64%	60%	62%	65%	64%	63%	59%	59%
Czech Repulic	22%	20%	19%	20%	25%	27%	26%	28%	26%	24%
Estonia	6%	3%	3%	4%	5%	6%	5%	4%	4%	4%
Hungary	14%	11%	11%	12%	16%	20%	20%	17%	15%	14%
Lithuania	21%	23%	24%	24%	45%	44%	39%	40%	46%	43%
Latvia	17%	15%	15%	16%	27%	24%	25%	22%	20%	15%
Poland	67%	65%	63%	61%	65%	64%	63%	61%	60%	59%
Romania	25%	19%	18%	15%	17%	16%	17%	16%	18%	19%
Slovakia	6%	8%	7%	6%	8%	9%	9%	9%	9%	8%

Source: own research on the basis of Eurostat data (Eurostat Energy Statistics and EU-SILC).

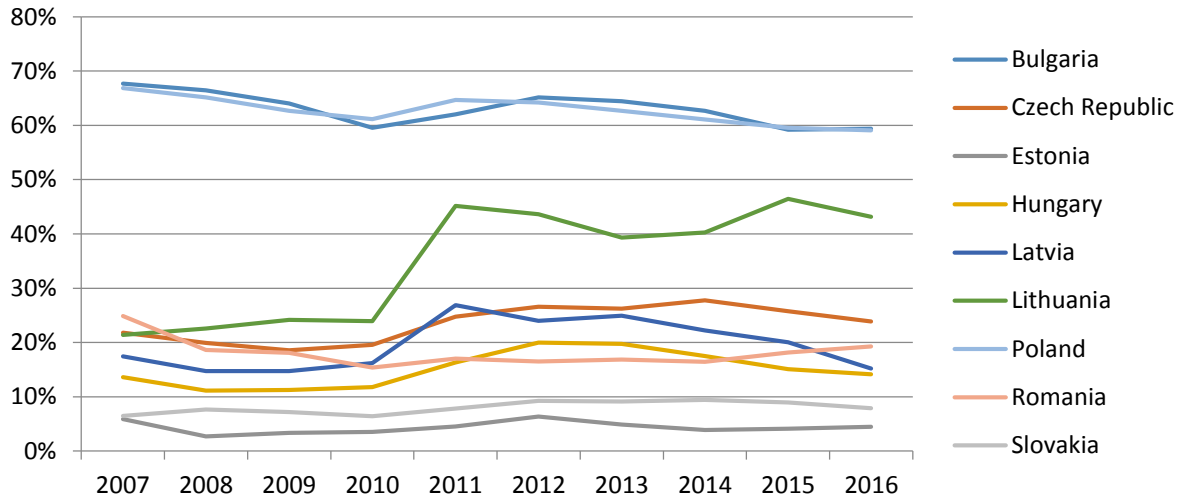

Figure 2. Changes of indicator limiting accessibility to energy services in selected EU countries between 2007 and 2016
Source: own research on the basis of Eurostat data.

4.2. Changes in the ability to acquire energy services

In the accepted methodology, the ability of households to acquire energy services (Table 4) is shaped by two variables: percentage of the households getting behind with the on-time payments for using homes and percentage of households, for which the payments for using homes are high. For the first criterion the referential countries were Bulgaria (between 2007 and 2011) and Greece (between 2012 and 2016), because these countries recorded the highest values of the indicator in the respective periods. For the second criterion, the

referential countries were Bulgaria (in 2007), Denmark (between 2009 and 2010) and Greece (in 2008 and between 2011 and 2016).

Table 4. Changes of indicator limiting the ability to acquire energy services in selected EU countries between 2007 and 2016

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Bulgaria	100%	80%	64%	63%	68%	67%	68%	60%	55%	63%
Czech Republic	31%	33%	25%	29%	27%	22%	22%	19%	16%	15%
Estonia	20%	19%	25%	31%	36%	29%	25%	24%	18%	15%
Hungary	56%	47%	51%	61%	67%	61%	55%	46%	33%	30%
Lithuania	27%	21%	25%	41%	44%	33%	30%	23%	21%	21%
Latvia	37%	37%	47%	58%	67%	52%	45%	38%	30%	24%
Poland	54%	37%	36%	43%	44%	38%	34%	31%	22%	21%
Romania	62%	78%	71%	78%	69%	74%	65%	49%	40%	39%
Slovakia	52%	18%	37%	33%	29%	22%	20%	19%	18%	7%

Source: own research on the basis of Eurostat data (Eurostat Energy Statistics and EU-SILC).

The adoption of the criterion of ability to acquire energy services enables for a distinction of two groups of countries. The first group constitutes the countries, where the limitations in the ability to acquire energy services were on the increase between 2008 and 2011, and later decreased significantly (Fig. 3). This group of countries reported relatively quick increase in energy prices in the period of crisis. It is worth emphasizing, that the level of energy prices is influenced by the market factors, fiscal and regulatory policies of the country, and in the countries belonging to the studied subgroup the additional burdens in the scope of taxes from energy were introduced to respond to the crisis. These changes include in particular: excise duty imposed on electricity, energy carriers (oil, natural gas, coal) and transport fuels (petrol, diesel) as well as taxes connected with the emission of CO2.

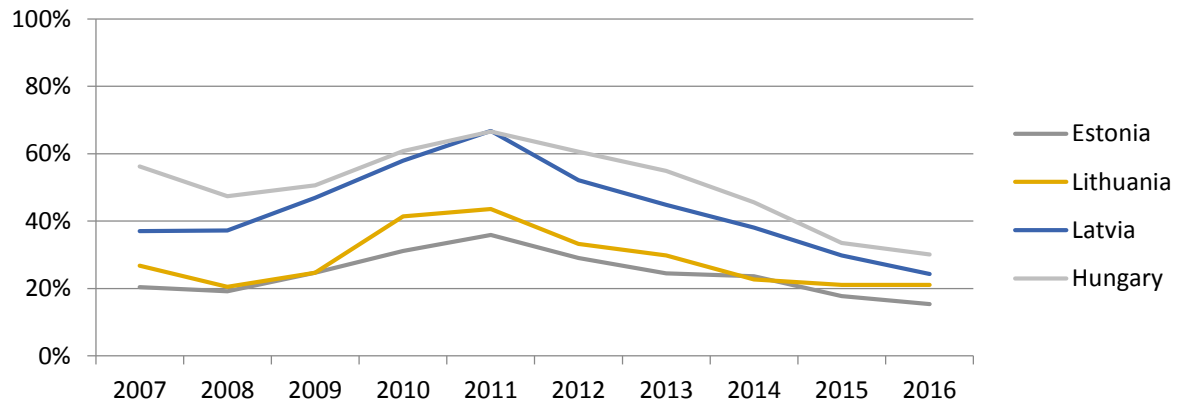

Figure 3. Changes of indicator limiting the ability to acquire energy services in Hungary and the Baltic States between 2007 and 2016
Source: own research on the basis of Eurostat data.

The second group of countries constitutes the economies, where limitations in the ability to acquire energy services successively decrease (Fig. 4). This is the result of relatively stable energy prices (which increase in the case of Poland is additionally regulated by the state) and the increase of income levels of households.

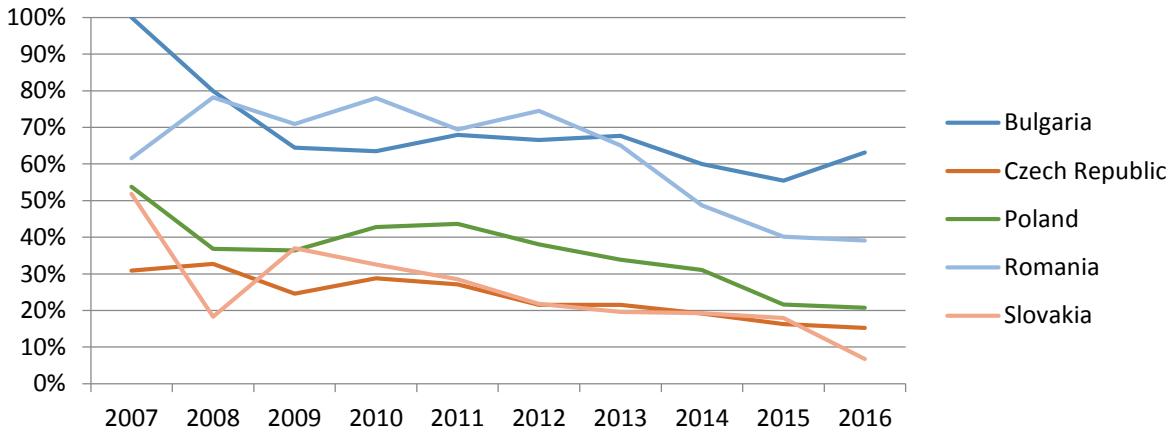

Figure 4. Changes of indicator limiting the ability to acquire energy services in Bulgaria, the Czech Republic, Poland, Romania and Slovakia between 2007 and 2016
Source: own research on the basis of Eurostat data.

4.3. Changes in the energy efficiency of households

According to the adopted method of measurement, changes in the energy efficiency of households are shaped by two factors: consumption of energy in households and level of energy efficiency of buildings inhabited by these households. The level of energy consumption is influenced by changing consumption patterns and changes in the household equipment for modern appliances, the use of which requires access to different forms of energy, whereas the biggest changes take place in the use of electricity. The referential country during all studied period was Luxembourg, where the consumption of energy in households was the highest. In the studied group of countries relatively higher level of energy consumption (Fig. 5) was recorded in five countries (Estonia, Latvia, the Czech Republic, Poland and Hungary).

The second indicator (energy efficiency of buildings) enables to observe changes in energy efficiency resulting from the improvement in the state of buildings inhabited by the studied households. During the studied period this indicator was decreasing successively in all countries, except Hungary, where according to EU-SILC data, the level of this indicator increased from 19.2% to 26.7%. Hungary is therefore a country, where the shaping of energy efficiency in households (Table 5) is influenced both by the level of energy consumption and by the low efficiency of residential buildings.

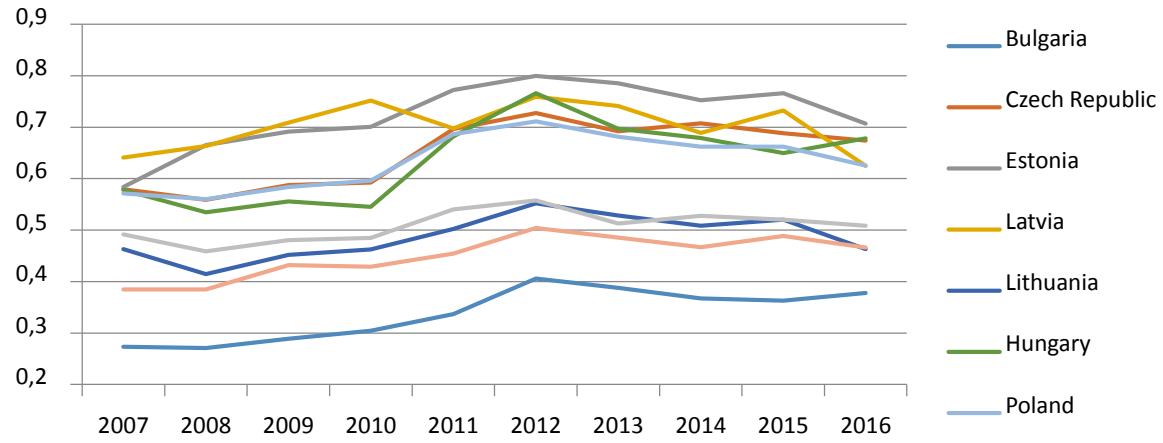

Figure 5. Changes of energy efficiency indicator in selected EU countries between 2007 and 2016
Source: own research on the basis of Eurostat data.

Table 5. Changes of energy efficiency indicator in selected EU countries between 2007 and 2016

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Bulgaria	33%	63%	53%	39%	38%	42%	40%	38%	41%	39%
Czech	50%	50%	53%	48%	52%	53%	50%	49%	50%	47%
Estonia	58%	61%	68%	64%	66%	71%	67%	62%	62%	58%
Lithuania	57%	61%	57%	53%	52%	56%	58%	54%	56%	53%
Latvia	67%	75%	78%	76%	72%	83%	80%	76%	80%	67%
Poland	79%	65%	58%	54%	51%	52%	50%	47%	54%	50%
Romania	59%	58%	57%	50%	49%	50%	50%	44%	47%	45%
Slovakia	33%	38%	35%	33%	38%	42%	37%	37%	37%	36%
Hungary	55%	77%	51%	65%	66%	77%	77%	75%	78%	78%

Source: own research on the basis of Eurostat data (Eurostat Energy Statistics and EU-SILC).

5. Overview

The analysis of energy poverty indicates diversification of level and dynamics of this phenomenon in the studied countries. Among the countries of Central and Eastern Europe, there are both the countries, where the problem of energy poverty is the highest (Bulgaria), and the lowest in Europe (Slovakia). Nevertheless, almost the whole studied group is characterized by decreasing level of energy poverty during that particular period. The analysis of the index components indicates diversification of energy poverty profiles. Some countries experienced difficulties in the scope of two criteria: either the accessibility and affordability of energy services (Bulgaria) or the accessibility of energy services and energy efficiency

(Latvia and Hungary). Other countries were characterized by high indicators only in one of the studied areas (Poland – accessibility of services, Romania – energy services affordability, Estonia – energy efficiency). Important factor shaping the ability to acquire energy services was also the consequence of economic crisis, especially lowering the level of incomes and the increase of energy prices as a result of increasing tax burdens imposed on energy carriers.

6. Conclusions and recommendations

The aim of the conducted study was an analysis of the level and the reason for energy poverty in selected EU member countries. Results indicate, that the Central and Eastern European countries report relatively high level of energy poverty. The presented diversification of the countries indicates, that it is not possible to implement uniform programs counteracting energy poverty on the EU level. These activities should remain the domain of member countries and should be conducted on the national level.

Instruments of the state policy aimed at fighting the energy poverty should include diversification of households' profiles experiencing this problem. Identification of the main reasons for the creation of energy poverty is important for the creation of solutions that will reduce the scale and the scope of this phenomenon. In the case of households that are poor in the income and energy category, the reduction of economic poverty is the necessary condition of reducing the energy poverty. However, if the energy poverty affects the households with average incomes, nonetheless constituting sensitive groups, the role, character, scope and efficiency of the state impact changes.

Because of the factors shaping energy poverty, we can distinguish three directions of actions that enable the reduction in the scope of this phenomenon: direct financial support of households, shaping the system of energy tariffs, which enables for the reduction of expenses on energy services as well as instruments supporting the improvement of energy efficiency in households. What is important, among the indicated actions, only the improvement in energy efficiency allows to counteract the phenomenon of energy poverty in the longer run. Other actions are only interim actions, because they do not lead to the elimination of the reasons for the phenomenon. It should be also underlined, that the used instruments should have a selective character. Their correct addressing requires more precise studies conducted on a microeconomic level.

As it was already mentioned, diversification of the countries makes it impossible to conduct policy that would prevent energy poverty on the EU level. At the same time, however, it is worth starting a discussion about the costs of transforming energy systems. Important is the fact, that the costs of this process do not deepen the phenomenon of energy poverty and do not worsen the situation of the most sensitive groups of households.

When discussing further research on energy poverty on international level there is a need for common definition. The present lack of such agreement means that there are no official figures about the extent of energy poverty, and it estimates the range in dependence on the

metrics that are used. Although it is not possible to implement common economic policy against energy poverty, globally-accepted definition would provide better recognition and political visibility of the problem, clarify terminological confusion, standardize statistics and measures and therefore help to achieve links with other policy domains.

References

Barnes D. F., Khandker S. R., & Samad, H. A. (2011). Energy poverty in rural Bangladesh. *Energy Policy, 39*(2), 894-904. https://doi.org/10.1016/j.enpol.2010.11.014

Bhide, A., & Monroy, C. R. (2011). Energy poverty: a special focus on energy poverty in India and renewable energy technologies. *Renewable Sustainable Energy Review, 15*(2), 1057-1066. https://doi.org/10.1016/j.rser.2010.11.044

Boardman, B. (2010). Liberalisation and fuel poverty. In I. Rutledge and P. Wright (Eds.), *UK Energy policy and the end of market fundamentalism*, (pp. 255-280). Oxford Institute for Energy Studies.

Boardman, B. (2012). Fuel poverty synthesis: Lessons learnt, actions needed. *Energy Policy,* 49, 143-148. https://doi.org/10.1016/j.enpol.2012.02.035

Bouzarovski, S., Petrova, S., Sarlamanov, R. (2012). Energy poverty policies in the EU: A critical perspective. *Energy Policy,* 49, 76-82. https://doi.org/10.1016/j.enpol.2012.01.033

Cook, C. C., Duncan, T., Jitsuchon, S., Sharma, A., & Guobao, W. (2005). *Assessing the impact of transport and energy infrastructure on poverty reduction*. Mandaluyong City: Asian Development Bank.

Dagoumas, A., & Kitsios, F. (2014). Assessing the impact of economic crisis on energy poverty in Greece. *Sustainable Cities and Society,* 13, 267-278. https://doi.org/10.1016/j.scs.2014.02.004

Dubois, U., & Meier, H. (2016). Energy affordability and energy inequality in Europe: Implications for policymaking. *Energy Research & Social Science,* 18, 21-35. https://doi.org/10.1016/j.erss.2016.04.015

European Economic and Social Committee. (2010, July 14). *Energy poverty—the impact of liberalisation and the economic crisis*, *CESE 990/2010—TEN/420, Exploratory Opinion.* Brussel: EESC. http://www.eesc.europa.eu/?i=portal.en.ten-opinions.19528

European Economic and Social Committee. (2013, November 21). *Opinion of the European Economic and Social Committee on 'For coordinated European measures to prevent and combat energy poverty' (own-initiative opinion), (2013/C 341/05).* Official Journal of the European Union. https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:C:2013:341:0021:0026:EN:PDF

Gaye, A. (2008). *Access to energy and human development, Human Development Report 2007/2008, United Nations Development Program, Human Development Report Office, Occasional Paper*. New York: UNDP.

Central Statistical Office. (2017). *Energy consuption of households in 2015.* Warsaw: CSO. https://stat.gov.pl/files/gfx/portalinformacyjny/pl/defaultaktualnosci/5485/2/3/1/zuzycie_energii_w_gospodarstwach_domowych_w_2015_r..pdf

González-Eguino, M. (2015). Energy poverty: An overview. *Renewable and Sustainable Energy Reviews,* 47, 377-385. https://doi.org/10.1016/j.rser.2015.03.013

Healy, J. D., & Clinch, J. P. (2002). Fuel poverty, thermal comfort and occupancy: results of a national household-survey in Ireland. *Applied Energy, 73*(3-4), 329-343. https://doi.org/10.1016/S0306-2619(02)00115-0

Healy, J. D., & Clinch, J. P. (2004). Quantifying the severity of fuel poverty, its relationship with poor housing and reasons for non-investment in energy-saving measures in Ireland. *Energy Policy, 32*(2), 207-220. https://doi.org/10.1016/S0301-4215(02)00265-3

Hills, J. (2011). *Fuel poverty: the problem and its measurement. CASE report, 69.* Department for Energy and Climate Change, London, UK. http://eprints.lse.ac.uk/39270/1/CASEreport69%28lsero%29.pdf

International Energy Agency. (2002). *Energy and Poverty, World Energy Outlook 2002.* Paris: International Energy Agency.

International Energy Agency. (2004). *Energy and Development, IEA, World Energy Outlook 2004.* Paris: International Energy Agency.

International Energy Agency. (2009). *World Energy Outlook 2009.* Paris: International Energy Agency.

International Energy Agency. (2010). *Energy Poverty: How to Make Modern Energy Access Universal? IEA, World Energy Outlook 2010.* Paris: International Energy Agency.

International Energy Agency. (2017). *From Poverty to Prosperity, Energy Access Outlook 2017, IEA.* Paris International Energy Agency.

Karpenko, L., Serbov, M., Kwilinski, A., Makedon, V., & Drobyazko, S. (2018). Methodological platform of the control mechanism with the energy saving technologies. *Academy of Strategic Management Journal, 17*(5), 1939-6104-17-5-271: 1-7. https://www.abacademies.org/articles/Methodological-platform-of-the-control-mechanism-1939-6104-17-5-271.pdf

Li, K., Lloyd, B., Liang, X. J., & Wei, Y. M. (2014). Energy poor or fuel poor: What are the differences?. *Energy Policy,* 68, 476-481. https://doi.org/10.1016/j.enpol.2013.11.012

Mazurkiewicz, J. (2014). Zmiany systemów podatkowych w krajach UE w świetle założeń ekologicznej reformy podatkowej [Changes in tax systems in the EU countries in the light of the assumptions of ecological tax reform]. In M. Bucka & Z. Mikołajewicz (Eds.), *Procesy gospodarczego i społecznego rozwoju wobec wyzwań współczesnego świata – Processes of economic and social development against the challenges of the modern world.* Opole: University of Opole.

Moore, R. (2012). Definitions of fuel poverty: Implications for policy. *Energy Policy,* 49, 19-26. https://doi.org/10.1016/j.enpol.2012.01.057

Nussbaumer, P., Bazilian, M., & Modi, V. (2012). Measuring energy poverty: Focusing on what matters. *Renewable and Sustainable Energy Reviews, 16*(1), 231-243. https://doi.org/10.1016/j.rser.2011.07.150

Pachauri, S., & Spreng, D. (2011). Measuring and monitoring energy poverty. *Energy policy, 39*(12), 7497-7504. https://doi.org/10.1016/j.enpol.2011.07.008

Pereira, M. G., Freitas, M. A. V., & Fidelisda da Silva, N. (2011). The challenge of energy poverty: Brazilian case study. *Energy Policy, 39*(1), 167-175. https://doi.org/10.1016/j.enpol.2010.09.025

Sagar, A. D. (2005). Alleviating energy poverty for the world's poor. *Energy Policy, 33*(11), 1367-1372. https://doi.org/10.1016/j.enpol.2004.01.001

Sesan, T. (2012). Navigating the limitations of energy poverty: Lessons from the promotion of improved cooking technologies in Kenya. *Energy Policy,* 47, 202-210. https://doi.org/10.1016/j.enpol.2012.04.058

Sovacool, B. K. (2012). The political economy of energy poverty: A review of key challenges. *Energy for Sustainable Development, 16*(3), 272-282. https://doi.org/10.1016/j.esd.2012.05.006

Tvaronavičienė, M. (2016). Entrepreneurship and energy consumption patterns: case of hoseholds in selected countries. *Entrepreneurship and Sustainability Issues, 4*(1), 74-82. https://doi.org/10.9770/jesi.2016.4.1

United Nations-Energy. (2010, April 28). *Energy for a sustainable future: the secretary-general's advisory group on energy and climate change summary report and recommendations.* New York: United Nations-Energy.

Van Der Kroon, B., Brouwer, R., & Van Beukering, P. J. (2013). The energy ladder: Theoretical myth or empirical truth? Results from a meta-analysis. *Renewable and Sustainable Energy Reviews,* 20, 504-513. https://doi.org/10.1016/j.rser.2012.11.045

World Bank. (2016). *Doing Business 2016: Measuring Regulatory Quality and Efficiency.* Washington, DC: World Bank.