

Social and Spatial Changes in Energy Poverty

Albena VUTSOVA

*Sofia University “St. Kl. Ohridski”, Sofia, Bulgaria
avutsova@feb.uni-sofia.bg*

Emil MITOV

*Sofia University “St. Kl. Ohridski”, Sofia, Bulgaria
emil.mitov@feb.uni-sofia.bg*

Martina ARABADZHIEVA*

*Sofia University “St. Kl. Ohridski”, Sofia, Bulgaria
Corresponding author, m.arabadzhieva@feb.uni-sofia.bg

Abstract. *Energy poverty is an important societal and economic issue in Bulgaria and due to financial limitations a significant share of households is at risk of falling into this category. This study aims to analyze the socio-demographic and spatial aspects of energy poverty by assessing the impact of income, educational status, age, size and type of the households, as well as the characteristics of the residential building stock. Based on an empirical study of households, an assessment was made of specific subjective indicators for access to energy and an adequate quality of life. The results from the study show that elderly people, households with low income where people share a single-family home in small towns and villages, as well as single person households, are the most vulnerable with regards to the risk of energy poverty. The risk of energy poverty is not only due to economic factors, but also to a set of accompanying indicators, such as social structure, demographic characteristics, and type of dwelling. On the basis of an in-depth analysis, a number of targeted policy recommendations and measures for limiting energy poverty and improving energy efficiency have been formulated.*

Keywords: energy poverty, socio-demographic factors, energy efficiency, public policies, policy measures.

Introduction

Energy poverty is one of the most serious socio-economic challenges of the 21st century. It increases as a result of the dynamic geopolitical trends over the past few years and it is a challenge for social inclusion which countries have to deal with. Energy poverty is a multilayered issue because it has economic, social, and ecological dimensions - from energy prices and the income of the population to the energy efficiency of the residential building stock and climate policies. It mainly concerns households which cannot afford access to a sufficient quantity of energy for heating, lighting, or using essential electrical appliances.

On a global scale, 770 million people still do not have access to electricity according to the International Energy Agency. In the developing countries, energy poverty often means a complete lack of the necessary infrastructure, whilst in the industrialized regions - such as Europe - it is manifested through the inability to cover energy costs, especially in the winter months.

Over 35 million people in the European Union, who are not able to adequately heat their homes, fall into the ‘energy poverty’ category. The problem is especially acute in the countries of Southern and Eastern Europe where lower income and older residential buildings with lower energy efficiency are more severely impacted by the increasing energy prices. The 2022–2023 energy crisis caused by the geopolitical tension and the disruptions in the supply of gas has showed

how vulnerable even the developed economies can be when there is a lack of sustainable energy solutions.

According to Eurostat and the Energy Poverty Advisory Hub (EPAH), approximately 9.3% of the population in the EU did not manage to adequately heat their homes in 2022 (European Commission, Directorate General for Energy, 2024).

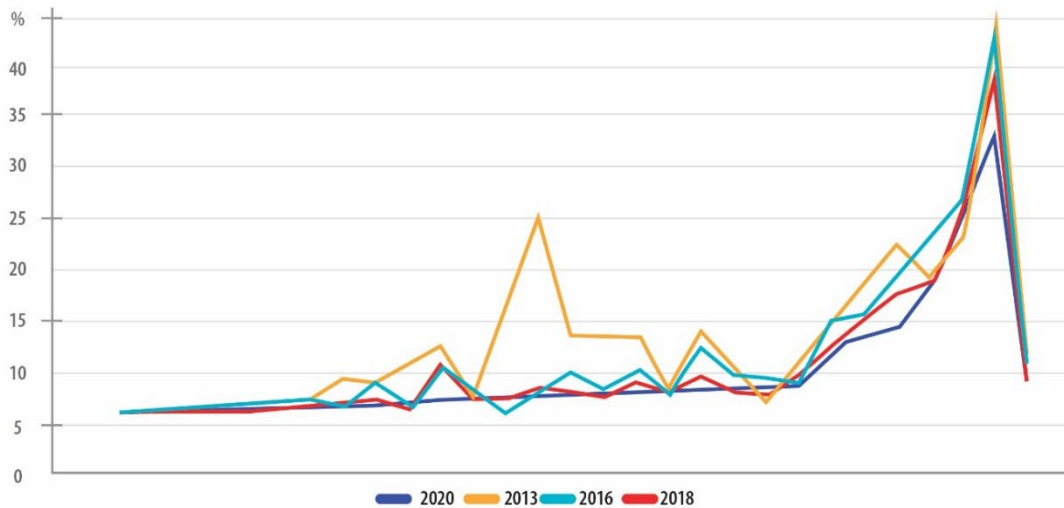


Figure 1: Share of the persons who are constantly unable to maintain their home adequately heated, 2013-2020. ¹

Source: Ozdemir&Koukoulfikis, 2024.

According to JRC report (Ozdemir&Koukoulfikis, 2024) it is evident that the countries from South-East Europe are impacted the most, despite some of them having a milder climate, and countries like Sweden, Denmark and Switzerland have the lowest levels thanks to the high income and effective energy policies.

Obviously, the issue of energy poverty has been the subject of numerous studies aimed at identifying effective solutions.

The aim of this study is to research and analyze the state and the socio-spatial models of energy policy in Bulgaria in the context of the Green Act by identifying the most vulnerable socio-demographic groups, assessing the impact of income, the characteristics of the residential building stock and its energy efficiency, and to formulate targeted policy recommendations for limiting it.

On the basis of a suitable methodological toolkit indicated below, we set the following research goals:

- To provide an overview of the theoretical and empirical approaches to measuring and analyzing energy poverty, including the indicators used and international practices.
- To analyze the socio-demographic profile of the households affected by energy poverty in Bulgaria, focusing on income, age, and education.
- To study the socio-spatial differences in the manifestation of energy poverty between the different types of settlements.
- To assess the impact of the characteristics of the residential building stock - age of the buildings, type of heating, energy efficiency, and ownership - on the risk of energy poverty.

¹ Germany is excluded from the total for the EU due to lack of data for seven out of the nine years of the period given. For Germany, the 2020 figure corresponds to 2019.

- To identify the subjective and objective risk factors perceived by the households in relation to the access to energy and the ability to maintain an adequate temperature in the dwelling.
- To offer policies and measures aimed at reducing energy poverty and improving the energy efficiency in the residential sector.

Literature review

EU and the energy poverty issue

The European Commission looks at energy poverty not only as an economic, but as a social and ecological issue as well. The European Green Act initiative envisages energy efficiency policies, investments in renewable energy sources, and targeted support for vulnerable groups through a Social Climate Fund. The aim is to guarantee a 'fair' energy transition which, however, poses economic and social challenges to vulnerable groups that allocate a significant amount of their income for energy costs, especially taking into consideration the fact that the prices of fossil fuels are systematically increasing.

According to the EC definition (European Union, 2023), energy poverty is defined as a 'situation in which a household or a natural person is unable to access essential energy services (heating, cooling, lighting, mobility, and electricity) in order to ensure a fair standard of living due to a combination of low-income, high-energy price, and low energy efficiency of the home.' The definition of energy poverty determines the category itself as poverty, without instructing on the types of support and ways of implementation.

In specialized literature, energy poverty is defined as lack of access to essential energy services which ensure a fair standard of living and health, including heating, cooling, lighting, and charging appliances, in correspondence with the national context.

According to some authors and their more up-to-date definitions of energy poverty, the latter depends on the impact of three main factors - low income, high energy needs (due to energy inefficient buildings), and high energy prices. Alongside that, there are a number of other conditionalities between this type of poverty and other factors - geopolitical, demographic, type of fuels and their availability, etc. (Doukas&Marinakis, 2020).

Some definitions of energy poverty specifically define groups or individuals that are accepted as energy poor, without highlighting the reasons and the levels of poverty. When a certain threshold that requires support is defined, it is a function of the existing resource. In some cases, an internal categorization is applied and the support, therefore, should be directed only to the poorest. Thomson et al. (2017a) define energy poverty as a household's insufficient access to energy services, including heating, cooling, lighting, and use of appliances.

Alternative definitions used by the UN (United Nations Organization, 2018) postulate the lack of access to high-quality energy services as energy poverty. Over the past years, some researchers included the aspects of sustainability in the concept of energy poverty, analyzing energy efficiency and access to renewable energy (Siksnyte-Butkiene, 2021).

Regardless of the increasing interest in Europe towards the impact of energy poverty on the health and well-being of the population, most of the studies are dominated by analyses of individual countries (Thomson et al., 2017b). In Eastern and Central Europe, energy poverty is most acute as households affected by this type of poverty show a considerably worse level of physical and mental health compared to households that are not energy poor.

There are several components that impact energy poverty - state of the energy markets, price trends, mobility, dwelling, household, and person. The level of impact and conditionality are illustrated on figure 2.

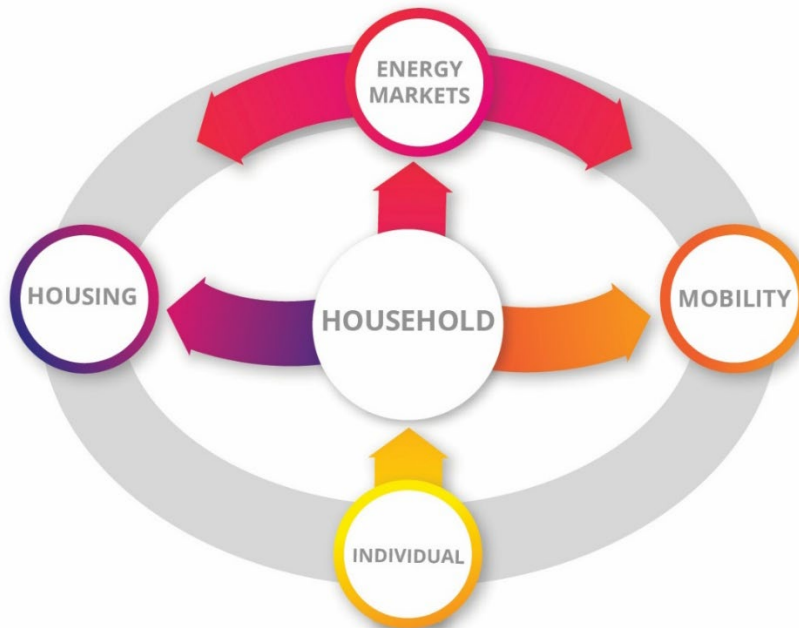


Figure 2: Components of energy poverty

Source: Adapted from Zahariev&Yordanov, 2023.

These components build a closed system in which households consume energy for living spaces depending on the number of household members, their age and health, and, respectively, whether they can or cannot get access to the necessary energy quantities.

Dealing with the issue of energy poverty, which is evidently a systemic one, requires an intersectoral approach that combines the efforts of public and local authorities, the private sector and the civil society. Measures are needed to improve the energy efficiency of buildings, encourage awareness about sensible consumption, and incentives for innovation in energy technologies. In a long-term aspect, dealing with energy poverty is not just a matter of access to energy, but a matter of social justice, sustainability, and human dignity.

The EU legal framework appeals for measures to overcome energy poverty and, moreover, EU Member States are obliged to assess and address the issue within their own national energy and climate plans. The Member States have to include measures for overcoming this issue in their energy and climate plans. Directives such as the revised Electricity Directive and Directive 2009/73/EC require measures for overcoming energy poverty, protecting vulnerable consumers, and assessing the households affected. The Energy Efficiency Directive focuses as a matter of priority on the reasons for energy poverty in the context of the commitments to energy efficiency. With the revised Energy Performance of Buildings Directive, the Member States are obliged to introduce national measures for alleviating energy poverty through long-term strategies for renovating the residential building stock.

With Directive (EU) 2019/944, the European Commission imposes an obligation on Member States to establish systems for identifying and protecting households which are at risk of energy poverty. In the implementation of programs aimed at increasing energy efficiency and installing renewable energy resources, vulnerable groups have to be prioritized

(Directive 2012/27/EU and Directive 2010/31/EU, revised in 2021 and 2023). In order to avoid a negative impact of the climate policies and the expanded scheme for trading with emissions from buildings and the automotive transport, the EU adopted the Regulation establishing a Social Climate Fund with the aim of providing protection and support to the most vulnerable groups. The Energy Efficiency Directive (European Parliament & Council of the European Union, 2023) came into force on 20/09/2023 and there was a two-year transitional period after which there are going to be opportunities to provide support to energy poor households through the obligation schemes for energy suppliers. Some of the taxable entities will be as follows:

- end suppliers, suppliers of last resort, traders that sell electricity to end users amounting to more than 20 standard measurement units (SMU) annually;
- enterprises with heating networks and suppliers of thermal energy that sell thermal energy to end users amounting to more than 20 SMUs annually;
- end suppliers and natural gas traders that sell to end users more than 10 SMUs annually;
- traders of liquid fuels that sell more than 2 000 t of liquid fuels annually to end users;
- traders of fossil fuels that sell more than 13 000 t of fossil fuels annually to end users.

According to the EU legal framework, overcoming energy poverty does not impede the smooth functioning of the markets and it underlines the importance of a fair retail market for a smooth transition. The report of the International Monetary Fund (IMF, 2022) also notes that the poorest countries that have no preparations in place to protect the population against emerging crises and long-term changes are going to be the most affected by the climate crisis. The countries should prepare their social systems in order to meet the new needs of the society and citizens. The application of universal rules is an unbearable financial burden for every government.

One of the possible solutions is the introduction of a ‘social tariff’. The idea behind the social tariff is for energy poor consumers to buy the energy they need directly and at a lower ‘social’ price calculated for example as a percentage of the regular price that the rest of the consumers pay. Regardless of being met with a lot of objections, such a tariff was introduced in some EU countries. (For example, the Special Solidarity Tariff - Tarif spécial de solidarité – TSS) is directed at consumers of gas, both in individual houses and in apartment blocks. This tariff envisages either a discount form the bill or standard monthly allowances for households (Zahariev & Yordanov, 2023).

Means of measuring energy poverty

There are very few available and generally accepted indicators for measuring energy poverty because they have to cover the complexity of the issue, which is a difficult task due to the fact that energy poverty is the result of numerous reasons and it manifests itself in different forms. The Energy Poverty Advisory Hub (EPAH) (Gouveia et al., 2022) looks at the reasons for energy poverty as ones that are due to contextual and individual factors, identifying low income, low energy efficiency, and high energy prices. The consequences of energy poverty on human well-being can be severe both in a short-term and long-term aspect (Gouveia et al., 2022). The impact on particular groups of the population can be different due to the social and demographic specificities, composition of the household, health, energy literacy, and cultural factors.

There is no consensus as to how to best measure energy poverty. The lack of a universally accepted indicator can be explained with the lack of consensus regarding the consumer basket of essential energy services (Culver, 2017). This is partly related to the fact that the consumption of energy varies significantly due to the national specificities. Whilst research publications agree that energy poverty is related to the lack of energy services, there is no data as to how this concept can

be turned into a standardized set of measurements. At the same time, there is an agreement that the measurable parameters of energy poverty should not be randomly selected, without taking into account their shortcomings and without knowing which aspect of energy poverty the specific indicator is measuring (Herrero, 2017). Pye et al. (2017) reach to the conclusion that the concept of energy poverty varies significantly in individual EU Member States.

Gouveia et al. (2022) divide the indicators of energy poverty in the EU as follows: ones based on costs, self-evaluative (subjective approach), and direct indicators.

Bulgaria - the energy poverty issue

Energy poverty is a relatively new issue that affects our society. It gained a lot of attention in 2013 when a series of protests took place due to the high electricity prices. In recent years, the issue exists in one form or another. In the national context, energy poverty is especially concerning because of the combination of low-income, high-energy costs, old residential building infrastructure, and limited access to energy efficient technologies. Part of the households with lower-than-average income for the country are forced to choose between heating and other vital needs, such as food, medicines, or education. The issue with this type of poverty has become more topical in the light of global efforts aimed at a transition towards sustainable energy and fighting climate change. The question is not only how to reduce emissions, but how to ensure that this transition does not leave anyone behind. Due to the fact that for a long time Bulgaria lacked a clear definition of energy poverty, a number of working definitions had to be used.

In 2022, for example Peneva et al. (2022) suggested the following framework definition for energy poverty: ‘An energy poor consumer (an individual or a household) is one that, at the current prices for energy services (electricity, heating, gas), due to their income, age, employment status, marital and/or health status falls under the official poverty threshold after deducting the costs related to reasonable consumption of energy services at home that are necessary to perform various non-commercial, domestic activities in order to ensure the statutory standards for heating in the living space of the dwelling and for lighting, use of different domestic and other types of appliances for cooking, lighting, cooling, hot water, fun, exchange of information, etc. that are needed to satisfy the respective basic needs.’

At a subsequent stage, a number of research groups offered working definitions. In November 2023, within the Energy Act Bulgaria adopted an official definition of energy poverty - ‘A household in the state of energy poverty is one that, at the current prices for energy services, has an available average monthly income per member of the household for the previous year which is lower or equal to the official poverty threshold and which is then reduced by the costs for covering the type of energy consumption defined according to the energy characteristics of the home, and one that as a result lacks access to essential energy services for adequate heating, cooling, lighting, and energy supply for domestic appliances.’ The definition is a result of previous research conducted by the Institute for Economic Research at BAS in 2022 (Zlatinov et al., 2024).

In the fast-paced economic environment, research on energy poverty is often a mix of quantitative and qualitative approaches and there should be a consensus as to how exactly it should be measured - for example, as a percentage of the income that is spent on energy or as a level of comfort and access to essential energy services.

Quantitative research uses **surveys**, analysis of data from national statistical institutes, etc. It provides information about the income of households, energy costs, and the consumption of energy resources, energy prices. A household in the state of energy poverty is one that, at the current prices for energy services, has an available average monthly income per member of the

household for the previous year which is lower or equal to the official poverty threshold and which is then reduced by the costs for covering the type of energy consumption defined according to the energy characteristics of the home, and one that as a result lacks access to essential energy services for adequate heating, cooling, lighting, and energy supply for domestic appliances. Based on this information, models and different forecasts can be developed. Quantitative research uses **secondary data** from different agencies or foreign databases; it implements **descriptive statistics** in which the data is processed through calculating basic statistical indicators, such as average values, medians, standard deviations, and percentages; **correlation analysis** studies the links between two or more variables, **regression analysis**: this method models the dependencies between independent variables (such as income, educational level, etc.) and the dependable variable (for example, energy poverty).; **time series analysis**: studies data collected over particular period of time; **group analysis**: segments the data of different groups (for example, according to income, geographical region, or type of household) and researchers can compare the differences in energy poverty between different populations; **meta-analysis**: combines the results from different studies in order to assess the common trends and effects in the context of energy poverty.

Qualitative research usually focuses on the **analysis of text data** and could contribute additionally to enrich the existing information. To a certain degree, **geographic information systems (GIS)**: allow us to visualize the spatial distribution of energy poverty. By mapping the data about income and energy costs, researchers can identify regions with a high concentration of energy poverty. A PEST analysis is applied in order to support specific political solutions that prevent the issue. Different indexes are used in correspondence with the ones used in the EU. The most commonly used ones are:

- **Share of energy costs**, which represents the percentage of the income of households that is spent on energy services. A threshold level is often applied (10% or 15%) in order to determine whether a household is energy poor.
- **Energy poverty index**, which combines different aspects of energy poverty, including energy costs, income, and access to essential energy services. It offers a summarized evaluation of the energy poverty in a given region.
- **Energy efficiency index**: it is applied in order to assess the energy consumption in households in the context of their income and the size of the dwelling.
- **Access to energy services indicator**- includes data about the availability of electricity, heating, and cooling, as well as the quality of these services.
- **Quality of the dwelling**: assesses the physical conditions of dwellings (insulation, availability of heating systems, etc.) and could be used to assess the vulnerability of households to energy poverty.
- **Social and economic vulnerability index**: This index combines different socio-economic factors, such as income, education, employment, etc. and is used to evaluate the risks of energy poverty in different populations.
- **Regional energy poverty index** - identifies regions with a higher concentration of energy poverty.

Since the issue of ‘energy poverty’ in Bulgaria is a permanent one, many researchers analyze the genesis and reasons for its durability. Some studies show that around 60% of the households in the 2014-2019 period spent over 10% of their net income on energy, where the average share of the energy costs from the income is 14% (Peneva, 2022). The share of energy poor people is approximately 32% of the general population or with almost 8 to 10 percentage

points higher than those of people under the poverty threshold. (Zlatinov et al., 2024). It must be noted, however, that the share of energy poor people does not only depend on the economic development of the country, but also on the active energy policy and the regulation of the prices on the household market. This share has its own dynamic, which is a little more different than the one of the official poverty threshold. The 30% with the lowest income of the population remain in permanent energy poverty, regardless of the macroeconomic situation in the country (Zlatinov et al., 2024). Figure 3 below clearly shows the ratio of the levels of energy poverty in Bulgaria and in the EU.

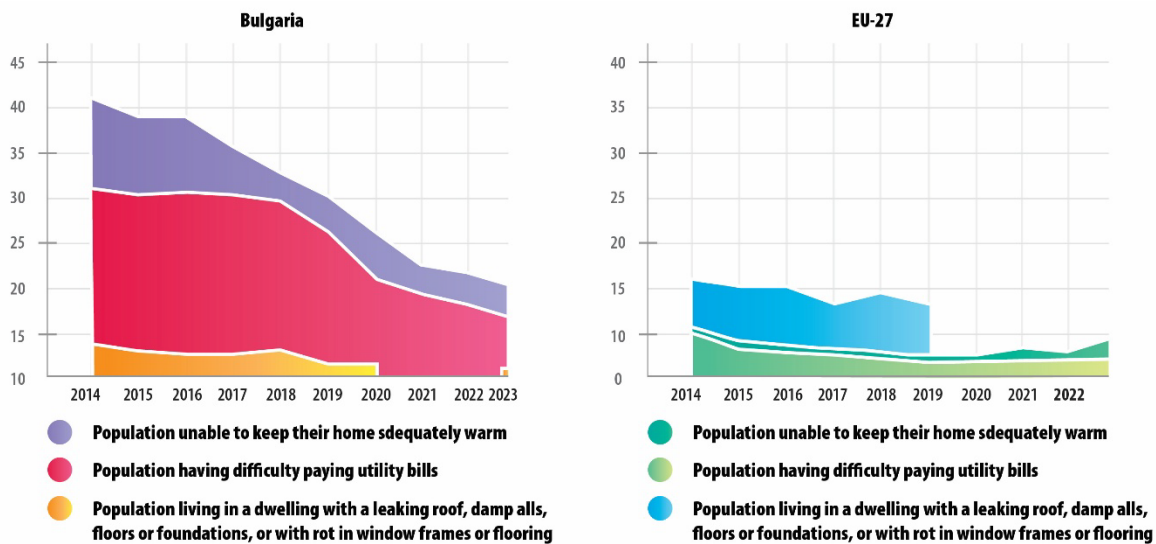


Figure 3. Energy poverty indicators according to Eurostat (%)

Source: Eurostat, SILC, 2024.

The chronological overview of the state of energy consumption in Bulgaria and, respectively, the emergence of the ‘energy poverty’ phenomenon (Table 1) show that energy poverty emerged at the beginning of the previous period (90 years). This is understandable, taking into account that the transformation from a centrally planned economy to market economy is always painful. It is accompanied by a high unemployment rate in specific periods and a visible layering of social groups.

Table 1: Energy poverty in Bulgaria (1980–2024)

Year/Period	Political context	% of households affected by energy poverty*	Main characteristics
1980–1989	Centrally planned economy	<5% (not measurable)	Subsidized energy, universal access
1990–1995	Beginning of the transition period	~20–30% (evaluation)	Liberalization of prices, reduction in income
1996–2000	Economic crisis	~30–40%	Mass transition to fossil fuels
2001–2006	Before EU membership	~35%	Lack of targeted policies, low efficiency
2007–2012	EU membership	~40–50%	Retrofitting without a social focus, first research
2013	Protest against the price of electricity	~60% (the ‘10% rule’)	Great public pressure, beginning of the debate
2014–2018	Social benefits for heating	~50–55%	Partial measures lack of definition

Year/Period	Political context	% of households affected by energy poverty*	Main characteristics
2019–2022	Green Act, COVID crisis	~45–50%	Vulnerable groups, increasing energy prices
2023	Definition adopted by the state	~23.7%	Introduction of new criteria and pilot programs
2024	European policies in force	~22–24%	National Energy and Climate plan

Sources: NSI, Eurostat, Open Society Institute - Sofia, BAS; WWF Bulgaria².

A confirmation of the above-mentioned statement is presented in Fig. 4 which illustrates the dynamic of GDP in an approximately 40-year-long period.

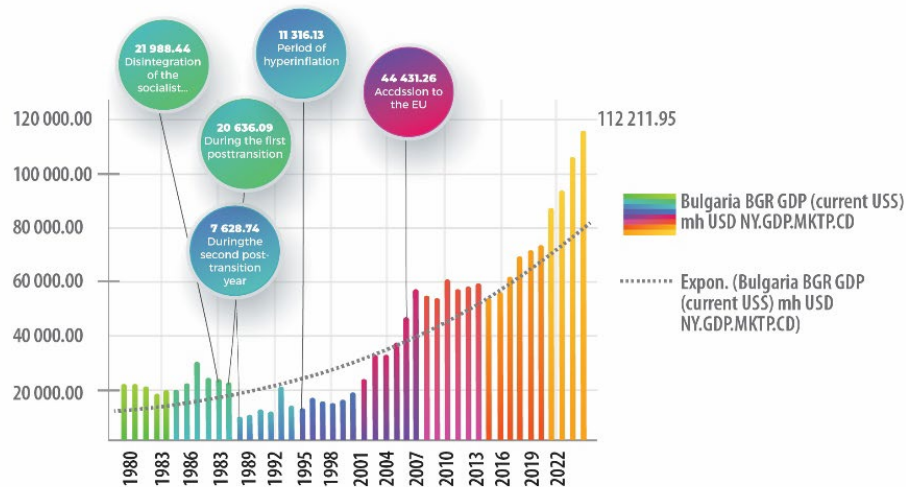


Figure 4. Income mobility of the population - World Bank

Source: World Bank, 2025.

It is evident that the beginning of the transition period was marked by a severe drop in GDP in comparison to previous years and it managed to achieve the levels before the changes as early as the beginning of the new millennium. Naturally, this affects the income of the population and indirectly impacts the levels of energy poverty. The drop in GDP in 2013 and its slow recovery in 2014 was due to a decrease in the internal demand. The significant shrinking in the internal demand (15%) for Bulgaria came from the cumulative drop in investments in this period which led to a deflation in the 2013 – 2015 period (Kasabov&Kasabov, 2015). ‘The formation of a negative inflation in the second half of 2013 and its preservation in 2014 also reflected the deflation effect of international prices. Due to the limited size and the openness of our economy, international prices of food, fuels and other essential materials traditionally have a significant impact on the end consumer prices in the country’. Another factor that had a negative impact on the recovery of the economy in 2014 were the disruptions in the bank system in the second half of 2014 which had a negative effect on the credit activity of banks and companies.

Taking into account the variety of indicators, a synthesized version of a formula for energy poverty is proposed: $\frac{D - E}{N} \leq L$

² The percentages are indicative and depend on the methodology used and the period of acquiring the data and their duration.

where:

D - total income of the household (monthly or annual),

E = costs for ‘specific energy consumption’ (electricity, heating, cooking, etc.),

N = number of members of the household,

L = official poverty threshold (to be determined annually by the Ministry of Labor and Social Policy; for example, for 2024 – BGN 526 (EUR 269) member/month).

In table 2, there are approximate values of the main indicators and their respective weight in the evaluation of energy poverty. Their values, to a large extent, are relevant to ones established in a national study.

Table 2: Main indicators

Indicator	What is it	Approximate ³ weight*
Household income	Value received after deducting the energy-type costs from the budget of the household	38–52%
Energy costs	Collates electricity, heating, fuel costs depending on tariffs and seasonality	18–23%
Characteristics of the home	Type of building, insulation, heating system, area	10–12%
Composition of the household	Number of members, age, children, or disabled people	10–12%
Subjective evaluation	Sense of cold, discomfort, social isolation	5–8%

Source: Authors’ own research.

The household income holds the biggest weight because it is formed by their financial resource and this impacts the degree of energy costs a household can afford. The remaining parameters can increase or alleviate the size of the energy costs depending on the characteristics of the building and the residents of the home, but they are not defining. The subjective factor is only additive.

Methodology

The methodological set of tools implemented incorporates several approaches: A national study was conducted through surveys, summarizing the information regarding household incomes, energy costs, consumption of energy services, living conditions, and demographic profiles. The structured survey among households allows for the accumulation of data regarding the type of heating systems and energy services used, characteristics of the home, seasonal difficulties related to heating and cooling. The national study was conducted in 2024 among 764 respondents who are 18+, representatives of households from around the country, on the following grounds: sex, age, type of settlement and education. In the study, a data registering method was applied that included a standardized personal ‘face-to-face’ interview using a tablet for the purpose of registering data (TAPI Tablet Assisted Personal Interviewing). The survey allowed for measuring both objective financial indicators, as well as subjective evaluations about energy vulnerability.

Subjective indicators which deal with self-evaluation indicators measuring the perception of comfort in the home, subjective evaluation about the adequacy of the heating, difficulties in terms of covering energy costs; feelings of energy insecurity or insufficiency, were also included. These indicators are in addition to the quantitative data and support the identification of households that experience a subjective discomfort which is not always reflected in the statistical indicators.

³ The weight of the indicators is indicative and vary depending in the specific model. In some LIHC methods, the focus is more income and costs, whilst in subjective surveys personal perception carries more weight.

The National Statistical Institute, European Statistical Databases, and other existing national and international studies that accumulate indicators on income, energy costs, consumption of energy resources, building characteristics, have contributed to the research with secondary data.

In view of the accurate interpretation of the data, it is necessary to make a few methodological clarifications:

The households in the sample are grouped in three groups according to the weight of their heating costs within the total income of the household during the winter months. They are allocated in the following categories:

- Group 1: households with low heating costs (under 10% of the income),
- Group 2: households at risk of energy poverty (with heating costs during the winter between 11-15%) and
- Group 3: households in the category of energy poverty (with heating costs during the winter of over 15% of their income).

The separation of these three groups is done based on an analysis of the general statistical distribution of the households in the sample according to the criterion for an approximate average cost of the household for heating during the winter months as a share of the total income of the household. The results from this analysis show the following specifics:

The average costs of all households for heating during the winter as a share of the household income is 10,43%. The average and the mode overlap (the most common answer in the heating costs - income ratio is also 10%). The median (the quantity that shows the value which divides the distribution in two equal parts) is 8% - i.e. half of the households have heating costs that fall under 8% of their income, and the other half have heating costs that are over 8% of their income. The data about the percentile groups⁴ with regards to heating costs is presented in Table 3.

Table 3: Distribution of households according to the share of heating costs

Percentile groups*	Heating costs as a share of the total household income
The first 10% with the lowest heating costs	Under 3,7%
10-20	Between 3,7 and 4,9%
20-30	Between 4,9% and 6,0%
30-40	Between 6,0% and 7,1%
40-50	Between 7,1% and 8,0%
50-60	Between 8,0% and 10,0%
60-70	Between 10,0% and 11,1%
70-80	Between 11,1% and 13,4%
80-90	Between 13,4%-19,7%
Over 90	Over 19,7%

Source: Authors' own research.

The first percentile group (the first ten percent with the lowest heating costs) pays heating costs that are under 3,7% of their income. The second percentile group pays between 3,7% and 4,9% for heating. The third percentile group pays between 4,9% and 60%, etc. Positioned in this order, it is interesting that 60% of the households pay under 10% - as we said, the average and the median are around this value, which is why this group was distinguished as the group with low

⁴ Separating the accumulation in 10 equal parts.

heating costs– under 10% of their income). The following specifics were taken into account for the other two groups – the final two percentile groups - those with the highest heating costs during the winter have costs over 19,7%, and the former group – costs between 13,4% and 19,7% of the household income. Following the logic of this distribution, the following groups were established:

- households with heating costs in the winter that are under 10% of the income. This group is called - households with ‘low heating costs’
- households that spend between 11% and 15% of the household income on heating in the winter. This group is deemed at risk of energy poverty.
- households that spend over 15% of the household income for heating in the winter. In this group, the costs of the households vary within a large spectrum and some of them even surpass 30%. This group is called ‘households in energy poverty or energy poor households. The share of each of these groups is as follows:

Table 4: Share of the groups of households at risk of energy poverty

Group 1: households with low heating costs (under 10% of the income),	68%
Group 2: households at risk of energy poverty (with heating costs during the winter between 11-15%) and	15%
Group 3: households in the category of energy poverty (with heating costs during the winter of over 15% of their income).	17%

Source: Authors’ own research.

Results and discussions

The analysis also examines the specificities, demographic features, living conditions, and behavior of each of the three groups. The specifics of the households have been outlined - which particularities of their dwellings and living conditions are a precondition for energy poverty and which factors determine this status to the largest extent.

This is an opportunity to define **the share of the groups of households that fall into the category of energy poor households**. The following demographic profile has been distinguished for households in the energy poverty category (with heating costs over 15% of their income):

- The individuals in energy poor households are most often over 60 years of age with a secondary school level of education, living in villages, district cities or small towns.
- The individuals from households at risk of energy poverty are most often over 50 years of age, living in small towns and villages, with a completed secondary school and higher education.
- The individuals with low heating costs are mainly located in district cities and small towns, with a completed secondary school education or higher education.

The age distribution of individuals at risk of energy poverty is illustrated in Figure 5.

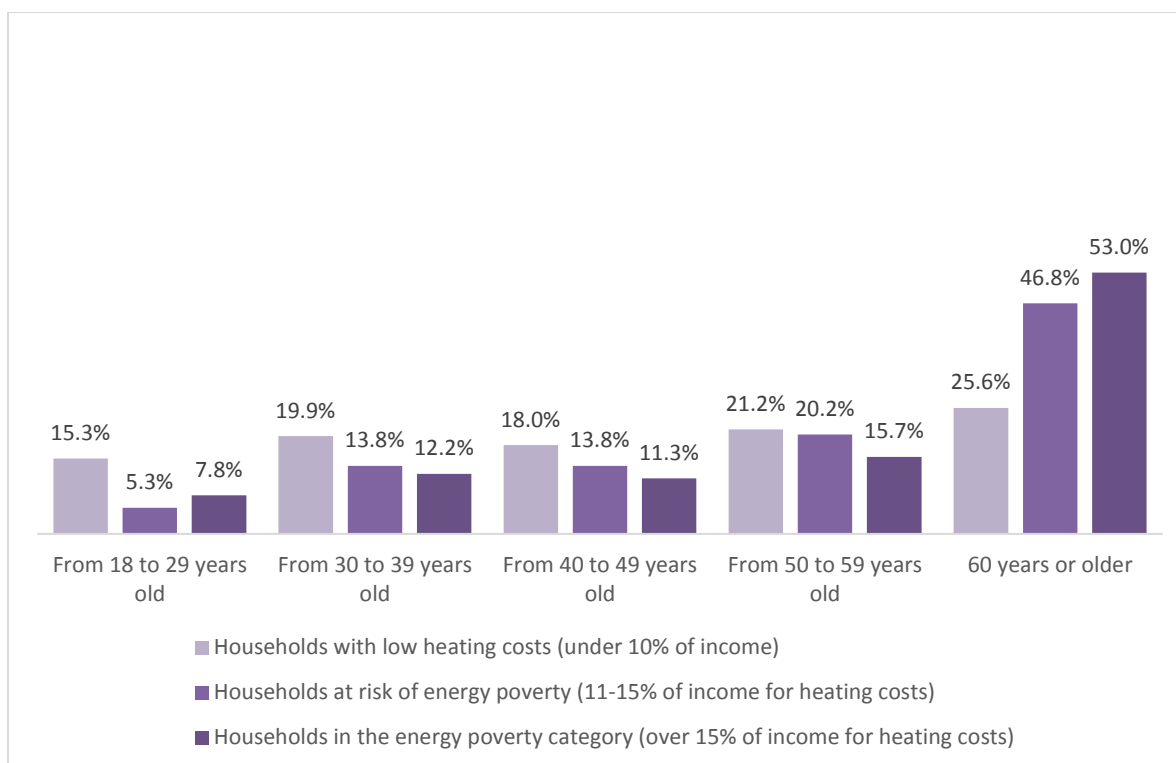


Figure 5: Age distribution

Among the households with low heating costs, the highest share lives in district cities (almost 45%). One fifth of the households with low heating costs live in small towns, another one fifth - in villages, and around 14% - in the capital. Among the ones living in the capital, approximately three quarters of the respondents are from households with low heating costs, one in ten - from a household at risk, and around 14% - from a household in the energy poverty category. Among the residents of district cities, three quarters are from households with low heating costs and approximately 13 % are from households at risk of energy poverty. Among the residents of small towns, around two thirds are from households with low heating costs and approximately one fifth - from households at risk or in the energy poverty category. Around 57% of the residents in villages are from households with low heating costs, around 17% - from households at risk of energy poverty, and around a quarter- from households in the energy poverty category.

Despite the fact that electricity prices in Bulgaria are among the lowest in Europe, the percentage of poor households⁵ is among the highest in the European Union. This is one of the factors according to which energy poverty in Bulgaria differs significantly from the one in developed countries from Western and Northern Europe where the main reason is the poor quality of the residential buildings (Peneva, 2022).

Dealing with the 'energy poverty' phenomenon is monitored by the EC through the European Energy Poverty Index (EEPI) and is evaluated on a scale from 1 to 100 (indicated in Table 3). Sweden, Finland, Austria, and Denmark are the best at dealing with the issue, Hungary, Slovakia, Portugal respectfully have the following indexes: 6.19, 8.35, and 36.67, and Bulgaria takes the bottom most position with an index of 0.71 according to the internal sub-index for

⁵ According to the official definitions of poverty and measurement methods of Eurostat

household energy poverty (last of all the EU countries) and second to last before Hungary with 5.30 of the total Energy Poverty Index (Zlatinov et al., 2024).

Table 5: European Energy Poverty Index

Country	EPI	DEPI	TEPI	Country	EPI	EDEPI	ETEPI
Sweden	86.34	95.41	78.13	Slovenia	62.05	51.34	74.90
Luxembourg	83.07	80.88	87.19	Lithuania	57.42	42.37	77.82
Austria	79.58	81.21	77.99	Croatia	57.19	58.79	55.64
Denmark	78.04	81.88	76.10	Greece	56.70	43.60	73.58
The Netherlands	77.25	78.09	76.42	Ireland	55.86	79.29	39.35
France	75.35	73.33	77.43	Portugal	53.42	36.67	77.83
The United Kingdom	74.98	80.54	69.79	Latvia	52.55	40.01	69.03
Belgium	73.26	67.62	79.37	Italy	52.09	52.10	52.08
Germany	72.32	75.77	69.02	Estonia	48.65	58.02	40.80
Spain	71.80	64.67	79.72	Slovakia	26.33	8.35	83.04
The Czech Republic	68.99	60.21	79.05	Finland	18.38	85.56	3.95
Poland	64.45	61.01	68.08	Malta	15.56	58.56	4.13
Romania	62.40	64.23	60.63	Bulgaria	5.30	0.71	39.55
Cyprus	62.27	46.23	73.90	Hungary	4.57	6.19	3.38

Source: OpenExp, 2019.

The European Energy Poverty Index (EEPI)⁶ is a composite indicator which evaluates and ranks the progress Member States make in regards to alleviating the household and transport energy poverty, as well as their connection (OpenExp, 2019). It consists of two sub-indexes – European Household Energy Poverty Index (EDEPI)⁷ and European Transport Energy Poverty Index (ETEPI)⁸. The EEPI result is calculated for the population from the first quintile of income (lowest level of income) as an average geometric value of EDEPI and ETEPI. The higher the result, the better the country's performance is.

Table 6 *illustrates the dynamic* of the poverty threshold⁹ and the energy poverty threshold of one individual after deducting energy costs.

⁶ European Energy Poverty Index.

⁷ European Domestic Energy Poverty Index

⁸ European Transport Energy Poverty Index

⁹ Until 2019, the official poverty threshold had been calculated according to a methodology adopted with Decree No. 345/2006 of the Council of Ministers, in which it is calculated as a percentage of the median total net equivalent income for the country on the basis of pre-defined minimum living needs. In accordance with the methodology adopted with Decree No. 241/2019 of the Council of Ministers, the official poverty threshold is linked to the poverty threshold of an equivalent unit according to data from the EU-SILC study, but taking into account the inflation on the basis of the small consumer basket. This methodology was used to determine the official poverty thresholds for 2020 and 2021. In August 2021, the methodology changed and the official poverty threshold for 2022 and after that is equal to the poverty threshold according to SILC, without taking into account the impact of the inflation.

Table 6: Poverty threshold and energy poverty threshold of one individual in the context of energy costs

	014	015	016	017	018	019	020	021	022
Poverty threshold according to SILC⁷⁹									
BGN/year	885	910	698	213	213	957	412	052	311
BGN/year	24	26	08	51	51	13	51	04	26
Annual growth (%)		.6	5.4	3.9	.0	7.7	.2	1.8	.3
Energy poverty threshold per individual according to SILC (with a reflected energy cost)									
BGN/year	665	788	602	121	153	869	429	111	323
BGN/year	89	99	84	27	29	89	36	93	10
Annual growth (%)		.6	3.9	1.3	.6	3.9	.5	0.6	.0
Ratio between the two thresholds	.20	.22	.24	.22	.22	.18	.19	.17	.16

Source: Zlatinov et al., 2024.

There is a decrease in the ratio between the two thresholds, as well as a gradual decrease in the difference (from approximately 20% in 2014 to 15% in 2023), which, to a certain extent, is due to the ongoing trend of a decrease in the average number household members (Zlatinov et al., 2024).

Figure 6 shows the condition of households that are at risk of energy poverty depending on the type of settlement.

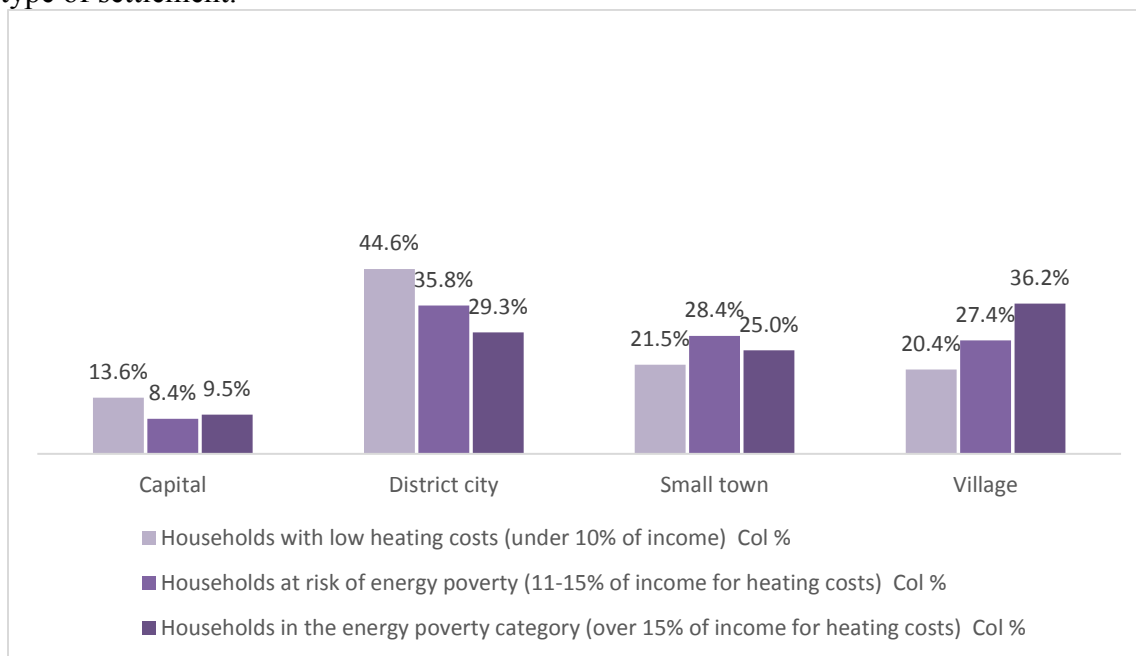


Figure 6: Type of settlement

When researching the dependency of energy poverty on the educational level (37% university graduates, approximately 50% – with secondary school education and 15% - with primary school education or lower), it was established that among the households with low heating costs, the share of the university graduates is higher and there is a lower share of people with primary or secondary school education who have low energy costs. Among the households which are at risk of energy poverty, the share of people with a completed secondary school education is higher and there is a lower share of people with a university degree or a primary school education in that category. Among the households in the energy poverty category, we have a significantly higher share of people with a primary school education (22,3%) compared to the average for the country. These dependencies are illustrated on Figure 7.

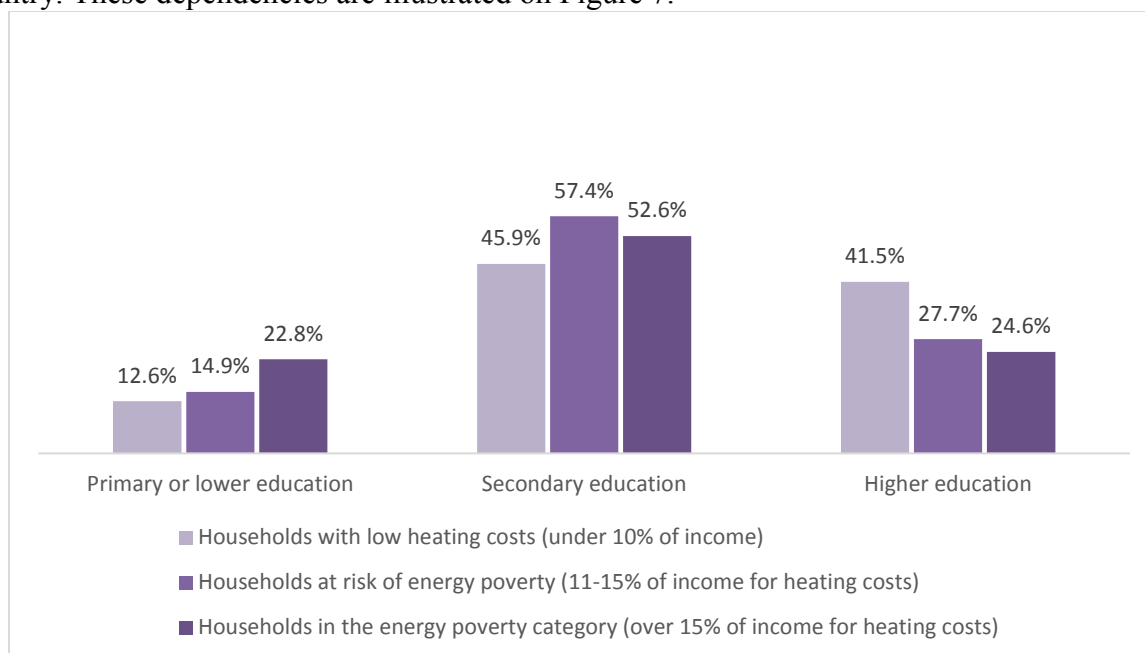


Figure 7: Level of education

The research data shows that households with low heating costs have an average monthly income of around BGN 2 900 (~EUR 1 480); households at risk of energy poverty have an income of approximately BGN 2 000 (~EUR 1 020), and for the households in the energy poverty category - BGN 1 500 (~EUR 767) (Figure 8).

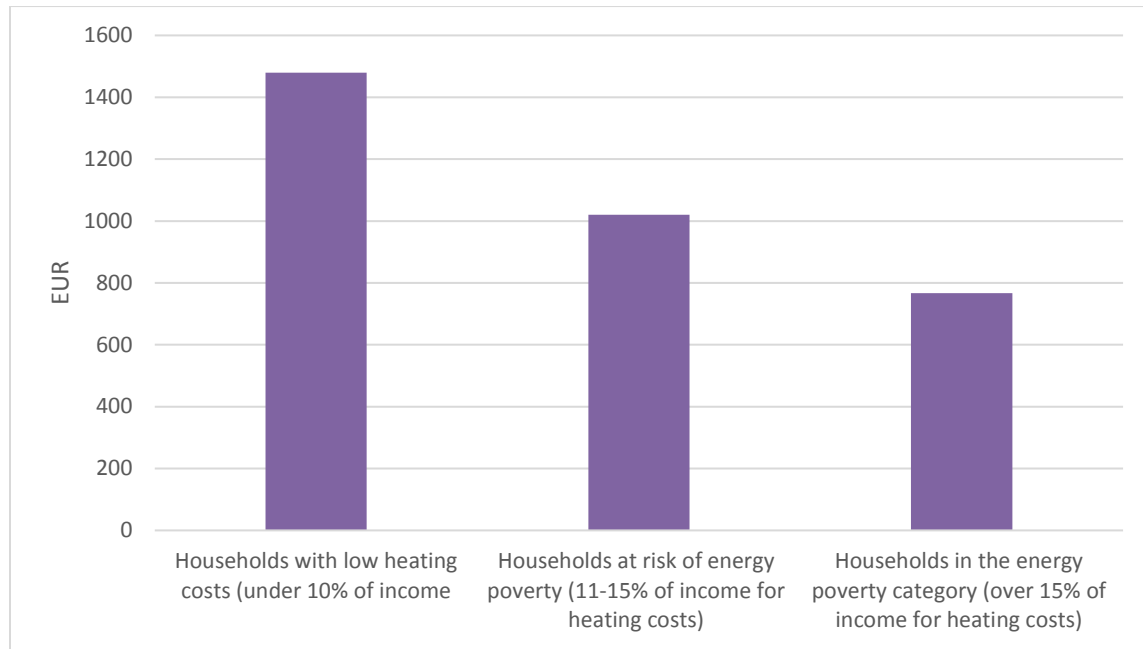


Figure 8: Total monthly income per household in Euro

The households in the energy poverty category often consist of one to three people. Among the single-person households, we have an almost twice as high share of households in the energy poverty category in comparison with the average level registered for the country.

The conditionality between the type of dwelling and the level of energy poverty has been examined. **Approximately two in five households live in a single-family house (41%), one in four – in an apartment in a brickwork apartment block/apartment houses (24,6%), and one in five live in panel-system buildings (21,9%).** 6,4% of households live in an apartment in a panel-system building and approximately 5% - in a multi-family house (Figure 9).

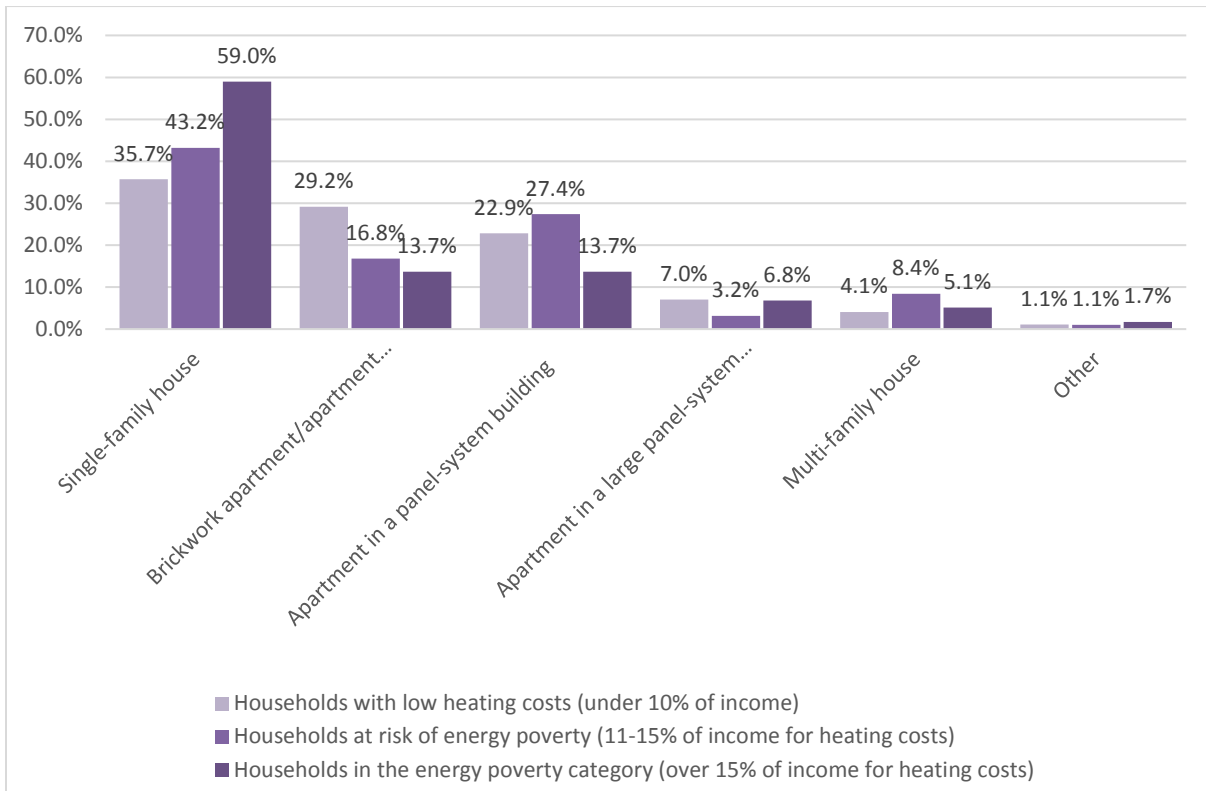


Figure 9: What type of dwelling do you live in?

The predominant part of households in the energy poverty category (with heating costs over 15% of the income) live in single-family houses. The households that are at risk of energy poverty often live in single-family houses (43,2%). The remaining 27% live in an apartment in a panel-system building, approximately 17% - in an apartment in a brickwork building/apartment house, and 8,4% -in a multi-family house.

- Among the respondents who are responsible for households at a risk of energy poverty, who often claim to live in single-family houses, there are a lot of people with a secondary school education, over the age of 50, living in small towns and villages.
- Among the households with low heating costs, around 36% live in single-family houses, and around 29% - in an apartment in a brickwork building/apartment house and around 23% - in a panel-system building.
- These are often people who claim that they could afford most essential goods, with a secondary school diploma or university degree, residents of district cities, towns, and villages.
- Around half of the households with low heating costs in the country live in apartments in panel-system buildings, and 3 in 10 - in a brickwork building/apartment house.
- Among the households with low heating costs, approximately 9 in 10 live in single-family houses.

Among the households from the total studied, the area of the total living area of their dwellings is often between 51 and 90 m². The average value is around 93 m², the median i.e. the value in the middle between the lowest and the highest value of the living area, is 80 m², and the mode, which is most often indicated by respondents, is 90 m². Around 8% of the households live

in dwellings with an area of up to 50 m². The highest share of households lives in an area between 51 and 70 m² – 30%, as well as the ones whose homes are between 71 and 90 m². A living area between 91 and 100 m² is occupied by 12,5% of the households. Respectively, 9,4% live in homes with a living area of 101 and 120 m², and 11,8% - in homes with a living area above 120 m². The conditionality between the area of the dwelling and the risk of energy poverty is illustrated on Figure 10.

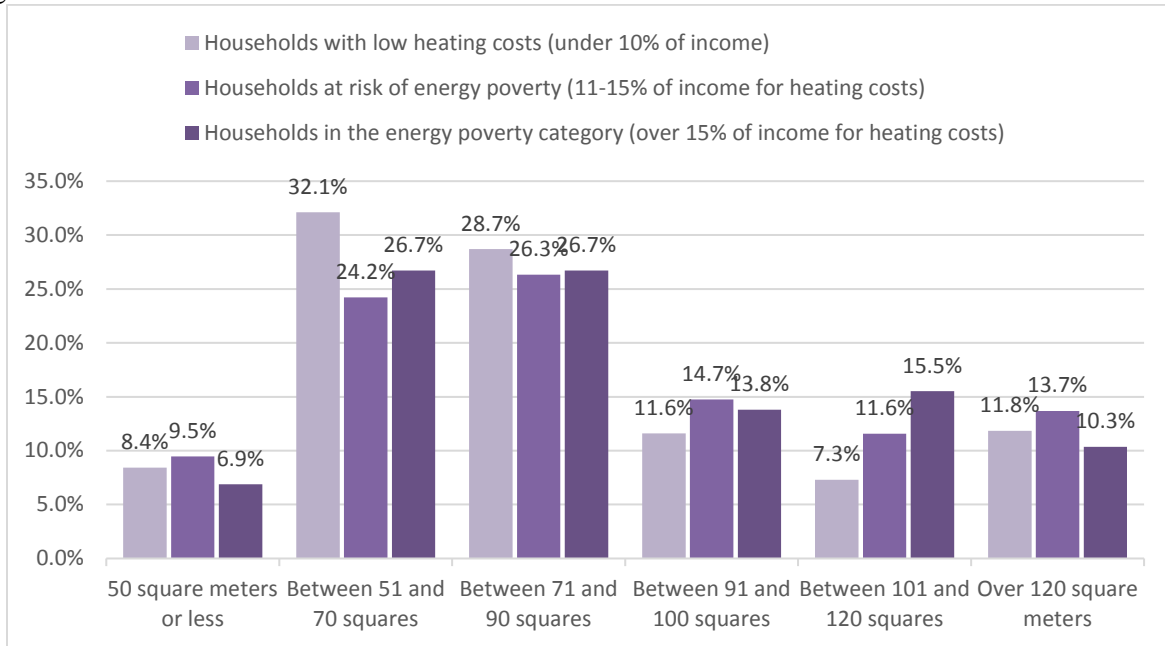


Figure 10: The square area of the total living area and trends towards energy poverty

There are no significant statistical differences according to the types of target groups. An exception is registered among households in the energy poverty category – the share of people living in homes with an area between 101 and 120 m² is 6 percentage points higher than the average level registered on a national scale, as well as among the households that are at risk of energy poverty – the share of people living in homes with an area of 51-70 m² is around 6 percentage points lower than the average level registered for the country as a whole.

With regards to the age of the dwelling, it was established that approximately 10% of the households live in a building constructed after 2001. 19% are the households living in buildings constructed over the course of the past three decades (from 1991 till present). A total of two thirds of the households live in buildings constructed in the 1961-1990 period: in 1961-1970 (17,5%), in 1971-1980 (25,3%), in 1981-1990 (21,7%). This is the period marked by the most intensive construction of residential buildings.

The type of construction, as well as adherence to the respective construction standards, also has an impact on the potential risk of energy poverty.

Since specific parts of the study are subjective by nature, the preferred temperature in the dwelling was studied, as well as the opportunities for maintaining it (people have different temperature preferences).

When asked the question ‘How would you define the comfort in your dwelling in the winter in terms of the temperature you maintain most of the time?’, approximately 9 in 10 households(86,5%) shared that they maintain a normal temperature, and the share of households at

risk of energy poverty (81,1%) and the households in the energy poverty category (82,8%) is lower compared to the average level. This is compared to the households that share that their homes are too cold in the winter. Among the households at risk of energy poverty, the share of the ones that claim that their home is too cold in the winter, is 11,6%, and among the households in the energy poverty category – 11,2% at an 8% average level.

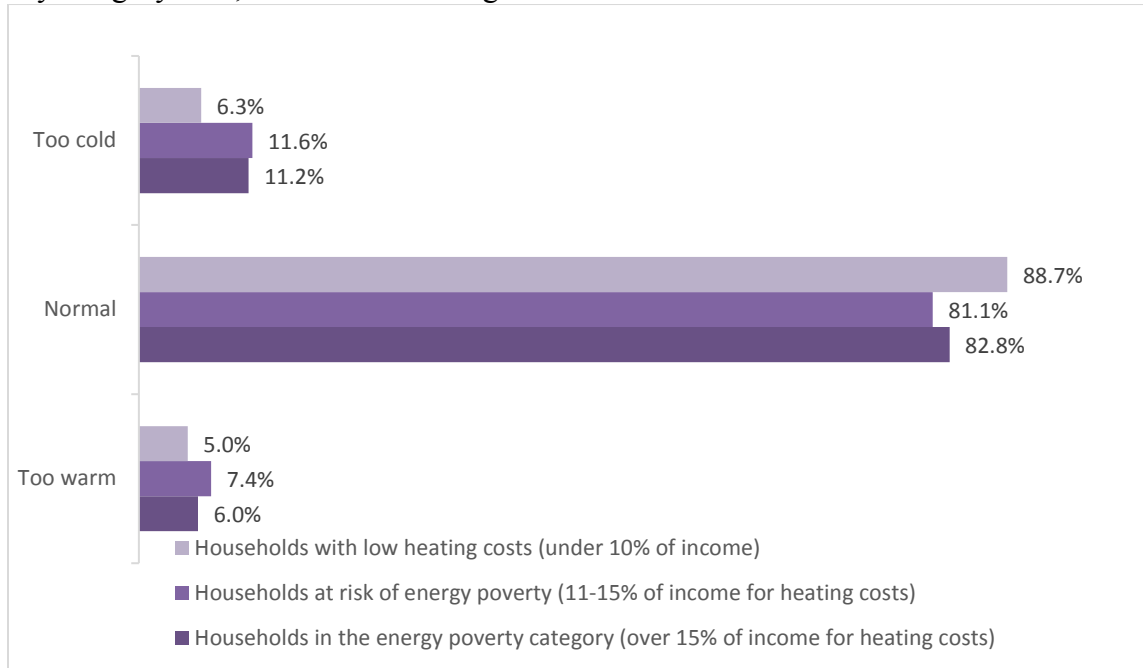


Figure 11: Comfort of the dwelling in the WINTER with regards to the temperature maintained over a prolonged period of time

The study includes a monitoring of the temperature which is usually maintained in the living spaces during the day. A total of 3 in 10 households say that usually the temperature in the main living spaces in their homes during the winter is up to 22 degrees. One in two households indicate that usually the temperature in this period is above 23 degrees. One in five households are not able to say. In the context of the average level, there are no significant statistical differences according to the target groups. Among the households that are at risk of energy poverty, there is a higher share of the ones that cannot tell what the usual temperature in the main living spaces is during the winter.

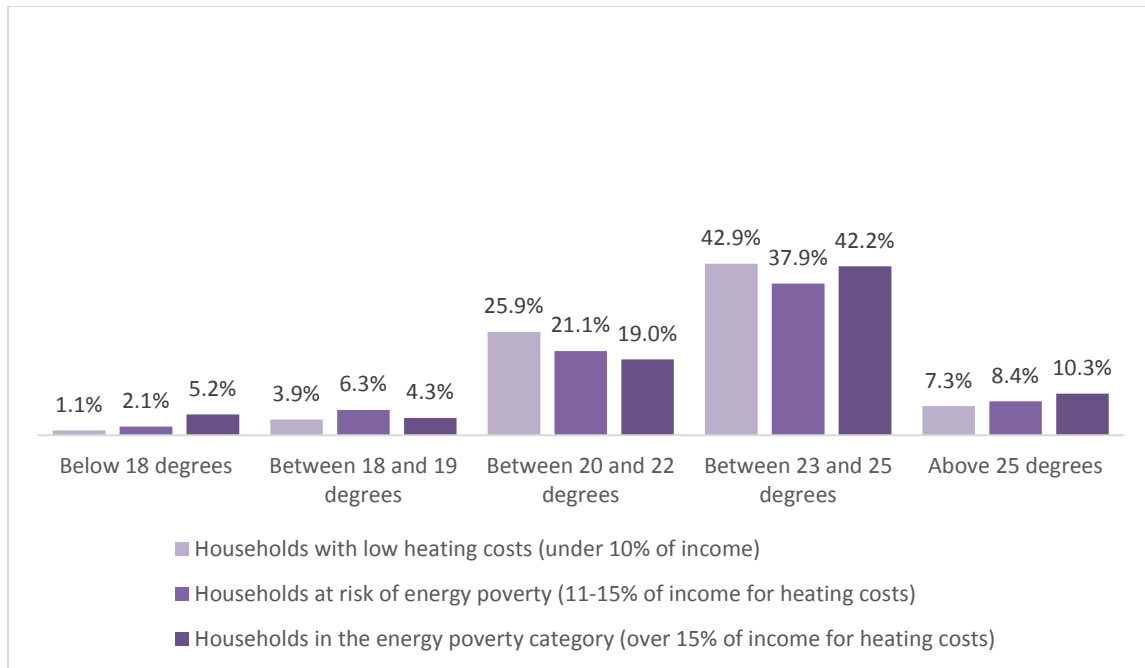


Figure 12: The usual temperature of the main living spaces during the winter

The predominant part of households feel comfortable in their homes in the summer with regards to the temperature they maintain most of the time. Compared to the rest of the target groups, among the households at risk of energy poverty there is a higher share of those that think the temperature is normal.

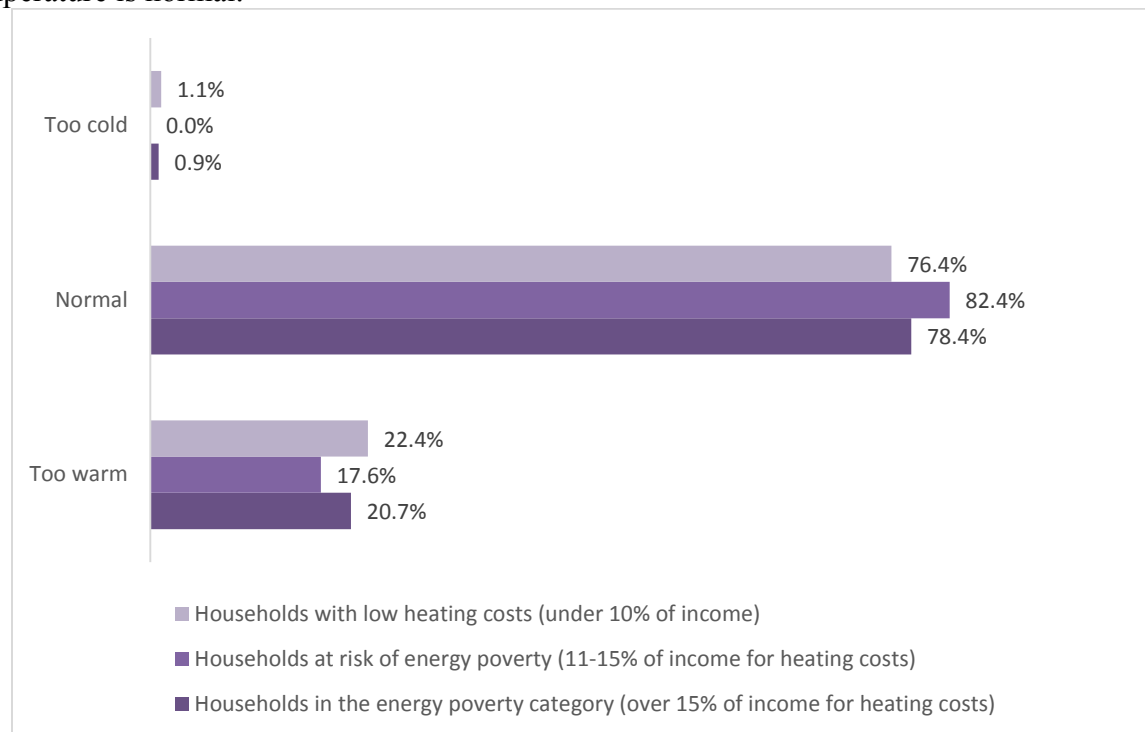


Figure 13: Comfort in the dwelling in the SUMMER with regards to the temperature maintained most of the time

When asked the question: ‘What is the usual temperature in the main living spaces during the day in the summer?’, approximately one fifth of the households indicate that it is no more than 22 degrees, and one in three - between 23 and 25 degrees, an around 21% - over 25 degrees. The share of the ones that are not able to tell is high - one in four households do not know what the usual temperature of the main living spaces in the summer is. Among the households in the energy poverty category, there is a lower share of households that indicate that the average temperature in the summer is between 19 and 22 degrees, compared to the average level. Among the households at risk of energy poverty, there is a lower share of the ones that indicate that the usual temperature in the summer is above 25 degrees. As a whole, it can be noted that among the households at risk of energy poverty and the households in the energy poverty category there is a higher share of the ones that are not able to tell what the usual temperature of the main living spaces is during the day in the summer months. Regardless of the category of energy poverty of the households, it can be concluded that the temperature preferences in the living spaces are comparable.

Despite the fact that most households in Bulgaria have relatively low heating costs, the share of the ones at risk of energy poverty or the ones that are already in this category remains significantly high - around one third of the population. Therefore, energy poverty in Bulgaria is not just a question of energy price policy, but mainly a function of low income, demographic specificities, and the type of dwellings. The most vulnerable households have heating costs over 15% of their income and this group includes mainly elderly people over 60 years of age with a primary school education, living in single-family homes in small settlements - villages or towns. The concentration of energy poor people in single-family homes proves that the type of residential structure forms the issue because the latter are often energy inefficient and the heating costs are not proportional to the income. At the same time, the households at risk of energy poverty include individuals over the age of 50 with a higher level of education, which shows that vulnerability does not depend only on qualification, but it is also influenced by age and domicile.

The data confirms that despite the relatively low prices of electricity in Bulgaria, the percentage of households that cannot afford to maintain an adequate temperature in the winter is among the highest in the European Union. This distinguishes us from countries in Western and Northern Europe where the main reason for energy poverty is the poor quality of dwellings. The factors in Bulgaria are complex: low income, small-sized households, poor age structure, and large number of inefficient dwellings. The subjective evaluations with regards to the temperature of the dwelling confirm this status quo - over 11% of the households at risk of energy poverty and the energy poor ones claim that the temperature in their dwellings in the winter is too low compared to an average of 8% for the whole population. This fact highlights the thesis that the issue is not purely an economic one and that it directly impacts the living comfort and the health of the vulnerable groups.

Based on the analysis made, we can claim that dealing with energy poverty in Bulgaria cannot be limited only to regulating the energy prices. A comprehensive approach is needed, one that includes targeted social policies, support for improving the energy efficiency of single-family houses, special measures for elderly people, and attention to households with low income in small settlements where the vulnerability is the highest.

Conclusion

A comparative analysis of a number of indicators for income and energy costs of the households between Bulgaria and the average levels for the European Union confirm the higher levels of energy poverty in our country. **Bulgarians have twice as low general consumer expenditure**

compared to the EU average (measured as a standard of purchasing power), they consume only 60% of energy in terms of quantity compared to the average European and have approximately equal energy needs and an approximately three times lower income in nominal terms. The lower electricity prices in Bulgaria do not lead to a decrease in the level of energy poverty, which remains twice as high as the EU one, even when the increase in the electricity prices in the European Union is much higher. That is why, limiting energy poverty through price regulation is not sufficient. An active social and investment policy is needed to support households for a long-term reduction of energy costs and losses which are the result of the poor energy characteristics of the dwellings and inefficient heating equipment.

The buildings sector accounts for only 8% of the carbon emissions in Bulgaria but its decarbonization is a serious task due to the low level of renovation of buildings and the insufficient introduction of rooftop renewable energy installations (REI). The reform in the National Recovery and Resilience Plan refers to the creation of a mechanism for funding energy efficiency and REI projects for energy bills. Within the reform, a mechanism for protecting vulnerable households must be established. Based on the study conducted, the following recommendations can be highlighted:

1. To introduce and/or implement more accessible application schemes for retrofitting and energy efficiency programs by re-arranging the requirements. In the current scheme, **the requirement for the size of the initial investment excludes energy poor households from participating in the programs.** The first phase of retrofitting with a 100% grant attracted a lot of households around the country and the number of applications received was 3.5 times higher than what could be accepted under the programs by the application deadline. The second renovation phase (June 2023), officially registered project proposals for only 43% of the total financial resource up until the end of 2024. Due to a lack of support by the state and the requirement for 20% co-funding, the reforms cannot not be completed. If the households are energy poor, they cannot take advantage of the low-interest or no-interest credits. At the end of March 2024, projects amounting to BGN 152 million (EUR 144.18 million) were registered with an availability of a grant of BGN 282 million (EUR 77.72 million) and a total amount of funding, including the percentage of co-funding, amounting to BGN 353 million (EUR 180.5 million). There is an availability of an unused resource which, instead of being combined with the necessary financial instruments, is provided through the unsustainable 100% grant scheme.
2. To shorten the payment deadlines for the grants for households that are approved for funding (with the existing schemes, the payment deadlines of investments that have been implemented extend to over two years).
3. To reduce the administrative burden on the implementation of a given support measure.
4. To introduce target measures for the two vulnerable groups with the introduction of a liberal energy market.
5. Periodic monitoring and analysis of the effect of the mechanisms implemented for the protection of the vulnerable groups in this period with feedback on their design.
6. To introduce tax exemptions on a municipal and state level, as well as with regards to the income tax paid by working individuals who have retrofitted their home. The amount of this exemption should be valid for a period of 5 years of the investment for retrofitting or energy efficiency taking place.
7. To introduce a One-Stop-Shop service based on the best practices in order to avoid duplicating documents.

8. To recover part of the tax credit for the materials purchased for the purpose of retrofitting the buildings and for investments in solar, wind sources of energy, and means to protect individuals from vulnerable groups.

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