

Socio-demographic factors' influence on the energy-saving behaviour of residential consumers: Evidence from Romania

**Stelian Stancu¹, Anca Maria Hristea², Camelia Kailani³,
Denisa Elena Bala⁴, Andreea Pernici⁵**

¹ Bucharest Academy of Economic Studies, Faculty of Economic Cybernetics, Statistics and Informatics, Romania, ORCID: 0000-0002-4727-993X, stelian.stancu@csie.ase.ro;

² Bucharest Academy of Economic Studies, Faculty of Accounting and Management Information Systems, Romania, ORCID: 0000-0002-6154-8673, anca.hristea@cig.ase.ro;

³ Bucharest Academy of Economic Studies, Faculty of Marketing, Romania, ORCID: 0000-0002-7766-8653, camelia.kailani@mk.ase.ro (corresponding author);

⁴ Bucharest Academy of Economic Studies, Faculty of Economic Cybernetics, Statistics and Informatics, Romania, ORCID: 0000-0003-3519-1110, andreea.pernici@csie.ase.ro;

⁵ Bucharest Academy of Economic Studies, Faculty of Economic Cybernetics, Statistics and Informatics, Romania, ORCID: 0009-0008-0754-7849, denisa.bala@csie.ase.ro.

Abstract: *In the context of various attempts to regulate energy consumption and educate consumers in the spirit of sustainable behavior, this paper aims to identify the role of the main socio-demographic factors on the decision to adopt measures to reduce consumption and save energy. Many studies have approached similar topics, but correlating their conclusions, it can be deduced that psycho-socio-demographic factors interact differently from one country to another, depending on the economic and political context of the moment. From the fact that in the former communist countries, the severe political regime subjected the population to very restrictive living conditions, based on deprivations that led to the formation of a traditional saving behavior and, on the other hand, considering the new Sustainable Development Goals (SDGs) that shape the young generation in the spirit of sustainable society, the authors aimed to study the correlation between socio-demographic factors (age, gender, education, professional status, income) and consumption and energy saving behavior at residential level, in an ex-communist state, Romania. For this purpose, quantitative research was carried out based on the answers of 865 subjects to the questionnaire distributed at the Academy of Economic Studies in Bucharest and in the immediate environment to the members of the university community, using convenience sampling. Using descriptive statistical indicators and linear regression techniques, the intensity of correlation between selected variables was determined and the degree of differentiation of the purchasing and use behavior of green-label household appliances was analysed, as well as the population's availability to adopt some energy-saving methods. Although the sample is not representative, the conclusions are that measures to reduce energy consumption must be voluntary and stratified, depending on the nature of social and demographic factors.*

Keywords: *Sustainability, energy consumption reduction, residential consumer, voluntary measures, influences on saving behavior.*

JEL Classification: *F00, F64, M00, M20, O13.*

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Introduction

More than ever, we are now living an unprecedented experience: on the one hand, in recent decades, with the industrial revolution, the quality of life has centered on consumerist policies (Copeland & Boulliane, 2022; Eriksson & Vogt, 2012; Hou & Poliquin, 2024; Lee & Fong, 2021), which are meant to exponentially increase investors' profits, even at the risk of overproductions whose supply far exceeds the capacity of consumption; on the other hand, the devastating effects of uncontrolled production and consumption (Roy et al., 2022), which are endangering the future of the planet, so that only through huge global efforts, centered on sustainability criteria, the situation can be remedied before it is too late.

With the signing by the United Nations in 2015 of the global framework for an inclusive, just and sustainable society by 2030, 17 Sustainable Development Goals (SDGs) have been promoted as a universal call for action to end poverty, protect the planet and ensure global peace and prosperity (UNDP, 2023). The most recent research of the authors of the present work has focused on SDG7 "Ensuring access to affordable, reliable, sustainable and modern energy," through the perspective of reconsidering the efforts to neutralise the climate and to update the strategic measures imposed by the current geopolitical, economic and social context.

The European strategic projections of recent years aim to adopt the most coherent measures to facilitate the member states of the European Union (EU) transition to an environmentally friendly energy system that accelerates economic growth and climate neutrality by 2050. To achieve the proposed goal and mainly to prevent an energy collapse associated with the degradation of the Russian-European diplomatic relations amid the war in the region, the European Union institutions have also drawn up specific directives aimed at promoting voluntary measures aimed at saving energy at residential level and the transition to green

energy in a shorter time than initially anticipated in the 2015 SDG.

In the context of the aforementioned Sustainable Development Goals (SDGs), starting from the most recent European norms, legislation and recommendations (European Commission, 2023) and selecting the best practices adopted at the international level in the field of reducing energy consumption, the authors made a diagnosis regarding the specific market of consumers in Romania. Integrating itself as a continuation of the research mentioned above, the purpose of the present work is the analysis of the behavior of the Romanian household consumer towards the voluntary measures to reduce energy consumption at the residential level in terms of correlations between age, level of education, and the average level of income and energy price.

By capitalising on the studied specialised literature and the practical conclusions resulting from the experience of other countries of the world (Belgium, Canada, France, Germany, Italy, Norway, Poland, Sweden, and the USA) in the field of energy consumption at the residential level and appreciated by us as a representative, it was analysed the behavior of consumers, based on the responses of the sample of respondents and the availability of household consumers to outline a sustainable consumer profile.

This paper, regarding a possible change in energy consumer behaviour, is elaborated in the context of recommendations of the recent European document RePowerEU, adopted on February 14, 2023 (European Commission, 2023), which highlights that the population of the energy consumption sector represents about one-third of the total consumption, can be a source of saving and preventing a deep energy crisis, by adopting voluntary measures to reduce uncontrolled energy consumption. The results of our paper can be capitalised in community studies or comparative studies in time and space, or they can be included

in a cluster of statistical data to rethink and reshape policies for the transition to green energy.

As regards the structure of this paper, the introduction briefly describes the theme of the research, the key concepts integrated into the body of the work, the purpose, and the scientific content. In the section Theoretical background, a review of the scientific literature on the topic is carried out. Section Research methodology describes the methodology of the research and the main objectives targeted, the next section refers to the description of the scientific approach and the main results of the research carried out, and last section presents a set of conclusions in the light of the results obtained from the research carried out.

1. Theoretical background

In the scientific literature, most often, the term “low consumption” is associated with that of poverty, a difficult and defiant problem for many states of the planet (Dercon & Luc, 2011; Hallegatte & Rozenberg, 2017; Krishna, 2004; Martin et al., 2020; Olson Lanjown & Lanjown, 2001; Ravallion, 2014; Schwalb et al., 2023). The economic and social reality confirms this phrase: a limited capacity of aspiration to well-being is unanimously equivalent to the population’s low access to food, housing, drinking water, sanitation, energy or education and health services (Emerick et al., 2016; Kaidi & Mensi 2019; Sun et al., 2022).

The low standard of living is directly influenced by the degree of development of a state and the average income per family or per inhabitant (Harrison, 2007; Narain et al., 2008; Wang et al., 2023; Zhang et al., 2023). The present study focuses on Romania. According to The World Bank (2022), in a world ranking of GDP per capita for 190 states, Romania was in the 61st position with USD 15,619 per inhabitant; this was above the world average of USD 12,263 per capita but well below the average of the European Union, which was for the same period at the level of USD 37,280 per capita.

Contemporary society is facing a series of interconnected manifestations (pandemics, economic crises, devastating natural phenomena, reduced availability of resources), one of the main causes being represented by the long promotion of unsustainable production and consumption systems, of an intensely globalised and insufficiently harmonised economy (Kuc-Czarnecka et al., 2023; Lazaric & Toumi,

2022). The diversification of energy production sources and the reduction of its consumption is one of the directions of action contained in the UN strategy to change the image of the world in the next two decades (De Oliveira & Oliveira, 2023; Gebara & Laurent, 2023).

Sustainable Development Goal 7 (SDG7) – affordable, reliable, sustainable and modern energy for all by 2030 aims to reduce economies’ unsustainable and harmful dependence on fossil fuels and implement new energy solutions that neutralise climate change (Anwar et al., 2022; Elavarasan et al., 2023; Toukabri & Youssef, 2022).

With the adoption of the European Green Deal and the Green Generation or RePowerEU agreements, the transition to green energy has become a necessary step towards reducing the EU’s energy dependencies (European Commission, 2023) on external suppliers. Although in recent years, the signing of the UN SDG agreement is paying increasing attention to the analysis of energy consumption at the level of household consumers and its impact on the environment, it should be noted that there is a lot of particularly valuable research carried out well before 2015, with excellent results and practical applicability, which emphasise the correlations between the factors of influence on energy consumption at the residential level and the effects on the environment (Abrahamse et al., 2005; Brandon & Lewis, 1999; Greening et al., 2000; Poortinga et al., 2004; Steemers & Young Yun, 2009).

The general and specific factors that influence the energy consumption policies at the national level, and in particular at the residential level, differ greatly from one nation to another and even within the same state, depending on the given conjunctural context. Studying the specialised literature in the field of energy consumption at the residential level, the authors came to the conclusion that the higher the segmentation of the research topic, the more the specificity of the conclusions increases. To capitalise on the research results of as many studies and experiences as possible, it is recommended not to compare certain phenomena and processes that take place in the case of a different context from the one used as a model.

Many factors have been discovered to influence household energy-saving habits, which can be grouped into three primary sources:

individual characteristics, external influencing variables, and intentions to save energy (Reiss & White, 2006; Wang et al., 2023; Zhang et al., 2023). Individual characteristic factors can be divided into objective and subjective characteristics. Gender, age, income, and educational background are examples of socio-demographic traits (Alibeli & Johnson, 2009; Frederiks et al., 2015; Palani et al., 2023; Schwepker & Cornwell, 1991).

Most authors consider that age is an important influencing factor for many decisions, but correlations between energy saving and consumption are insufficiently studied; some conclusions (Estiri & Zgheni, 2019) show that with age, up to 55 years, energy consumption increases because increase in the number of family members requires large households and superior material needs. Among the elderly population, there is often a lower level of energy consumption, which is linked to behavioural aspects and household status (Wang et al., 2023; Yagita et al., 2021).

Analysing the importance of income and the impact of various socio-economic, behavioural and physical factors on energy efficiency and energy consumption at the residential level, Kumar et al. (2023) consider that sustained efforts are needed to understand better the correlations between attitudes towards consumption and directions of action aimed at energy conservation and the study of human behavior must be part of intervention strategies at the national and regional level.

Many authors, quoted by Baltruszewicz et al. (2023), think that there are significant inequalities in the distribution of energy consumption and that the population with high well-being is the main user of energy because sophisticated needs require high consumption (Darby and Fawcett, 2018; Gough, 2017; Wiedmann et al., 2020) while many households consume so little energy that they cannot achieve a satisfactory level of well-being (Ivanova et al., 2017; Kikstra et al., 2021).

According to Poortinga et al. (2004), academic background is highly associated with energy-saving behaviors and is strongly correlated with the adoption of various energy-saving solutions. As higher education occupants were more likely to be environmentally aware, the increase in education level is one of the most effective policies. As several years are necessary to increase the education

level in a country, this measure will have mainly long-term and not immediate effects (Vogiatzi et al., 2018). The impacts of individual objective characteristics on energy-saving behavior are diverse and no consensus has been reached for some variables, probably due to the differences in empirical contexts and data (Zhang et al., 2019). Previous research has shown that respondent age, gender, educational background, income level, and marital status all influence individual energy-saving practices (Han & Cudjoe, 2020). Piao and Managi (2023), in a study on life satisfaction in 37 countries, believe that buying energy-saving household products has a more limited effect on energy consumption expenditure compared to energy-saving behavior.

In the most recent Plan of European measures (February 2023) aimed at reducing consumption and the transition to green energy (RePowerEU), it is stipulated that special attention should be paid to strategies to adapt the behavior of household consumers to new trends, noting that the adoption of sustainable solutions anchored in the reality of each state, could lead to a decrease in the consumption of this segment even by up to 20% compared to the present moment (European Commission, 2023). In this context, it is interesting to analyse some factors that can influence the energy-saving behavior of the Romanian consumer, given that Romania is a country with a consumption per family located at the lower limit of the European Union states.

Starting from the fact that in the ex-communist bloc, in Central and Eastern Europe, such an approach has not yet been achieved, most authors developing behavioral studies and regression analyses in provinces of China, African countries, Arab states or developed countries, where conditions and perceptions regarding energy consumption are specific, the authors considered this paper an important starting point in the process of evaluating the behavior of the population in an ex-communist state, which could be extended to other countries with a similar past. The results are useful to understand the typology of residential consumers from the perspective of their sensitivity to energy problems as well as their willingness to adopt some voluntary energy-saving measures.

In the current geo-political and strategic context, this paper is a continuation of the authors'

research in the field of information analysis on SDG7 and the involvement of household consumers in adopting the most efficient measures for reducing energy consumption and transition to green energy (Stancu et al., 2023).

Based on the theoretical background, our research aimed to know the influence of some socio-demographic factors on the intention to adopt voluntary measures to reduce electricity consumption in the context of sustainable development measures.

The following research objectives have been established, with the related hypotheses:

RO1: Identify the extent to which the socio-demographic factors (age, income, education) determine changes in the consumption behavior at the residential level in the context of intensifying national and international discussions on the energy crisis and the achievement of the strategic sustainable development goals (SDG7).

H1: Socio-demographic factors (age, income, level of education) exert a significant influence on the adoption of voluntary measures to reduce energy consumption.

RO2: Assessment of the influence of income and information level on the perception of national macroeconomic measures to reduce energy consumption and targets imposed by the European Union in the light of UN strategies.

H2: The perception of the government's measure to increase electricity prices is significantly influenced by income and level of information and is predominantly negative.

2. Research methodology

The research consisted of a quantitative survey based on a questionnaire. Methods specific to deductive statistical analysis were used for testing the research hypotheses. The cause and effect links and their significance level were identified and tested using SPSS under Windows (descriptive statistics and correlation methods). Central trend indicators (mean and median scores) were used, as well as vaulting and asymmetry indicators. To find if the difference between the responses of two groups is statistically significant or not, a two-sample *t*-test was performed. Similar methods were found in the literature, when influence of factors determining consumer-saving behaviour was analysed (Boomsma et al., 2019).

The data used in this research is the result of processing the valid answers obtained to the questions formulated by the authors

in a questionnaire, distributed through the Google Forms platform. For sampling, the convenience sampling technique (a non-probability sampling method) was used, in which units are chosen for participation in the sample due to their being the most accessible to the researcher. A total of 902 individuals provided answers to the 22 questions designed to identify a possible consumer electricity pattern, as well as to estimate their potential willingness to adapt to new global trends in energy consumption and diversification. The questionnaire was addressed to students, teaching staff and non-teaching staff of the Academy of Economic Studies in Bucharest, where the authors work, to groups of people from the social environment close to the authors as well as to the general public (between May and June 2023). The response rate to the questionnaire was about 55%, and the questionnaire was addressed to a total of 1,690 subjects.

The structured questionnaire contains sections that include 22 questions, of which 20 are closed and 2 are open. A five-point Likert scale (from 1 – strongly disagree to 5 – strongly agree) and semantic differential were used. The questions referred to the socio-demographic distribution (age group, gender, level of education, income level, family size, civil status, occupational status) and knowledge and attitude regarding the reduction of energy consumption, general consumption behaviour and the sources of electricity consumption.

The first stage of this research was the analysis of the consistency and reliability of the constructed questionnaire. In this regard, we estimated Cronbach's alpha coefficient. According to the author, it is estimated that the threshold of 0.7 is an indication that measurements were made consistently. The coefficient value (0.87) confirmed the internal consistency of the scale used (Tab. 1).

The estimation of this coefficient involved the use of the following formula for calculation:

$$\alpha = \frac{N * \overline{cov}}{\overline{var} + (N - 1) * \overline{cov}} \quad (1)$$

where: *N* – the number of items included in the analysis; \overline{cov} – the average covariance of the items included in the analysis; \overline{var} – the average variance of the items included in the analysis.

Tab. 1: The results of the estimation of Cronbach's alpha coefficient

Cronbach's alpha	Cronbach's alpha (based on standardised items)
0.87999	0.89029

Source: own

Tab. 2: The socio-demographic characteristics of the respondents

Socio-demographics	Frequencies	Percentage (%)
Gender		
Women	586	65.0
Men	316	35.0
Age (years)		
18–25		75.0
26–35		7.0
36–45		7.0
46–55		9.0
Above 55		2.0
Marital status		
Unmarried		80.0
Others		20.0
Education		
Higher education		81.4
High education		7.2
Secondary and primary education		0.4
Monthly average income per capita (EUR)		
Below 400		34.0
401–800		18.0
801–1,200		9.0
1,201–1,600		33.0
Above 1,600		6.0
Employing status		
Employee (part-time or full-time)		81.4
Others		8.6

Source: own

Following the pre-processing stages of the data, out of the 902 completed questionnaires, 865 questionnaires were validated. From a socio-economic point of view, the structure of the respondents is described in Tab. 2.

3. Results and discussion

Most of the respondents believe that at the household level, there is a fairly high possibility of reducing electricity consumption. About 34.6% of respondents estimated that

they can reduce consumption by up to 10%, while 29.9% of individuals believe that they could ensure a reduction in consumption of between 10% and 20%.

From the perspective of adopting clear measures to reduce consumption, the majority of respondents say that they have purchased electrical equipment with the A+ energy label (about 51.3%). The second most popular measure adopted among households is thermal insulation of dwellings. At a rate of 11.9%, the respondents say that they have installed solar panels within the household to streamline electricity consumption and diversify the sources. The second stage of the analysis process was related to the research objectives, using various descriptive metrics and statistical methods to test the significance.

The results of the research revealed the existence of differences in perception between age segments (Fig. 1). The predominant group, represented by respondents aged 18–24 years, recorded an almost equal distribution of opinions among the three savings thresholds presented in the content of the question in the questionnaire (up to 10%, 10–20%, and

21–30%). Respondents in the 25–34 years old segment tend to believe that the reduction can be made especially in the range of 0–20%, family life demanding a higher electricity consumption, justified by the nature of more complex activities and by the diversity of functional appliances. The 45–54 years old segment considers in a larger percentage that the reduction could reach 21–30%.

The age group over 65 years believes that, due to low incomes, the consumption of electricity and heating agents is already very well controlled so that the annual savings can reach an increase of up to 10%. 33% of the respondents segment consider that, being single persons, they can reduce the consumption by 21–30% as a result of less intense routine household activities and of the important time spent at other residences than the permanent one (e.g., of sons, cohabitation partners).

Next, in order to identify the impact of social and demographic factors on the quality of life and energy consumption behavior, we tested two indicators considered relevant in the literature: consumption associated with income and education levels. In the first case, regarding

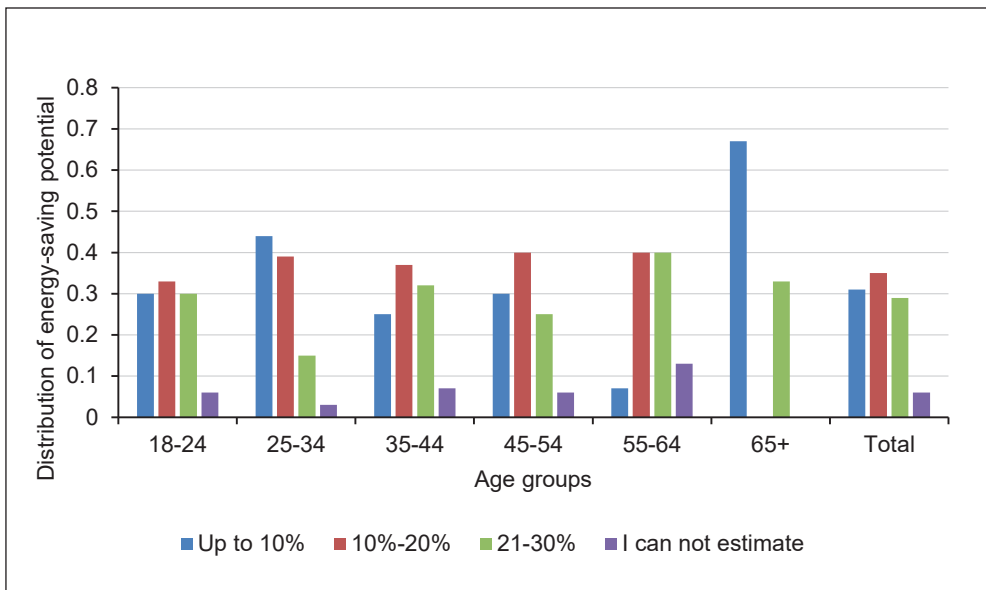


Fig. 1: Energy-saving potential relative to the age group

Source: own

the analysis of the consumption behavior according to the income, the respondents were divided into two groups:

- N1: Respondents with a source of income: employees, freelancers, retirees;
- N2: Respondents without a source of income: students, unemployed.

To see if there are significant differences in the attitude towards energy consumption

between the two groups, we applied the *t*-student test for variation, for 4 of the voluntary measures to reduce energy consumption included in the population opinion survey questionnaire: the purchase of smart devices for consumption management, the arrangement of solar panels, the purchase of electrical equipment and appliances with the A+ label, thermal insulation of dwellings (Tab. 3).

Tab. 3: Two-samples for variances test

	INT_DEV (N1)	INT_DEV (N2)	Panels (N1)	Panels (N2)
Mean	0.32546	0.25413	0.11024	0.12397
Variance	0.22011	0.18994	0.09834	0.10882
Observations	381	484	381	484
df	380	483	380	483
F	1.15885		0.90368	
P (F ≤ f)	0.06338		0.14973	
F_{critical}	1.17211		0.85166	
	Energy class A (N1)	Energy class A (N2)	Insulation (N1)	Insulation (N2)
Mean	0.61155	0.42355	0.55906	0.43595
Variance	0.23818	0.24466	0.24716	0.24641
Observations	381	484	381	484
df	380	483	380	483
F	0.97352		1.00306	
P (F ≤ f)	0.39258		0.48589	
F_{critical}	0.85166		1.17211	

Note: Int_DEV – interval of deviation (confidence interval).

Source: own

It is noted that in neither of the four situations was the $F_{calculated}$ smaller than $F_{critical}$ – meaning that there are no significant differences between groups, which means that the null hypothesis referring to the fact that there are no significant differences between the two groups of respondents will be accepted.

Along with the average income, another important feature is the level of education. Thus, depending on the most recent form of graduated education, we have created two other segments of respondents:

- N1: Respondents with secondary education: gymnasium, high school;
- N2: Respondents with higher education: bachelor's, master's, doctoral.

From the summary descriptive statistics, we note that in respondents with higher education, the average associated with the intensity of knowledge of the importance of measures to reduce energy consumption and the transition to the green economy was higher than the average belonging to respondents who do not have university education (Tab. 4),

Tab. 4: Level of importance given to measures to reduce consumption, depending on the level of education

Education level	Average	Median	Standard deviation	Asymmetry	Vaulting
Medium	3.835	4	1.12	-0.64	-0.385
High	4.011	4	1.18	-1.12	0.450

Source: own

respectively 4.001 compared to 3.835 (score on a scale from 1 to 5).

Introducing the vaulting coefficient in the analysis, which will show us the shape of the distribution, we notice that for those respondents with higher education, the curve will be slightly leptokurtic, so we will have an excess of frequencies in the central area, while for those with secondary education, the distribution will be platikurtic, so the range of values will be wider, what can be an indication that there are differences between the two groups of respondents.

As for the measures agreed at the European level, perhaps the most important of these

was the reduction by 10% of the gross electricity consumption and by 5% of the residential consumption during peak hours. To reach these targets, some of the most common mechanisms have been integrated through the increase in the price of electricity, under the pressure of the current geo-political and economic context. Thus, regarding the level of information and knowledge of the targets imposed by the European Union (codified by the variable EU_RED), only 66 of the respondents (7.6%) consider themselves very familiar with the subject of the European approaches regarding the change of the consumption behavior (Tab. 5).

Tab. 5: Descriptive statistics

Attitudinal	Average	Median	Standard deviation	Max (respondents)	Min (respondents)
EU_RED	2.80	3	1.16	66	154
PRICE_RED	2.75	3	1.20	59	183

Note: EU_RED – the level of information related to energy-saving targets, imposed by EU; PRICE_RED – the attitude towards energy's price rise.

Source: own

The average response was 2.80 (on a scale of 1 to 5). Over 70% of the surveyed segment does not know the content of sustainability policies. The complete distribution is presented in Fig. 2.

As for the strategic measure of price rise, opinions were divided, resulting in a distribution that tends towards a disagreement, with 72% of respondents believing that the action is not at all, very little or less appropriate. When we add the income variable, we find that the distribution increases slightly towards the perception of the appropriate strategic measure; 36% of the respondents with an income

of more than EUR 800 (4,000 lei) consider that the measure to increase prices responds to the problems of the energy crisis in the current critical context (Tab. 6).

Therefore, *H2* is partially correct, meaning that income does not significantly influence the perception of energy price increase associated with the reduction of energy consumption, but the level of information does.

Based on the results presented in the previous section, we can observe that age influences the perception of potential consumers to reduce monthly electricity consumption, conditioned by the more efficient use of home appliances.

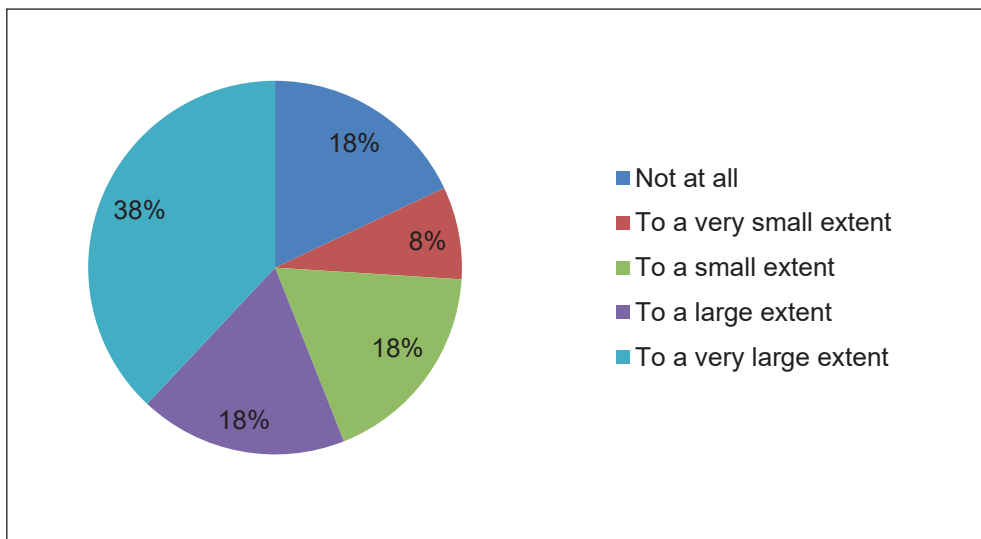


Fig. 2: Awareness of the EU's energy reduction targets

Source: own

Tab. 6: Perception of electricity price increase related to income

Income	Perception (%)				
	Not at all	To a very little extent	To a little extent	To a great extent	To a very great extent
Income < EUR 800	21	17	36	21	6
Income > EUR 800	25	18	21	27	9

Source: own

Based on previous findings, age could be considered a curtailment energy-saving behaviour, but not always was tested in the case of efficiency behaviour (Karlin et al., 2012). In agreement with the authors cited in the body of the paper (Estiri & Zagheni, 2019; Yagita et al., 2021; Wang et al., 2023), age is a component that impacts energy consumption. In the case of our study, besides the fact that respondents under 50 years of age accept that consumption demand increases with age and family growth, at the same time the concern for energy saving propagates amplified, more than for respondents over 65 years which is already in a long process of adapting its needs to the minimum consumption. At the same time,

as evidenced by the research of Frederiks et al. (2015) and Palani et al. (2023), the consumption behavior of the population tends to change over time under the impact of socioeconomic factors, in the case of our study by introducing ecological practices at the family level, such as: checking the energy class of appliances before purchasing, reducing the frequency of use of certain devices or streamlining their operation, thermal insulation of homes, decoupling electrical equipment from the network when leaving home, so that the loss of energy is considerably reduced.

Regarding the classification of respondents by income categories, it is found that there are no significant differences in saving behavior,

so within the group of respondents, the size of the income is not a factor influencing the application of voluntary measures to reduce electricity consumption. However, we must remember that 75% of our respondents are students or very young people, so their income is small and most likely they do not have their own home, so they are determined to purchase their own household appliances and ecological technologies or more, to make changes to the housing structure, which would involve important investments. According to Urban and Ščasný (2012), income has a positive effect on efficiency investments.

Concerning the influence of education level on energy-saving behavior, our results sustain the premise that high education level would lead to the conduct of more energy-saving behaviors (Belaïd & Garcia, 2016; Han & Cudjoe, 2020; Yang et al., 2016), even though there is research stating that formal level of education does not play prominent role concerning domestic energy-saving (Urban & Ščasný, 2012). In contrast to income, the research found that the level of education is a differentiating aspect, with respondents with higher forms of education giving greater importance to sustainable behaviour and being more likely to save energy at home, as was stated also by Vogiatzi et al. (2018). Due to the importance of education in this context, the same authors proposed some educational actions that have a more immediate effect, such as courses in schools about energy use, energy consumption and energy saving.

As regards the price increase associated with the reduction of energy, consumption is perceived as a negative strategic measure, both by the category of high-income and low-income respondents. However, previous research results raised doubt as to the effectiveness of classic price-based interventions in reducing electricity consumption (Werthschulte & Löschel, 2021). At the same time, 70% of the respondents do not have information about the targets set by the world and European forums to reduce electricity consumption. As a result, this aspect will negatively influence the understanding of the necessary macroeconomic measures or the integration of voluntary actions to reduce consumption.

Conclusions

Household energy consumption accounts for an important share of a country's total

consumption. The adoption of a set of voluntary measures aimed at reducing energy consumption among the population is the premise for the transition to a new society, in which sustainability will become a unanimously accepted reality. Although numerous researches have been conducted in the literature that have built ideas, generated conclusions and created solutions, it goes without saying that, with the emergence of new challenges and trends, such as the transition to the digital age and the green economy, the profile of the energy consumer will not remain the same over time. The future consumer behaviour will never be similar to that of the past or present, at least because digitalisation will create new needs, devices and equipment and energy sources for consumption will no longer have the same origins as the current ones. That is why the role of studies like the present one is to capture the essence of the moment, to capitalise on it and transform it into medium and long-term social advantages. The acceptance of change in everyone's life and the willingness to be part of this process is influenced by many factors, among which socio-demographic factors play a particularly important role.

From the multiannual statistical data but also from the results of the specialised literature consulted by the authors, it resulted that even up to the moment of triggering the present crises and political conflicts, there were notable differences between nations, from the point of view of residential energy consumption. These differences are clearly associated with numerous factors (geo-strategic, economic, political, social). The level of development of each country and the purchasing power of the population has already shaped a certain consumption behavior, so a radical change of consumption habits, without being associated with reliable directions of action (accessibility to cheaper energy sources, support for financing common objectives, and the education of the population) is unviable.

The research results provide important insights regarding the energy-saving behaviour of Romanian residential consumers (especially young people) and the influence of some socio-demographic factors, but the findings cannot be generalised, due to the size and the structure of the sample. To obtain representative conclusions, future research will improve the sample size and structure and extend the analysis to other categories of residential consumers.

Also, the findings have to be integrated into the larger context of shaping the typology of residential consumers of an ex-communist country from the perspective of their sensitivity to energy problems and their willingness to adopt some voluntary energy-saving measures. Comparison with other studies from other countries of the European Union could lead to a better understanding of which measures are more impactful for inducing energy-saving behavior. A future research direction could be an extended analysis of factors determining energy-saving behaviour at the entire bloc of former communist countries.

In the authors' opinion, the change of consumption behavior must be carried out naturally and with caution, by understanding the benefits and evaluating the costs of opportunity, so that the contemporary world can identify and understand the area of balance resulting from the effort-cause-effect correlation. Consumption habits are shaped in a variable time and have at their origin numerous factors, so that any pressure or amendment of some behaviors considered natural until now, can generate counter-effects and delays in achieving the proposed sustainability objectives.

References

- Abrahamse, W., Steg, L., Vlek, C., & Rothengatter, T. (2005). A review of intervention studies aimed at household energy conservation. *Journal of Environmental Psychology, 25*(3), 273–291. <https://doi.org/10.1016/j.jenvp.2005.08.002>
- Alibeli, M. A., & Johnson, C. J. (2009). Environmental concern: A cross national analysis. *Journal of International and Cross-Cultural Studies, 3*(1), 1–23.
- Anwar, A., Chaudhary, A. R., & Malik, S. (2022). Modeling the macroeconomic determinants of environmental degradation in E-7 countries: The role of technological innovation and institutional quality. *Journal of Public Affairs, 23*(1). <https://doi.org/10.1002/pa.2834>
- Baltruszczyk, M., Steinberger, J. K., Paavola, J., Ivanova, D., Brand-Correa, L. I., & Owen, A. (2023). Social outcomes of energy use in the United Kingdom: Household energy footprints and their links to well-being. *Ecological Economics, 205*, 107686. <https://doi.org/10.1016/j.ecolecon.2022.107686>
- Belaïd, F., & Garcia, T. (2016). Understanding the spectrum of residential energy-saving behaviours: French evidence using disaggregated data. *Energy Economics, 57*, 204–214. <https://doi.org/10.1016/j.eneco.2016.05.006>
- Boomsma, C., Jones, R. V., Pahl, S., & Fuertes, A. (2019). Do psychological factors relate to energy saving behaviours in inefficient and damp homes? A study among English social housing residents. *Energy Research & Social Science, 47*, 146–155. <https://doi.org/10.1016/j.erss.2018.09.007>
- Brandon, G., & Lewis, A. (1999). Reducing household energy consumption: A qualitative and quantitative field study. *Journal of Environmental Psychology, 19*(1), 75–85. <https://doi.org/10.1006/jevp.1998.0105>
- Copeland, L., & Shelley, B. (2022). Political consumerism: A meta-analysis. *International Political Science Review, 43*(1), 3–18. <https://doi.org/10.1177/0192512120905048>
- Darby, S., & Fawcett, T. (2018). *Energy sufficiency: An introduction concept paper for ECEEE* [Technical report]. European Council for an Energy Efficient Economy.
- De Oliveira, C. T., & Oliveira, G. G. A. (2023). What circular economy indicators really measure? An overview of circular economy principles and sustainable development goals. *Resources, Conservation and Recycling, 190*, 106850. <https://doi.org/10.1016/j.resconrec.2022.106850>
- Dercon, S., & Christiaensen, L. (2011). Consumption risk, technology adoption and poverty traps: Evidence from Ethiopia. *Journal of Development Economics, 96*(2), 159–173. <https://doi.org/10.1016/j.jdeveco.2010.08.003>
- Elavarasan, R. M., Mithulananthan, N., Pugazhendhi, R., Sinha, A., Gangatharan, S., Chiaramonti, D., & Houran, M. A. (2023). The untold subtlety of energy consumption and its influence on policy drive towards Sustainable Development Goal 7. *Applied Energy, 334*, 120698. <https://doi.org/10.1016/j.apenergy.2023.120698>
- Emerick, K., de Janvry, A., Sadoulet, E., & Dar, M. H. (2016). Technological innovations, downside risk, and the modernization of agriculture. *American Economic Review, 106*(6), 1537–1561. <https://doi.org/10.1257/aer.20150474>
- Eriksson, K., & Vogt, H. (2012). On self-service democracy. *European Journal of Social Theory, 16*(2), 153–173. <https://doi.org/10.1177/1368431012459693>
- Estiri, H., & Zagheni, E. (2019). Age matters: Ageing and household energy demand in

- the United States. *Energy Research & Social Science*, 55, 62–70. <https://doi.org/10.1016/j.erss.2019.05.006>
- EuropeanCommission.(2023).*REPowerEU: Energie la prețuri accesibile, sigură și durabilă pentru Europa* [REPowerEU: Affordable, secure and sustainable energy for Europe]. https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal/re-power-eu-affordable-secure-and-sustainable-energy-europe_ro
- Frederiks, E., Stenner, K., & Hobman, E. (2015). The socio-demographic and psychological predictors of residential energy consumption: A comprehensive review. *Energies*, 8(1), 573–609. <https://doi.org/10.3390/en8010573>
- Gebara, C. H., & Laurent, A. (2023). National SDG-7 performance assessment to support achieving sustainable energy for all within planetary limits. *Renewable and Sustainable Energy Reviews*, 173, 112934. <https://doi.org/10.1016/j.rser.2022.112934>
- Gough, I. (2017). Recomposing consumption: Defining necessities for sustainable and equitable well-being. *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences*, 375(2095), 20160379. <https://doi.org/10.1098/rsta.2016.0379>
- Greening, L., Greene, D. L., & Difiglio, C. (2000). Energy efficiency and consumption – The rebound effect – A survey. *Energy Policy*, 28(6–7), 389–401. [https://doi.org/10.1016/S0301-4215\(00\)00021-5](https://doi.org/10.1016/S0301-4215(00)00021-5)
- Hallegatte, S., & Rozenberg, J. (2017). Climate change through a poverty lens. *Nature Climate Change*, 7(4), 250–256. <https://doi.org/10.1038/nclimate3253>
- Han, M. S., & Cudjoe, D. (2020). Determinants of energy-saving behavior of urban residents: Evidence from Myanmar. *Energy Policy*, 140, 111405. <https://doi.org/10.1016/j.enpol.2020.111405>
- Harrison, A. (2007). Globalization and poverty. In *Globalization and poverty*. University of Chicago Press. <https://doi.org/10.7208/chicago/9780226318004.003.0001>
- Hou, Y., & Poliquin, C. (2024). Political consumerism: Ideology or signaling? Social science research network. *SSRN Electronic Journal*. <https://doi.org/10.2139/ssrn.4718887>
- Ivanova, D., Vita, G., Steen-Olsen, K., Stadler, K., Melo, P. C., Wood, R., & Herwich, E. G. (2017). Mapping the carbon footprint of EU regions. *Environmental Research Letters*, 12(5), 054013. <https://doi.org/10.1088/1748-9326/aa6da9>
- Kaidi, N., & Mensi, S. (2019). Financial development, income inequality, and poverty reduction: Democratic versus autocratic countries. *Journal of the Knowledge Economy*, 11(4), 1358–1381. <https://doi.org/10.1007/s13132-019-00606-3>
- Karlin, B., Davis, N., Sanguinetti, A., Gamble, K., Kirkby, D., & Stokols, D. (2012). Dimensions of conservation. *Environment and Behavior*, 46(4), 423–452. <https://doi.org/10.1177/0013916512467532>
- Kikstra, J. S., Mastrucci, A., Min, J., Riahi, K., & Rao, N. D. (2021). Decent living gaps and energy needs around the world. *Environmental Research Letters*, 16(9), 095006. <https://doi.org/10.1088/1748-9326/ac1c27>
- Krishna, A. (2004). Escaping poverty and becoming poor: Who gains, who loses, and why? *World Development*, 32(1), 121–136. <https://doi.org/10.1016/j.worlddev.2003.08.002>
- Kuc-Czarnecka, M., Markowicz, I., & Sompolska-Rzechuła, A. (2023). SDGs implementation, their synergies, and trade-offs in EU countries – Sensitivity analysis-based approach. *Ecological Indicators*, 146, 109888. <https://doi.org/10.1016/j.ecolind.2023.109888>
- Kumar, P., Caggiano, H., Shwom, R., Felder, F. A., & Andrews, C. J. (2023). Saving from home! How income, efficiency, and curtailment behaviors shape energy consumption dynamics in US households? *Energy*, 271, 126988. <https://doi.org/10.1016/j.energy.2023.126988>
- Lazaric, N., & Toumi, M. (2022). Reducing consumption of electricity: A field experiment in Monaco with boosts and goal setting. *Ecological Economics*, 191, 107231. <https://doi.org/10.1016/j.ecolecon.2021.107231>
- Lee, F. L., & Fong, I. W. (2021). The construction and mobilization of political consumerism through digital media in a networked social movement. *New Media & Society*, 25(12), 3573–3592. <https://doi.org/10.1177/14614448211050885>
- Martin, A., Markhvida, M., Hallegatte, S., & Walsh, B. (2020). Socio-economic impacts of COVID-19 on household consumption and poverty. *Economics of Disasters and Climate Change*, 4(3), 453–479. <https://doi.org/10.1007/s41885-020-00070-3>
- Narain, U., Gupta, S., & van't Veld, K. (2008). Poverty and the environment: Exploring

the relationship between household incomes, private assets, and natural assets. *Land Economics*, 84(1), 148–167. <https://doi.org/10.3368/le.84.1.148>

Olson Lanjouw, J., & Lanjouw, P. (2001). How to compare apples and oranges: Poverty measurement based on different definitions of consumption. *Review of Income and Wealth*, 47(1), 25–42. <https://doi.org/10.1111/1475-4991.00002>

Palani, H., Acosta-Sequeda, J., Karatas, A., & Derrible, S. (2023). The role of socio-demographic and economic characteristics on energy-related occupant behavior. *Journal of Building Engineering*, 75, 106875. <https://doi.org/10.1016/j.jobe.2023.106875>

Piao, X., & Managi, S. (2023). Household energy-saving behavior, its consumption, and life satisfaction in 37 countries. *Scientific Reports*, 13(1), 1382. <https://doi.org/10.1038/s41598-023-28368-8>

Poortinga, W., Steg, L., & Vlek, C. (2004). Values, environmental concern, and environmental behavior. *Environment and Behavior*, 36(1), 70–93. <https://doi.org/10.1177/0013916503251466>

Ravallion, M. (2014). Income inequality in the developing world. *Science*, 344(6186), 851–855. <https://doi.org/10.1126/science.1251875>

Reiss, P. C., & White, M. W. (2006). Household electricity demand, revisited. *Review of Economic Studies*, 72(3), 853–883. <https://doi.org/10.1111/0034-6527.00354>

Roy, M., Sarkar, B. C., Manohar, K. A., Shukla, G., Vineeta, Nath, A. J., Bhat, J. A., & Chakravarty, S. (2022). Fuelwood species diversity and consumption pattern in the homegardens from foothills of Indian Eastern Himalayas. *Agroforestry Systems*, 96(3), 453–464. <https://doi.org/10.1007/s10457-021-00728-1>

Schwalb, M., García-Arrizabalaga, I., & Gibaja-Martins, J.-J. (2023). Profile of the political consumer: An international comparative study. *Journal of International Consumer Marketing*, 35(3), 296–313. <https://doi.org/10.1080/08961530.2022.2103866>

Schwepker, C. H., & Cornwell, T. B. (1991). An examination of ecologically concerned consumers and their intention to purchase ecologically packaged products. *Journal of Public Policy & Marketing*, 10(2), 77–101. <https://doi.org/10.1177/074391569101000205>

Stancu, S., Hristea, A. M., Kailani, C., Bala, D. E., & Pernici, A. (2023). Adoption of voluntary measures for reducing electricity

consumption in the REPowerEU plan context: A Romanian consumer perspective. *Amfiteatru Economic*, 25(64), 760–779. <https://doi.org/10.24818/ea/2023/64/760>

Steeners, K., & Yun, G. Y. (2009). Household energy consumption: A study of the role of occupants. *Building Research & Information*, 37(5–6), 625–637. <https://doi.org/10.1080/09613210903186661>

Sun, Y., Anwar, A., Razzaq, A., Liang, X., & Siddique, M. (2022). Asymmetric role of renewable energy, green innovation, and globalization in deriving environmental sustainability: Evidence from top-10 polluted countries. *Renewable Energy*, 185, 280–290. <https://doi.org/10.1016/j.renene.2021.12.038>

The World Bank. (2022). *Romania. Data*. <https://data.worldbank.org/country/RO>

Toukabri, M., & Mohamed Youssef, M. A. (2022). Climate change disclosure and sustainable development goals (SDGs) of the 2030 agenda: The moderating role of corporate governance. *Journal of Information, Communication and Ethics in Society*, 21(1), 30–62. <https://doi.org/10.1108/jices-02-2022-0016>

UNDP. (2023). *Sustainable development goals. Goal 7*. <https://www.undp.org/sustainable-development-goals/affordable-and-clean-energy>

Urban, J., & Ščasny, M. (2012). Exploring domestic energy-saving: The role of environmental concern and background variables. *Energy Policy*, 47, 69–80. <https://doi.org/10.1016/j.enpol.2012.04.018>

Vogiatzi, C., Gemenetzi, G., Massou, L., Pouloupoulos, S., Papaefthimiou, S., & Zervas, E. (2018). Energy use and saving in residential sector and occupant behavior: A case study in Athens. *Energy and Buildings*, 181, 1–9. <https://doi.org/10.1016/j.enbuild.2018.09.039>

Wang, Z., Wei, L., Zhang, X., & Qi, G. (2023). Impact of demographic age structure on energy consumption structure: Evidence from population aging in mainland China. *Energy*, 273, 127226. <https://doi.org/10.1016/j.energy.2023.127226>

Werthschulte, M., & Löschel, A. (2021). On the role of present bias and biased price beliefs in household energy consumption. *Journal of Environmental Economics and Management*, 109, 102500. <https://doi.org/10.1016/j.jeem.2021.102500>

Wiedmann, T., Lenzen, M., Keyßer, L. T., & Steinberger, J. K. (2020). Scientists' warning on affluence. *Nature Communications*, 11(1), 3107. <https://doi.org/10.1038/s41467-020-16941-y>

Yagita, Y., & Iwafune, Y. (2021). Residential energy use and energy-saving of older adults: A case from Japan, the fastest-aging country. *Energy Research & Social Sciences*, 75, 102022. <https://doi.org/10.1016/j.erss.2021.102022>

Yang, S., Zhang, Y., & Zhao, D. (2016). Who exhibits more energy-saving behavior in direct and indirect ways in China?

The role of psychological factors and socio-demographics. *Energy Policy*, 93, 196–205. <https://doi.org/10.1016/j.enpol.2016.02.018>

Zhang, S., Liu, Q., Zheng, X., & Sun, J. (2023). Internet use and the poverty vulnerability of rural households: From the perspective of risk response. *Sustainability*, 15(2), 1289. <https://doi.org/10.3390/su15021289>