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Author: Grzegorz Libor, Stefan Bouzarovski

Citation style: Libor Grzegorz, Bouzarovski Stefan. (2018). The socio-demographic dimensions of energy poverty: a case study from Bytom, Poland. "Urban Development Issues" (2018, vol. 57, pp. 63-77), doi 10.2478/udi-2018-0018



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How to cite:

Libor G. & Bouzarovski S. (2018) *The socio-demographic dimensions of energy poverty: a case study from Bytom, Poland*, Urban Development Issues, vol. 57, pp. 63-77, DOI: 10.2478/udi-2018-0018

URBAN ISSUES

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#energy poverty
#age categories
#Poland
#Bytom

The socio-demographic dimensions of energy poverty: a case study from Bytom, Poland

Grzegorz Libor*

Institute of Sociology
University of Silesia in Katowice,
Poland
grzegorz.libor@us.edu.pl

Stefan Bouzarovski

School of Environment, Education
and Development
University of Manchester,
United Kingdom
Institute of Geography
University of Gdańsk,
Poland

Abstract

Energy poverty can be understood as the inability to secure a socially- and materially-necessitated level of energy services in the home. This article presents the results of empirical research on energy poverty in Bytom. The study was carried out using a questionnaire delivered to 121 persons living in Bytom. The questionnaire consisted of 20 single and multiple-choice questions. The primary aim of the research was to achieve typological representativeness by identifying the differences between six age categories. Some of the results confirm what is already known about the relationships between the age of the head of household and energy poverty, while others are surprising. On their basis it is possible to formulate some recommendations for local anti-poverty energy policies.

submitted: June 2017
reviewed: February 2018
accepted: May 2018

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Introduction

According to Eurostat, 24.5% of European Union (EU) citizens, i.e. 122.6 million people, were at risk of poverty or social exclusion in 2013. In other words, the problems of poverty and social exclusion threaten one in every four citizens of the EU. Such persons are at risk of poverty, are severely materially deprived, or are living in households with a very low work intensity (Eurostat 2016a). These three different but often interrelated factors demonstrate the multi-dimensional nature of the problem of poverty, as well as the related phenomenon of social exclusion. In recent years it has been the last of the above criteria, i.e. material deprivation, that has achieved special attention from researchers due to successive economic crises. A Eurostat definition sees material deprivation as a 'state of economic strain and durables' including the 'enforced inability (rather than the *choice* not to do so)' to, *inter alia*, afford 'the adequate heating of a dwelling, durable goods like a washing machine, colour television, telephone or car, being confronted with payment arrears (mortgage or rent, utility bills, hire purchase instalments or other loan payments)' (Eurostat 2016b).

In this context, difficulties in accessing or affording adequate levels of domestic energy services (space heating, lighting, cooling etc.) due to financial, regulatory or technical constraints has led large numbers of people to experience a condition known as fuel poverty in the British and Irish settings (Bouzarovski 2014). According to a common definition, a household suffers from fuel poverty if it needs to spend more than 10% of its income on total fuel use. But by this definition even high income households qualify as living in fuel poverty when they need to spend more than 10% of their earnings on energy bills (Boardman 1991; Legendre & Ricci 2015). The phenomenon wherein better-off households that are not in fact fuel poor nevertheless benefit from public support programmes that target fuel poverty is called 'leakage'. Leakage calls into question the methodological approach of many governmental programmes and projects based in the UK and in other countries, where implementation of the 10% income definition of fuel poverty creates the possibility that affluent households will benefit from public support programmes, such as programmes that enhance building energy efficiency (Walker et al. 2013).

Of course the 10% income definition is not the only method used by governments and institutions; there are also others based on income intervals (O'Sullivan, Howden-Chapman & Fougere 2015; Walker et al. 2014), or on a 'Low Income/High Cost' approach (Moore 2012). However, when undertaking scholarship on fuel poverty it is important to not only consider the methods that institutions follow and the research techniques they

employ, but also the geographic scale at which the research is conducted. The more detailed this level is, the more precise the results of the research are likely to be, given the high degree of spatial variation in patterns of energy poverty (Bouzarovski & Herrero 2016). At least such conclusions can be drawn from a study of the energy situation of households in Northern Ireland between 2012 and 2013 (Walker et al. 2014). Such fine-grained research is not only rare, but also expensive and time-consuming; however, it can provide important insights into the nature of fuel poverty in a particular area and among specific groups of households.

Given the above, the aim of this research is to illuminate the differences between various age groups, with particular emphasis on three aspects of people's lives: their dwelling situation, their health conditions and their everyday behaviour. It is generally assumed that there is such a correlation (Healy 2003; Liddell & Morris 2010), and our study seeks to corroborate this assumption based on the example of respondents living in Bytom, one of the most deprived areas in Poland.

It is difficult to imagine how the concept of fuel poverty would have ever been identified if it were not for its unfavourable consequences on health. One of the key impacts of fuel poverty on human life is an increase in the number of deaths during winter months. Excess winter mortality is mainly due to the fact that some people require permanent access to facilities that enable them to fight effectively against disease, while others require specific (and specifically clement) environmental conditions to be able to convalesce successfully. Frequently, however, after paying their bills, people with these needs cannot afford to buy the medicines necessary for them to stay healthy. Such conditions are conducive to the appearance and development of serious ailments such as: respiratory disease, respiratory distress syndrome, asthma, and rheumatoid arthritis or inflammation. Not surprisingly, therefore, the adverse consequences of fuel poverty are mainly felt among the elderly (O'Sullivan, Howden-Chapman & Fougere 2011), though also among children (Liddell & Morris 2010).

Moreover, staying in cold and unheated rooms affects not only the physical health of household members but also their mental health. Some of the consequences of living in fuel poverty are social isolation in the short term (Healy & Clinch 2004) and depression in the long term. There are additional dimensions to the impact of fuel poverty on the lives of children. Research shows that children from households that struggle with fuel poverty perform worse in school than their peers, have fewer career prospects, and are more vulnerable to social marginalisation (Morrison & Shortt 2008). However, different measurement methods also lead to different understandings of which groups are

vulnerable and the manner in which they are affected. For example, the British Building Research Establishment methodology takes into account the median non-equalised income, average fuel prices, geographical location and heating systems of all households surveyed. It identifies mainly single and older people as being at risk. In turn, UK Government statistics on 'Households Below Average Income' concentrate mainly on families with children (Fahmy, Gordon & Patsios 2011).

While the notion of 'fuel poverty' has been principally used to describe the situation of households in developed countries, a different concept – energy poverty – has traditionally been used when discussing developing countries. The distinction between the two concepts is essentially socio-economic and political in nature (the North–South divide between more economically developed and less economically developed countries), and the only factor linking them are the consequences for health to which living in conditions of either fuel or energy poverty lead. A paradigm shift has occurred relatively recently, as the result of globalisation on the one hand, and the growing number of studies of energy poverty in countries that, for various reasons, find themselves on the margins of social and economic development, on the other. Today both concepts can be placed under the common rubric of 'energy poverty' (commonly abbreviated as 'energy poverty' – as is the case in the remainder of this paper). According to S. Bouzarovski and S. Petrova (2015) 'energy services cannot be understood in solely technological or social terms, but rather represent hybrid *assemblages* operating across a multitude of scales and sites, beyond the confines of the home'. As such, they consist of 'composite accomplishments generating and sustaining certain conditions and experiences' that are deeply embedded in the 'orchestration of devices, systems, expectations and conventions'. Energy services embody social practices that are 'configured by the hanging together of institutional arrangements, shared cultural meanings and norms, knowledges and skills and varied material technologies and infrastructures' (Bouzarovski and Petrova 2015: 34).

Energy poverty in Poland: the current state of research

Energy poverty in Poland is a relatively unknown phenomenon. The lack of data makes it difficult not only to estimate the scale of the phenomenon properly, but also to take appropriate steps to limit its negative effects. In recent years, however, the situation has been gradually changing. One of the first attempts to deal with the problem of the lack of data in Poland was made by Szamrej-Baran, who sought to determine the scale of energy poverty using so-called 'soft modelling'. The

calculations made in this manner for Poland indicate that 90% of cases can be explained by the first of the above-mentioned external models, 75% to 97% can be explained by the model of material poverty, and about 78% by the external model of the energy efficiency of buildings variable (Szamrej-Baran 2014: 350).

Assuming, therefore, that in 2013 16.2% of Poles lived below the relative poverty line and 12.8% below the official poverty line (Nowalska-Kapuścik 2015: 169), the proportion of the Polish population affected by energy poverty was approximately 10 to 12%.

The analyses conducted by the Institute for Eco-Development show that the average share of energy expenditure in the total household budget is much higher in Poland than in other European countries. Specifically, between 2005 and 2009 this average share was 9 to 10%, which means that during this time a significant percentage of Polish households will have struggled with the problem of energy poverty, according at least to the 10% income criterion discussed above. Two years later the Central Statistical Office data showed that 40.3% of Polish households spent more than 10% of their income on expenses related to heating. These households comprised mainly pensioners and retirees, people living in small towns (up to 20 thousand residents) and medium-sized towns (20,000–100,000 residents), people occupying small flats with an area of 40–54 m², single-person households, and single parents (Stępniaik & Tomaszewska 2013: 14).

In 2015 the Institute published another report on energy poverty in Poland. This report is one of the most important and comprehensive studies of energy poverty in the country. It showed that in 2012 13.2% of Polish households declared having difficulties heating their homes in winter, and 25.6% said that their dwelling was not cool enough in the summer. More detailed research conducted by the Institute among Polish communes has shown that only 9.3% of communes believe that the problem of energy poverty concerns their inhabitants. The rate of return of the questionnaires was 35%. The main reasons why Polish communes do not collect data on energy poverty were found to be as follows: inadequate funding and lack of personnel, difficulties in gathering the data; lack of proper data collecting tools. The unsatisfactory results of the research among Polish communes encouraged the Institute to estimate the scale of energy poverty in Poland using selected methods from other countries, especially from the UK. And so 44.4% of Poles would be considered to live in energy poverty if the 10% income indicator was used, but only 32.4% in the case of a threshold of 13%. Taking into account the Low Income/High Cost definition of energy poverty, the percentage of Polish people living in energy poverty ranges from 10 to 17.9% (Tab. 1) (Owczarek & Miazga 2017).

TABLE 1
Scale of energy service poverty in Poland in 2013 depending on definition
Source: (Owczarek & Miazga 2017: 36)

Low Income Criterion	High Costs Criterion - adjusted energy expenses (original definition)		High Costs Criterion - energy expenses per m ² of housing (alternative definition)	
	in %	Number of people	in %	Number of people
60% of median	17.1%	6 437 151	17.9%	6 735 415
50% of average	16.4%	6 150 608	17.1%	6 403 456
Legal poverty line	10.0%	3 760 720	10.8%	4 058 696

The differences between the various definitions of energy poverty are revealed when the various types of household are taken into account. The risk of energy poverty increased not only with the number of household members, but also with the number of children. Also at higher risk of domestic energy deprivation were pensioners, farmers, and the self-employed. The situation was even more complicated in the case of the Low Income/High Cost (LIHC) definition and different income criteria. Thus, in the original High Cost definition and the first two Low Income criteria there were usually more parents and children in energy poverty than other groups, while in the case of the legal poverty line there were more often people who were married and who had two children or more (Owczarek & Miazga 2017).

The scale and character of energy poverty in Poland results in part from it being a Central and Eastern European (CEE) state whose energy situation is the result of differences in economic development between European countries traditionally defined as being in the core and periphery (Bouzarovski & Herrero 2015). Rather than reducing the negative consequences of differences in economic development, changes in and the transformation of the European energy market that have taken place in the last few years have, in fact, only deepened existing differences between core and periphery countries due to the strong geographical anchoring of policies underpinning these changes and transformations. One of the reasons for this state of affairs was an increase in household energy costs between 2007 and 2013, resulting from both the economic crisis and monetary deprivation. Similarities between CEE states in the case of their energy situation are apparent to different degrees. The difference between Poland and Hungary, for example, is much less significant than that between Poland and the Czech Republic when one takes into account, *inter alia*, the relationship between the energy poverty index and the at-risk-of-poverty rate. Despite this, it is still possible to distinguish an ‘energy divide’ – a geographic line in Europe separating areas that struggle more with the problem of energy poverty from areas that struggle less (Bouzarovski & Herrero 2015).

An important factor that determines the energy situation of Polish households in comparison with other European countries is undoubtedly the state of Polish housing stock. This is evidenced by an audit conducted on 193 European residential buildings in five countries (Balaras et al. 2005a). What was noticeable about Polish buildings was that they had not only the highest average heating energy consumption, but also the highest production of airborne emissions and the highest emission of solid wastes – both of which are partly the consequence of the lack of regulations on the private housing stock. Although, compared to other countries, Poland does well when it comes to the percentage of buildings that have sufficiently thermal insulation, the main factors negatively affecting Poland’s high heating energy consumption, high production of airborne emissions, and high emission of solid wastes, are their heating installations (Balaras et al. 2005a, 2005b). One option for households living in buildings that are not insulated is thermal upgrading (Alsabry 2016). As shown by studies conducted in other European countries, such buildings are primarily inhabited by low-income households (Santamouris et al. 2007). Further typical problems for buildings in Eastern Europe are leaking walls and rotting windows, although Poland experiences these problems in a much less acute way than do other countries in the same geographical zone (Santamouris & Kolokotsa 2015, Csoknyai et al. 2016).

Research methodology

Purposive sampling, which is a type of non-probability sampling techniques, was used in order to guarantee that each age category will be represented by the same number of respondents. The operation was aimed at ensuring typological representativeness of the results obtained. The age of the head of the household was chosen as it is one of the factors that determines the risk of living in energy poverty. Over-representation of any of these groups could lead to the distortion of the results. Interviewers were instructed on how to reach a specific group of respondents and so 121 persons who took

part in the research completed the questionnaire of 20 single and multiple-choice questions and 13 socio-demographic questions (see annex). They were treated as representatives of their households who were depicting the situation in their households, some of them were the heads of households as well. Because of this the statistical significance of the results presented in the paper only applies to the sample and not to the entire population of Bytom. The research was conducted in 2016. The spatial representativeness of the persons questioned has not been considered; the only criterion was to live in Bytom.

As G. Gobo and S. Mauceri (2014) state 'in a survey it might be preferable, in view of its aim, to utilise under certain circumstances sampling procedures that are non-probabilistic – that allow comparisons between groups (social types) of equivalent scales, identified by combined reference to relevant variables, regardless of their numbers in the general population [...] the requirement of statistical representativeness or in any case the ability to generalise the findings over the entire population is not always relevant' (Gobo and Mauceri 2014: 34).

The results were processed in IBM SPSS. Taking into account 20 general questions (dependent variables) asked

and the age of the head of household, a correlation between an independent and dependent variable was only observed at a significance level of less than 0.05 in some cases. Those correlations were analysed further, and are presented here. So an independent variable was the age of the head of the household and the dependent variables were as follows: the financial situation of the respondents' households, the level of energy consumption of the respondents' households, the respondents' consumer behaviour, the heating systems used by the respondents' households, the methods of payment of electricity bills, the standard of the respondents' households as well as the health situation of the respondents' households. The correlation between independent and dependent variables was checked in the case of each answer that was received.

Most respondents were persons living in households whose head had secondary and professional education (Tab. 2). Most of these were also living in households without children. The respondents were also classified according to the economic activity of their households. Exactly the same percentage of those surveyed lived in non-retired working households with at least one unemployed person and non-retired working households without an unemployed person (Tab. 3).

TABLE 2

The age of the head of household, gender distribution and educational level in %
Source: own research

Age	Gender		Education			
	Females	Males	Primary education	Secondary education	Professional education	Higher education
18-25	9.1	7.4	0.8	3.3	11.7	0.8
26-35	8.3	8.3	0.0	2.5	8.3	5.8
36-45	11.6	4.1	0.0	5.8	5.8	4.2
46-55	14.0	2.5	0.0	9.2	7.5	0.0
56-65	10.7	7.4	0.0	11.7	6.7	0.0
> 65	12.4	4.1	0.0	10.8	5.0	0.0
Total	66.1	33.9	0.8	43.3	45.0	10.8

TABLE 3

The age of the head of household, the actual number of children and the economic activity of households in %
Source: own research

Age	Number of children			Economic activity				
	0	1	2 and more	Non-retired working households without an unemployed person	Non-retired working households with at least one unemployed person	Non-working pensioner households	Working pensioner households	Non-retired unemployed households
18-25	14.8	1.6	0.0	2.5	10.7	0.0	0.0	3.3
26-35	11.5	4.9	0.0	11.5	4.9	0.0	0.0	0.0
36-45	4.1	9.0	3.3	9.0	7.4	0.0	0.0	0.0
46-55	7.4	4.9	4.1	8.2	8.2	0.0	0.0	0.0
56-65	18.0	0.0	0.0	4.1	4.1	5.7	4.1	0.0
> 65	16.4	0.0	0.0	0.0	0.0	13.9	2.5	0.0
Total	72.1	20.5	7.4	35.2	35.2	19.7	6.6	3.4

Short description of the research area

Despite its overall relative wealth, there is quite a lot of internal variation in the Silesian *voivodeship*. Cities with *powiat* status located on its territory differ from one another in the following respects: surface area ranging from 13 to 189 km², populations ranging from 50,600 to 298,100. Economic conditions also differ drastically from *powiat* to *powiat*. For example, in 2016 the highest unemployment rate in the Silesian *voivodeship* was recorded in Bytom (15.4%) and the lowest in Katowice (2.8%) — a difference of over 12%. Significant differences also exist within the Silesian *voivodeship* between average monthly gross income, with the highest average income being in Jastrzębie Zdrój (6131,62 zł), and the lowest being in Świętochłowice (3353,91 zł) (Urząd Statystyczny w Katowicach 2017: 170–204).

The high level of unemployment with which Bytom is currently struggling is a consequence of the restructuring of the mining and metallurgy industries (5 mines were closed). This largely explains why Bytom is one of the most deprived regions in the Silesian *voivodeship*. According to nationwide statistics, Bytom is one of the poorest cities with *powiat* rights in Poland. Of the 66 cities with *powiat* rights in Poland, Bytom ranks 65th in terms of unemployment rate, and 55th in terms of the number of entities in the National Business Registry Number per 10,000 inhabitants and the number of inhabitants getting help from social services. Bytom and the Silesian *voivodeship* are therefore ideal places to analyse the local dimensions of energy poverty in Poland.

The next few years may be particularly difficult for those Polish regions that are struggling with poverty, including energy poverty. Coal was and still is one of the cheapest fuels available in Poland for household heating. Changing the way apartments and houses are heated can be very expensive and difficult to achieve for many Polish households, especially the poorest ones. Despite the existence of alternative, more cost effective and more environmentally friendly heating methods — such as wood briquettes, which are used to heat family houses in the northeast of Poland (Stolarski, Krzyżaniak & Graban 2011) — more traditional heating sources, like coal, remain popular in many parts of Poland, including the Silesian *voivodeship*. This may be due in large part to the industrial background of the Silesian *voivodeship*'s economy.

Results and discussion

In order to pinpoint the extent of energy poverty, monthly average energy expenditures were considered as a proportion of average monthly net incomes per household member. This indicated that 62.9% of respondents lived in energy poverty if the 10% definition was adopted, but using actual rather than required expenditure. The most probable level of energy poverty was 29.1% as the respondents living in the households who earned from 0 to 1000 zł per member monthly were the most vulnerable people. A more pessimistic scenario assumes that 44.7% of those who took part in the survey could live in energy poverty, those living in the households who earned from 0 to 1500 zł.

TABLE 4

Level of energy poverty

% of households in fuel poverty in the study area = 62.9 % the result was obtained by adding all values in bold which show the households that spend more than 10% of their income on energy (10% definition of fuel poverty, N=86)

			Average monthly spending on energy					Total
			Below 50 zł	From 51 to 100 zł	From 101 to 200 zł	From 201 to 300 zł	> 301 zł	
From 501 to 1000 zł	% of average monthly net income per member		0.0	13.8	44.8	41.4	0.0	100.0
	% of total		0.0	4.7	15.1	14.0	0.0	33.7
From 1001 to 1500 zł	% of average monthly net income per member		0.0	20.7	34.5	31.0	13.8	100.0
	% of total		0.00	7.0	11.6	10.5	4.7	33.7
From 1501 to 2000 zł	% of average monthly net income per member		0.0	0.0	38.5	53.8	7.7	100.0
	% of total		0.0	0.0	5.8	8.1	1.2	15.1
> 2000 zł	% of average monthly net income per member		6.7	6.7	33.3	W33.3	20	100.0
	% of total		1.2	1.2	5.8	5.8	3.5	17.4

The use of both the income scale and the 10% definition of energy poverty is a good way to identify those who are the most vulnerable part of the research population when it comes to the risk of living in energy poverty. As was already mentioned, some households are wealthy enough to be able comfortably to pay higher energy bills than others. In the case of Bytom, such households may be represented by those households with an average per capita monthly income over 1501 zł (Tab. 4).

It was expected that the households whose head of household was aged 65 years or more were those for whom the energy bills should have been the greatest burden of energy expenditure. However, the findings from the research in Bytom suggest that the most vulnerable people were those living in the households whose head of household was aged 46 to 65 years. This group of people is also the one most endangered by unemployment which may be one of the reasons why they so often deal with energy poverty. While the answer 'adequate' was mainly chosen by respondents living in the households whose head of household was aged 26–45, the answer 'too high' was mostly chosen by people living in the households whose head of household was aged 46–65. This can be explained by the fact that these respondents lived in households which earned less than 1500 zł monthly per member and spent over 200 zł on energy bills more often than the remaining respondents. Those living in households whose head of household was aged 18–25 and those living in households whose head of household was aged over 65 had the greatest difficulty in assessing how high their bills were in relation to income.

Moreover, women were more likely than men to describe their energy bills as either 'too high' or 'adequate', however in older groups the share of men is smaller than in the younger groups. In the case of the youngest age

category the reason for this was the lack of a reference point due to insufficient energy experience. Most of the respondents living in the households whose head of household was aged 18–25 were unable to assess the level of the energy bills as they were energy consumers for a relatively short time in comparison to other age categories (Tab. 5). In the case of the oldest age category the reason was the loss of such a reference point as a result of reduced physical and mental health which made their broadly understood energy activity rather limited (Hsu 2007).

Therefore the following correlation between the age of the head of household and the number of respondents who purchased energy-efficient appliances / electronics should not be surprising. As the age of the head of household increased, so too did the percentage of people who treated the purchase of energy efficient appliances as a way to reduce their electricity bills. However, this only concerned respondents living in households whose head of household was aged 18–55. The opposite tendency was seen in the case of respondents living in households whose head of household was aged 56 years and older (Tab. 6).

A similar correlation was noticed in the way that respondents heated their dwellings. The percentage of respondents using mixed heating increased with age among those living in households whose head of the household was aged 18 to 55 years old. Among older heads of household, however, mixed heating was not very popular. The option of adopting mixed heating presents a household with the opportunity of saving money on energy bills. The low percentage of elderly heads of household benefiting from the opportunities afforded by mixed heating results either from their simply not having such an opportunity, or it may be an indication that the 18–55 age category is more aware of the benefits of mixed heating; it may be symptomatic of a greater technological awareness

TABLE 5

Level of energy bills and age of the head of household

$\chi^2=32.620$, $df=10$, $V=0.367$

Source: own research, $p=0.00$, $N=120$

		Age						Total	
		18-25	26-35	36-45	46-55	56-65	> 65		
Assessment of level of energy bills	Too high	% of respondents who chose 'too high'	2.4%	9.5%	14.3%	28.6%	31.0%	14.3%	100.0%
		% of total	0.8%	3.3%	5.0%	9.9%	10.7%	5.0%	34.7%
	Adequate to the level of consumption	% of respondents who chose 'adequate'	14.0%	27.9%	20.9%	9.3%	11.6%	16.3%	100.0%
		% of total	5.0%	9.9%	7.4%	3.3%	4.1%	5.8%	35.5%
	Hard to say	% of respondents who chose 'hard to say'	36.1%	11.1%	13.9%	11.1%	8.3%	19.4%	100.0%
		% of total	10.7%	3.3%	4.1%	3.3%	2.5%	5.8%	29.8%
Total			16.5%	16.5%	16.5%	16.5%	17.4%	16.5%	100.0%

TABLE 6
Purchase of energy-efficient appliances and electronics by age of head of household
 $\chi^2=11.452$, $p=0.043$, $df=5$, $V=0.320$
Source: own research, $N=112$

			Age						Total
			18-25	26-35	36-45	46-55	56-65	Over 65	
I purchase energy-efficient appliances	Chosen	% of those who buy such appliances	2.9%	17.1%	20.0%	25.7%	22.9%	11.4%	100.0%
		% of total	0.9%	5.4%	6.3%	8.0%	7.1%	3.6%	31.3%

TABLE 7
Ways of heating dwelling and the age of the head of household
 $\chi^2=19.659$, $p=0.001$, $df=5$, $V=0.403$
Source: own research, $N=121$

			Age						Total
			18-25	26-35	36-45	46-55	56-65	Over 65	
Mixed heating	Chosen	% of mixed heating	2.6%	15.4%	23.1%	33.3%	15.4%	10.3%	100.0%
		% of total	0.8%	5.0%	7.4%	10.7%	5.0%	3.3%	32.2%

TABLE 8
Payment order after receipt of invoice and the age of the head of household
 $\chi^2=23.618$, $p=0.000$, $df=5$, $V=0.447$
Source: own research, $N=118$

			Age						Total
			18-25	26-35	36-45	46-55	56-65	Over 65	
Payment order after receipt of invoice	Chosen	% of payment order after receipt of invoice	6.1%	3.0%	6.1%	21.2%	30.3%	33.3%	100.0%
		% of total	1.7%	0.8%	1.7%	5.9%	8.5%	9.3%	28.0%

among young to middle-aged respondents as already mentioned¹ (Tab. 7).

Another correlation was observed between the age of the head of household and the way they pay their electricity bills, in this case in one a particular way — an electronic payment order after receipt of invoice. This method of payment was popular among three age categories: 46–55, 56–65 and over 65. Among those represented in the research, one in four used this type of payment method. This kind of payment was mainly used by elderly heads of households and those living in multi-family ownership housing and put households at a greater risk of energy poverty (O’Sullivan et al. 2011). It was used much less often by respondents who were living in their own house or who rented an apartment.

The primary reason respondents chose one method of payment instead of another was convenience, and this was especially true for respondents living in multi-family

buildings. Another reason was concern about security of supply – predominant among respondents who owned their own apartment. Again, a correlation was observed between the method of payment and the age of the head of household: the respondents living in the households whose head of household was aged 56 years and older chose the best method of payment, based more often on security concerns rather than on other reasons (Tab. 8).

A further correlation was observed between the need to renovate or modernise a dwelling and the age of the head of household. It turns out that younger groups declared a need to upgrade/modernise their dwellings less frequently than older ones. Younger groups tended to live in buildings that were more modern than those occupied by older heads of households.

The research conducted in Bytom also revealed other interesting results concerning the energy situation of its inhabitants that were also worth mentioning. More than half of respondents declared that they never had problems with paying energy bills, with the remainder of participants answering that they had experienced difficulties

1. More about the benefits of mixed heating can be found: <http://www.instalacjebudowlane.pl/4780-23-53-efektywne-ogrzewanie--instalacja-mieszana.html>

paying energy bills at least once. One third of the total number of respondents answered that they experienced such difficulties 'quite often' or 'from time to time', which is almost the same as the percentage of respondents living in energy poverty when the 10% definition of energy poverty was used and people who were living in the households whose members earned between 0 and 1500 zł monthly per member were taken into account.

Generally the majority of the respondents believed that they consumed as much energy as needed, whereas almost one tenth believed they consumed too much energy. Roughly the same percentage of respondents considered their energy bills to be adequate to their level of consumption, as considered their bills to be too high. A slightly smaller proportion of respondents could not, however, provide a clear answer to this question. Not surprisingly, none of the respondents believed that their energy bills were too low.

More than half of the respondents had never had to limit their daily expenses to be able to pay their energy bills. One fourth claimed that they were 'rarely' forced to limit their other expenses in order to be able to pay their energy bills while less than one fifth did it quite often. Respondents who were forced to limit their other expenses to be able to pay their energy bills did so, in the main, by curbing their expenditure on food (84%); detergents and chemicals (44%); clothing (26%); entertainment (22%); cosmetics (18%); and housing renovation (14%).

Finally, respondents were asked to assess the overall health of their households. The vast majority defined it as either 'rather good' or 'very good'. Less than one fifth of respondents said their household's health was satisfactory, and only 1.7% assessed their household's health as 'bad'.

Despite the fact that, according to the present study, 29.1–62.9% of those surveyed faced the problem of energy poverty, only 4.6%–11.5% of them considered their household health to be poor (i.e. less than 'rather good' or 'very good'). These results are surprising, considering that it is the impact of domestic energy deprivation on household health in the first place that has led to the rise in popularity of the concept of energy poverty itself. Perhaps it is because any assessment of one's own health is a subjective measure and is likely to be largely aspirational in nature. Moreover, people affected by energy poverty are far less likely to benefit from the regular attention of medical experts, and as such are less likely to have access to reliable information about the actual state of their health.

Conclusions and policy implications

The results of the research conducted in Bytom contribute to the development of knowledge about the problem of energy poverty in Poland. In Poland, awareness of energy

poverty among policy-makers is still insufficient. Poland does not yet even have a statutory definition of energy poverty. Without a national understanding of what energy poverty is, there are limited opportunities for the development of coherent policy to combat both its consequences and causes. This applies to the broader CEE region: years spent under centrally planned economies ensured that domestic energy deprivation remained a private issue with which each household had to cope alone. Now the situation has begun to change as more and more attention is paid to the need to use environmentally friendly solutions which, being expensive to install and use, can only increase the scale of energy poverty in Poland. In 2016 the Institute for Structural Research published recommendations for dealing with energy poverty in Poland. One of the most important instruments to improve the situation of households living in energy poverty is to improve energy efficiency. Particularly effective actions are: thermal efficiency improvements, ensuring effective heat sources and educational activities to use electrical devices effectively. Such instruments require strong foundations to be efficient. That is why the following actions need to be taken: energy poverty issues should be regulated by Polish law, a working group responsible for assessing the effectiveness of the instruments used to alleviate energy poverty should be established including representatives of various sectors, pilot projects should be realised at local level, the energy poverty monitoring system should be improved and already existing instruments modified (Lis & Szpor 2016).

As the results from the present research show, the socio-demographic dimension of energy poverty should also be taken into consideration when formulating energy poverty policy in Poland, especially within cities. While some of the results of the research are not surprising there were a number of unexpected findings:

1. the respondents living in households in which the age of the head of household was 65 years or more did not think their energy bills were too high and they consumed too much energy, which may suggest that they were not struggling with energy poverty and explain why they have no knowledge about how their energy situation can be improved;
2. women were more often sceptical about the level of the energy bills than men, which may result from their responsibility for the household budget. It may also be one of the reasons why men did not take part in the survey;
3. mixed heating was not popular among respondents living in households whose head of household was aged 56 years or more and was popular among those aged 18–55 which means that that type of heating cannot be seen as one of the determinants of energy poverty;

4. respondents living in households whose head of household was from older age categories assessed the condition of their dwellings as less good than did those representing younger age categories;
5. the respondents living in households whose head of household was aged 56 years and older chose the best method of payment, based more often on security concerns than on other reasons, which can be explained by the fact that they usually take all new possibilities with a pinch of salt;
6. only up to 11.5% of the respondents considered their household health to be poor;

The above findings should be taken into consideration while planning local energy poverty policy in Bytom and could be a warning against using conclusions from the national studies of energy poverty directly at local level. For example, in the case of Bytom possible recommendations could be as follows: the most vulnerable people aged 46 to 65 years should be a priority target group of any governmental and non-governmental programmes that aim to alleviate energy poverty, with particular emphasis on women in order to increase their knowledge in terms of how to limit energy costs. Another step to be taken in order to tackle the problem of energy poverty in Bytom should be to promote mixed-heating and to also make it more available to those living in energy poverty as well as to encourage those affected by energy poverty to take advantage of the possibilities given by new solutions and technologies. In the case of older age categories it is mainly about breaking physical and mental barriers as younger age categories seem to deal better with energy issues than older ones.

In the case of Bytom, the 10% definition of energy poverty was used in combination with an income scale and additional questions. That is how the number of respondents living in energy poverty was identified. Up to 62.9% of the respondents lived in energy poverty if the 10% definition was adopted, but using actual rather than required expenditure. The most probable energy poverty rate was 29.1% as the respondents whose households earned from 0 to 1000 zł were the most vulnerable. Comparing these results with those obtained by the Institute of Structural Research by means of the Low Income High Costs indicator, the

difference between energy poverty rates was almost 23%. The Silesian voivodeship is considered as one of those regions of Poland where the subjective measure of poverty is high, and the LIHC measure is low (Lis, Miazga & Sałach 2016). However as the case of Bytom demonstrates, the Silesian voivodeship also has great internal variation in terms of energy poverty. This has serious consequences for policy on energy poverty. This fact should be taken into account whenever decisions are made on alleviating energy poverty. Existing institutional assistance structures – social welfare centres – could be leveraged to identify cities like Bytom which are exceptions to general trends on energy poverty. In order for this to happen, the issue of energy poverty in Poland would first need to be further politicised, made the subject of public debate and of legislative work. Unlike in Hungary (Bouzarovski et al. 2016), the goal of reducing energy poverty has not enjoyed widespread public support; such a goal could, however, form part of the on-going discussion about Polish energy security in the future. The issue of energy poverty arises far too infrequently in public discussions surrounding the introduction of new, environmentally friendly technologies in Poland. Such technologies are becoming increasingly popular in Poland thanks to support from European funds; but their introduction may end up leading to a disparity between social groups in access to energy, creating a source of further social inequality. Despite support provided by the European Union, the fact that energy-saving technologies need to be purchased by individual households means that the socially and economically vulnerable will often be unable to take advantage of them. A concerted effort on the part of governmental authorities to reduce air pollution by banning burning solid fuels could have a similar effect. Governments could subsidise the installation of environmentally friendly heating/cooling technologies in the poorest households; however, such a one-off solution could backfire in that the long-term use of such technologies could prove too expensive and so only aggravate the problem of energy poverty.

Acknowledgement

The research has been funded by the University of Silesia in Katowice.

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Annex

The University of Silesia in Katowice (Poland) is carrying out a survey to find out about the problem on fuel poverty in the United Kingdom and the actions taken in this field by the British government and non-governmental organisations. The findings from the survey will be used to prepare a book on fuel poverty in the United

Kingdom thanks to which authors of the publication plan to increase the awareness of the problem of fuel poverty in Europe among Polish policy makers so they could improve the condition of Polish citizens who are at the risk of fuel poverty. Taking part in the survey is totally anonymous and confidential. You cannot be identified in any way.

1. Have you ever encountered the situation where you were lacked of money on energy bills (electricity, gas, coal etc.)?	
1.1 It happens to me all the time	
1.2 It happens to me quite often	
1.3 It happens to me from time to time	
1.4 It happened to me so far only once	
1.5 It never happened to me	
2. How much energy do you use to heat your apartment / house?	
2.1 I consume too much energy	
2.2 I use as much energy as I need	
2.3 I consume not enough energy	
2.4 Hard to say	
3. How do you assess the level of your energy bills (electricity, gas, coal etc.)?	
3.1 Too high	
3.2 Too low	
3.3 Adequate to the consumption	
3.4 Hard to say	
4. How do you save energy? <i>Multiple-choice question</i>	
4.1 I turn off the lights in the empty rooms	
4.2 I turn off the devices I don't use	
4.3 I don't leave my chargers plugged in with no device attached	
4.4 I use power strips	
4.5 I buy energy-efficient appliances and electronics	
4.6 I run the washing machine, dishwasher only when they are full	
4.7 I use energy-saving light bulbs	
4.8 I renovate my apartment / house to reduce heat loss	
4.9 In a different way	
4.10 I don't save energy	
5. How often do you limit spending in other areas of life in order to pay energy bills?	
5.1 Very often	
5.2 Often	
5.3 Rarely	
5.4 Never - go to the question 7	
6. You save the money in order to pay energy bills on: <i>Multiple-choice question</i>	
6.1 Food	
6.1 Clothing	
6.1 Chemicals, cleaning agents	
6.1 Cosmetics	
6.1 Going to cinema, theatre, restaurants, etc.	
6.1 Renovation of your apartment or house	
6.1 Other expenses	
7. How do you heat your apartment / house? <i>Multiple-choice question</i>	
7.1 Electric heating	
7.2 Gas heating	
7.3 Oil heating	
7.4 Carbon heating	
7.5 Wood heating	
7.6 Other, please explain	
7.7 Don't know	

8. Which methods of payment of electricity bills do you use?	
8.1 Payment order after receipt of invoice	
8.2 Traditional bank transfer after receipt of invoice	
8.3 Electronic bank transfer after receipt of invoice	
8.4 Cash payment after receipt of invoice	
8.5 Traditional bank transfer as prepayment (ie. pre-paid)	
8.6 Electronic bank transfer as prepayment (ie. pre-paid)	
8.7 Cash payment as prepayment (ie. pre-paid)	
8.8 In a different way	

9. Why do you make a payment in this way?	
9.1 For reasons of convenience	
9.2 For security reasons	
9.3 Due to the ability to control the amount of energy consumption	
9.4 For other reasons, please explain	

10. Do you fall behind on your payments (electricity, gas, coal, etc.)? Multiple-choice question	
10.1 I fall behind on payments for electricity	
10.2 I fall behind on payments for gas	
10.3 I fall behind on payments for coal	
10.4 I fall behind on payments for gas	
10.5 I fall behind on payments for wood	
10.6 No, I don't - go to the question 16	

11. What are the main reasons for this? Multiple-choice question	
11.1 I forgot to pay the electricity bill - go to the question 13	
11.2 I pay only when I have no choice - go to the question 13	
11.3 I was surprised by the last bill - go to the question 13	
11.4 Incomes of my household are too low - go to the question 13	
11.5 Incomes of my household have been reduced - go to the question 12	
11.6 Other reasons	

12. What are the reasons for this? Multiple-choice question	
12.1 My own disease or disease of my relative	
12.2 Death of my relative	
12.3 Divorce or separation	
12.4 Loss of a job	
12.5 Other reasons	

13. How long do you fall behind on your payments?	
13.1 Less than 1 month	
13.2 From 1 to 2 months	
13.3 From 2 to 6 months	
13.4 From 6 to 12 months	
13.5 Over 1 year	
13.6 Hard to say	

14. How high are your arrears?	
14.1 Less than 50 zł	
14.2 From 50 to 100 zł	
14.3 From 101 to 200 zł	
14.4 From 201 to 300 zł	
14.5 More than 300 zł	

15. How do you assess the fact that you fall behind on your payments?	
15.1 It is a very big problem for me	
15.2 It is a rather big problem for me	
15.3 It is a rather small problem for me	
15.4 It is a very small problem for me	
15.5 This is not a problem for me	

16. Would you be willing to change your energy supplier?	
16.1 Definitely yes	
16.2 Rather yes	
16.3 Probably not	
16.4 Definitely not	
16.5 Hard to say	

17. Have you ever considered changing your energy supplier?	
17.1 Yes	
17.2 No	

18. How do you assess the standard of your apartment / house?	
18.1 As a very high	
18.2 As a rather high	
18.3 As a medium	
18.4 As a rather low	
18.5 As a very low	
18.6 Hard to say	

19. Does your apartment / house require the following measures of modernisation / renovation? <i>Multiple-choice question</i>	
19.1 Replacement / repair of the roof	
19.2 Replacing leaking windows	
19.3 Isolation of the walls	
19.4 Replacement of the heaters	
19.5 Dehumidification	
19.6 Other, please explain	
19.7 None of the above	

20. How do you assess the health situation of your household?	
20.1 Very good	
20.2 Rather good	
20.3 Satisfactory	
20.4 Bad	
20.5 Very bad	
20.6 Hard to say	

Respondent's particulars

21. Sex of the head of household	
21.1 F	
21.2 M	

22. Age of the head of household	
22.1 18-25	
22.2 26-35 years	
22.3 36-45 years	
22.4 46-55 years	
22.5 56-65 years	
22.6 Over 65 years	

23. Marital status of the head of household	
23.1 Single	
23.2 Divorced, divorcee	
23.3 Widower, widow	
23.4 Married	
23.5 Separation	

24. Education of the head of household	
24.1 Higher school or lower	
24.2 National Vocational Qualification	
24.3 Secondary education	
24.4 Higher education	

25. The average monthly income per household member	
25.1 Up to 500 zł	
25.2 From 501 - 1000 zł	
25.3 From 1001 to 1500 zł	
25.4 From 1501 to 2000 zł	
25.5 Over 2000 zł	

26. Average monthly bills on energy (TOTAL expenses for electricity, gas, coal, etc.).	
26.1 Up to 50 zł	
26.2 From 51 to 100 zł	
26.3 From 101 to 200 zł	
26.4 From 201 to 300 zł	
26.5 From 301 to 400 zł	
26.6 From 401 to 500 zł	
26.7 From 501 to 600 zł	
26.8 Over 600 zł	

27. The number of household members	
27.1 Adults	
27.2 Dependent children	

28. Do among the members of your household is a person with a disability?	
28.1 Yes	
28.2 No	

29. Does any of the members of your household receive social benefit?	
29.1 Yes	
29.2 No	
29.3 Don't know	

30. Building construction date	
30.1 Before 1945	
30.2 1945-1979	
30.3 1980-1989	
30.4 After 1990	

31. Type of building	
31.1 Single family - ownership	
31.2 Single family - renting	
31.3 Multi-family - ownership	
31.4 Multi-family - renting	