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Energy efficiency in household sector

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Abstract
Energy efficiency and behavioural changes are among the key pillars of decarbonization of the global energy system. Residential sector is responsible for a large share of fossil fuels final consumption, therefore the growth of its energy efficiency can bring a valuable impact on decarbonization speed and scale. In countries with growing economies residential energy consumption can increase dramatically due to the desire of the population to improve their standard of living, therefore striking a balance between economic growth and energy efficiency improvement is a complex policy challenge. The purpose of this study is to analyze attitudes and assess barriers of energy efficient behavior in Republic of Armenia as a country with growing economy and standards of living. The paper contributes to the literature by providing new empirical evidence of consumers' attitude toward different forms of energy efficient behavior in Armenia and reveals how general pro-environmental consciousness and social conditions influence on it. The results of the study prove that the level of general environmental consciousness of the population has a direct impact on the frequency of practical application of various patterns of energy-efficient behavior. As a policy application for emerging economies, our study proposes that the main direction of energy efficiency policy can be education of the population and raising its level of environmental self-awareness.

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1. Introduction

According to NetZero by 2050 roadmap of International Energy Agency (IEA), energy efficiency and behavioural changes are among the key pillars of decarbonization of the global energy system (IEA, 2021a; Revinova et al., 2023). The role of energy efficiency measures in buildings, industry, and transport is most important in restrain energy demand and emissions in the period to 2030. The residential sector accounts for 26.6% of the final consumption of electricity, 29.7% of the total consumption of natural gas, and 6.45% and 5.3% of the final consumption of coal and oil, respectively. (IEA, 2021b). Therefore, achieving of decarbonization goal is impossible without active participation of people, who drive demand for energy-related goods and services, and establish societal norms. IEA points out three main types of behavioural change necessary in NetZero scenarios: (1) reducing the excessive or wasteful use of energy; (2) changing the mode of transportation; (3) improving the efficiency of materials.

The scale and speed of adoption of the behavioural changes can vary widely between countries, depending on many factors such as ability of existing infrastructure to support such changes, income level, social and cultural conditions (Alcantara and Duro, 2004; Azam et al., 2015; Hariadi et al., 2016). High-income countries usually have higher levels of per capita energy use (Balashova et al., 2020), that is why changes in energy-related behavioural patterns can play an especially vital role in reducing excessive or wasteful energy consumption (Halkos and Tzeremes, 2014). In countries with growing economies, residential energy consumption can increase dramatically due to the desire of the population to improve their standard of living and bring previously unavailable products and

services, including energy-related, into everyday life (Bildirici and Kayıkçı, 2012; Klimenko et al., 2021; Gomonov et al., 2021). Similar phenomena were observed during the period of intensive economic growth in many countries, for example, China, India, Indonesia and others (Hu et al., 2017; Ding et al, 2017; Dong and Hao, 2018; Ravindra et al., 2019; Thapar, 2020; Hartono et al., 2020; Zhunussova et al., 2020; Lei at al., 2022). Striking a balance between economic growth and energy efficiency improvement is a complex management challenge, so studying the experience of different countries along the way is an important and timely research issue.

Armenia is a former Soviet Republic achieved its independence in 1991 and inherited energy intensive economy as all post-soviet countries (Ratner and Nizhegorodtsev, 2018; Ratner and Ratner, 2017). In result of disintegration from USSR economy, regional military conflicts, and consequences of a devastating earthquake in 1988, the country went through severe crises accompanied with energy blockades. The energy sector of the Republic of Armenia (RA) has historically been very developed branch of the economy, however, blockades of fuel and other goods imposed by surrounding countries due to the war in Nagorno–Karabakh, and extremely cold winters in 1992–1994 led to a severe energy crisis. Since Armenia has no significant hydrocarbons reserves and imported 90%-95% of its energy, during the energy crisis domestic energy consumption dropped more than 4 times (Fig. 1).

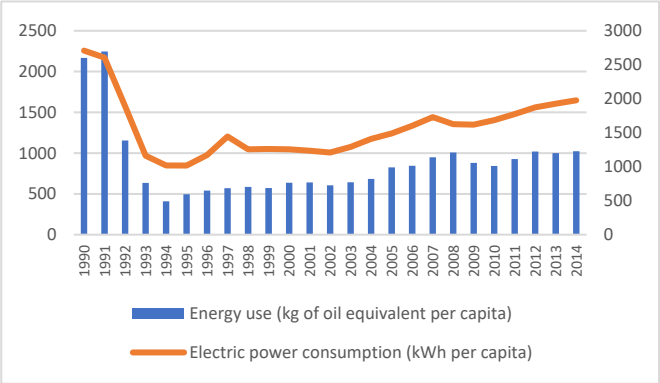

Fig. 1. Energy consumption in Republic of Armenia. Source: authoring based on World Bank data

The economic crises has reduced industrial consumption of electricity to 17% of total use, compared to 49% for residential use, while the typical distribution of demand in most developed countries is 40% and 30%. Armenia's electricity intensity in the end on 90-s was high as 2.49 kWh/USD of GDP compared with OECD average of 0.44 kWh/USD due to the fact, that households used electricity inefficiently in applications such space heating because the natural gas and district heating networks were not accessible (Anex, 2002).

After a period of economic and structural reforms real GDP growth in 1998 of 7.2% per annum, the highest among the Commonwealth of Independent States (CIS) countries (Gevorkyan, 2015). During last two decades GDP per capita, PPP (current international $) in RA has grown from 1.44 in 1993 to 18.94 in 2022, moreover, this growth was monotonous, with the exception of the crisis of 2009 and pandemic in 2020. However, more importantly that Armenia shows a decreasing trend in energy intensity that means it is seeking the way to decouple economic growth from energy consumption (Bianco et al, 2021). Armenia also has the biggest share of renewables among the Eurasian Economic Union (EEU) member-stated (32.5% in 2017) and has plans to increase it up to 70% (Burns et al., 2017).

At the same time, it should be noted that the increase in the energy efficiency of the Armenian economy is associated, first of all, with the implementation of various state and international programs for the development of building and urban infrastructure. These are UNDP/GEF programs for improvements of energy efficiency of city heating and hot water supply, UNDP/GEF program for increasing energy efficiency of buildings, urban green lighting and others (Lazanyuk et al., 2023). With the fulfillment of the main tasks of infrastructure modernization, a further increase in the energy efficiency of the economy will increasingly be associated with a change in the behavior of citizens in relation to the consumption of energy-related goods and services. In this context, it should be noted, that, according to the best of our knowledge, the issues of energy efficient behavior of the population of Armenia have never been studies in the scientific literature. Therefore, RA represents an interesting case study as a country with a growing economy and living standards. In addition, Armenia has experienced a severe energy crisis, which can also potentially influence the energy efficient behavior of the population. Besides, similar studies have already been conducted in other post-Soviet countries, which makes it possible to compare their results.

The purpose of this study is to analyze attitudes and assess barriers of energy efficient behavior in Republic of Armenia. The paper brings new empirical evidence of consumers' attitude toward different forms of energy efficient behavior in Armenia and reveals how general pro-environmental consciousness and social conditions influence on it. To achieve the study's objectives, we used a face-to-face questionnaire survey based on methodology introduced in (Lee et al, 2013) and implemented in (Phuphisith et al., 2020; Ratner et al., 2021; Salnikova, 2023). Application of this methodology gives the opportunity to compare the results of our study with similar studies conducted recently in Russia an Uzbekistan.

The rest of this paper is organized as follows. Next section presents a short literature review on the topic of energy efficiency and behavioral patterns. Section 3 presents the methodology of survey and gives brief statistical analysis of the sample of respondents. Section 4 describes the results, Section 5 provides comparison with similar papers with discussions. Section 6 concludes the paper with a summary of the key findings, study limitations, and directions for future research.

2. Literature review

Climate change is the one of the greatest threats to the planet and humanity (van den Broek and Walker, 2019). Unfortunatly, future generations, including modern youth, have to face the consequences of the unconscious environmental behaviours of the past and present generations (Ru et al., 2019).

Therefore, an increasing number of studies are focusing on the pro-environmental behavior of population in different countries, especially young people (Lange, 2023; Tian and Liu, 2022; Latif et al., 2022; Farrukh et al., 2022). Among different forms of environmental behavior, researchers pay special attention to energy-efficient behavior, since it is not sustainable energy consumption that currently has the greatest impact on the climate (Wang et al., 2022; Chien, 2022).

Most previous studies have focused on factors that influence household energy efficient behavior, such as environmental attitudes (Long et al., 2023), values, psychological factors (Li et al., 2022), socio-demographic factors, and subjective norms. Thus, the study of Chen and Gou (Chen and Gou, 2022) integrates personal moral norms (PMNs) into the Theory of Planned Behavior (TPB) and presents a new theoretical approach for studing internal factors influencing energy efficient behavior of students. Harun with co-authors (Harun et al., 2022) investigate the consumer purchases of energy-efficient appliances form the point of view of TPB. Brown and co-authors (Brown et al., 2023) study correlation between concern over carbon footprint with age and income of their respondents.

It should be noted, that in recent literature the energy-saving behavior is commonly classifyed into two main types (Hong et al., 2029): energy curtailment behavior (for example, direct reduction and life style adjustments) or energy-efficiency investment behavior (for example, purchasing energy-efficient home appliences). Therefore, in our study, we included both the factors considered in the theory of planned behavior and the division of behavioral practices into those related to lifestyle changes and those related to investment/purchasing decisions.

3. Experimental

The study of the attitude of the population towards energy efficient practices and the assessment of potential barriers to energy efficient behavior were carried out using a personal survey method (Yin, 2018; Revinova et al., 2020). The questionnaire has three parts: socio-demographic data of the respondent; (2) questions to determine the respondents' general environmental self-awareness; (3) questions for assessing the frequency and reasons for applying practices of energy-efficient behavior. As it was mentioned above, the main part of the questionnaire was similar to several other studies, in order to compare results with other countries from post-soviet group. Thus, the set of energy efficient practices included 29 pattern of behavior (table 1, left column).

However, unlike previous studies, we have modified the methodology by introducing two additional metrics that demonstrate the level of general environmental self-awareness of the respondent (Eco-index) and the level of energy efficiency of his behavior (EE-Index). The idea behind the introduction of these additional metrics was to test the hypothesis that the overall level of the respondent's environmental self-awareness is positively correlated with his energy-efficient behavior (Lange and Dewitte, 2019). The level of environmental consciousness (Eco-index) was determined by three metrics: 1) the answer to the question of who is responsible for improving the environmental situation in the country (national authorities, local authorities or the people themselves); 2) the answer to the question about the types of eco-actions the respondent participated in (multiple choices); 3) the answer to the question "Do your think that you can change the ecological situation in your city" (yes or no). The score of Eco-index was calculated using the formula:

$$Eco\text{-}index = Q1 + 2*Q2 + Q3, \quad (1)$$

where

$Q1$ – the answer to the question about responsibility for improving the environmental situation (0 – no answer; 1 – only authorities; 2 – authorities and people; 3 – people);

$Q2$ - the answer to the question about the types of eco-actions the respondent participated (0 – never participated; 1 – participated in at least one type of eco-actions; 2 – participated in two and more types of eco-actions);

$Q3$ - the answer to the question about the possibility to influence on environmental situation (0 – respondent think that he/she cannot influence; 0.5 – respondent no sure; 1 – respondent think that he/she can improve the situation).

The score of respondent's EE-index was calculated using the weighted linear sum of answers of the questions about frequency for applying patterns P1 – P29 of energy-efficient behavior (0 – never; 1 – seldom; 2 – often; 3 – always). Weight of each pattern in overall sum is given in the right column of table 1.

As one can see from Table 1, not all practices were included in the calculation of the energy efficiency behavior index. This is due to the rarity or ambiguity of their use in the Republic of Armenia. For example, interchangeable practices P23 and P24 were not correctly distinguished by respondents in the survey, and the use of patterns P26-P29 is still very limited, primarily by the level of income of the respondent (Ratner and Zaretskaya, 2021; Ratner et al., 2018). All other patterns were included in the calculation of the EE-index with weights equal to 1, 2 or 3, depending on how much pattern important for improving energy efficiency (Nash et al., 2017).

The survey was conducted from February to June 2023 and involved 183 respondents of various ages, income levels, occupations and places of residence. On the stage of pilot research (February – March), a face-to-face survey method was used. After analyzing the findings of the pilot study and rectifying a few questions, the research project was expanded using a respondent-driven sampling approach. (Heckathorn, 1997). In the respondent-driven sampling method, a university teacher from the pilot group conducts interviews with several individuals at a time, typically 7-8. This approach accelerates the study process and expands the sample size.

The procedure of respondent-driven sampling resulted in the subsequent distribution of participants by age and gender. (Fig. 2 and 3).

The majority of respondents are under the age of 20 (43%), with the second largest group (21%) falling within the age range of 20 to 29 years old. This discrepancy is due to the fact that most of the respondents are students, which provides

an additional opportunity to test the hypothesis regarding whether the educational process impacts the respondents' values and attitudes towards energy-efficient practices. The age groups of 30 to 39 (12%), 40 to 49 (11%), and 50 to 59 (7%) are well represented in the sample. However, the categories of individuals over 60 have lower representation, totaling only 6%.

The majority of respondents lives in Yerevan – capital city and largest agglomeration of RA (53%). A significant proportion of respondents live in Dilijan (5%), Razdan (4%), and Tzahkadzor (4%). Other regions of RA are also well represented in the sample (32%), however, without any significant concentrations on other major cities of the country. 2% of respondents live in the RA temporarily, being citizens of other countries (Fig. 4).

Table 1. Energy efficient patterns of behavior

Patterns of energy efficient behavior	Weight in EE Index
P1 Avoiding overloading the refrigerator	1
P2 Reducing opening and closing the door of the refrigerator	1
P3 Refrigerator temperature control	2
P4 Putting hot food into the refrigerator after preliminary cooling	2
P5 Using stairs instead of elevators	1
P6 Cleaning filter of the air conditioner	2
P7 Adjusting the temperature of the air conditioner	2
P8 Turning off lights in empty rooms	2
P9 Unplugging appliances not in use	2
P10 Turning off the TV when people are not watching	2
P11 Using energy-saving mode or turning off when not in use	2
P12 Doing ironing collectively	1
P13 Setting a lower shower temperature	2
P14 Adjusting the temperature of the radiator	2
P15 Reducing time for a shower	3
P16 Avoiding over-volume cooking	1
P17 Water heating of the required volume in an electric kettle	2
P18 Covering the pan with a lid when cooking or boiling water	1
P19 Buying energy efficient appliances	3
P20 Choosing goods with their CO2 emission in mind (carbon footprint)	3
P21 Using public transportation	3
P22 Using LED lamp instead of a fluorescent lamp	2
P23 Flame adjustment for cooking	Not included
P24 Use of residual heat when cooking on an electric stove	Not included
P25 Manual cleaning instead of using a vacuum cleaner	1
P26 Using dishwasher	Not included
P27 Using solar PV panels	Not included
P28 Using solar water heater	Not included
P29 Using electromobile	Not included

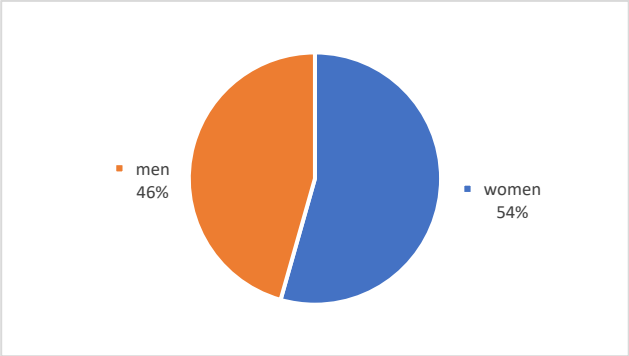

Fig. 2. Gender distribution

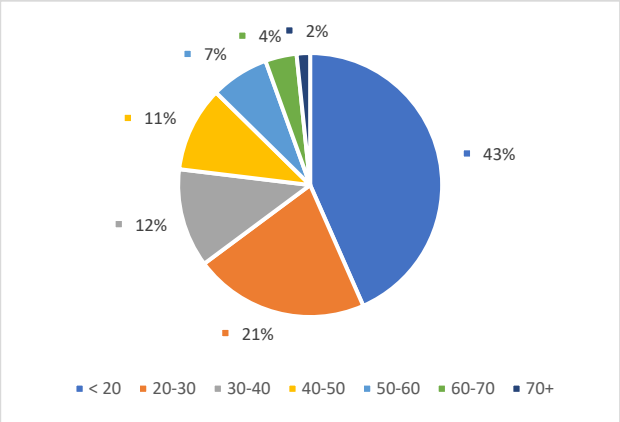

Fig. 3. Age distribution

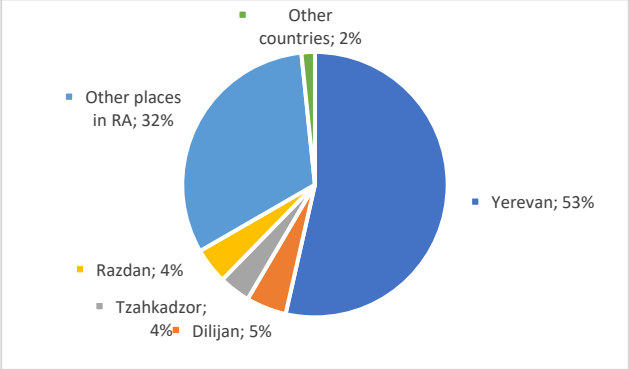

Fig. 4. Distribution by place of residence

The distribution of respondents by income level is the following: 23% of respondents determined their income level using the following description “I can satisfy all my needs and the needs of my family” (high). The share of those who defined their financial situation with the following phrase “In general ok, but sometimes I have to save” (middle) is the biggest (59%). 6% answered that they “Have to save on everything” (low) and 2% described they financial situation as “I live in poverty” (very low). 10% of respondents rejected to answer.

The absence of a normal distribution of data for most variables in the sample of respondents led to use non-parametric statistics tools to process the survey data (Hollander et al., 2013; Wu et al., 2017).

4. Results

At the first stage of the study, with the help of descriptive statistics, the frequency distribution of respondents' answers to the questions of the survey was studied. Our results demonstrate that 31.5% of respondents put responsibilities for improving the environmental situation in the country on authorities (country or/and local) (Fig. 4). However second largest group (almost 21%) believe that all agents (authorities and people) are responsible; 19.2% think that only people (community) are responsible. Another 24.2% believe that authorities of some level and people are responsible. Thereby, 64.3% of answers involve people (community) in responsibility for environmental situation (Fig. 5).

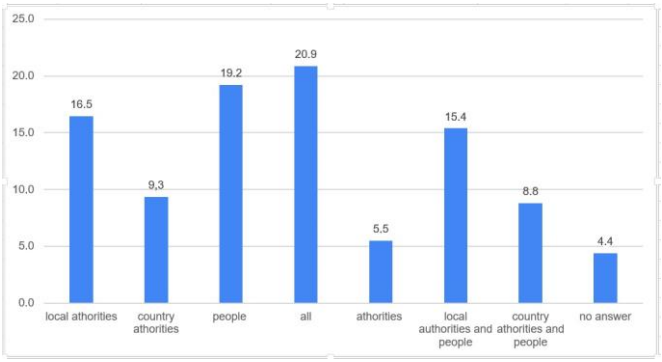

Fig. 5. Distribution of answers (percentage of all answers) about responsibility for improvements of environmental situation

Answers to the question about the belief that the respondent personally can improve the environmental situation distributed as follows: 56% believe that they can improve the situation; 20% think that they cannot influence, and 24% are not sure that they can change anything.

The distribution of respondents by the level of participation in environmental activities is the following: 54.4% of respondents never participated in any eco-activities; 34% of respondents participated in environmental campaigns to plant trees, clean garbage, collect wastepaper, glass containers, etc. at least once. About 12.6% of respondents filed complaints about any environmental pollution, participated in collecting signatures for appeals to the authorities with demands to improve the environmental situation. Almost 6.6% made donations for environmental activities. Only 2.2% of respondents took part in environmental protests. About 10% of respondent took part in more than one type of eco-activities.

The distribution of the frequency of application of patterns of energy-efficient behavior is shown in Fig. 6-8. Our results show that most popular practices are following: P4 (Putting hot food into the refrigerator after preliminary cooling), P8 (Turning off lights in empty rooms), P10 (Turning off the TV when people are not watching). Least popular practices: P3 (Refrigerator temperature control), P5 (Using stairs instead of elevators), P6 (Cleaning filter of the air conditioner), P15 (Reducing time for a shower), P20 (Choosing goods with their CO2 emission in mind), P25 (Manual cleaning instead of using a vacuum cleaner).

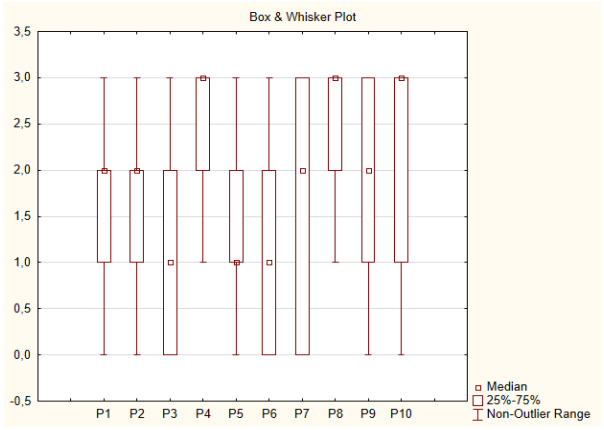

Fig. 6. Frequency of application of patterns of energy-efficient behavior P1 – P10

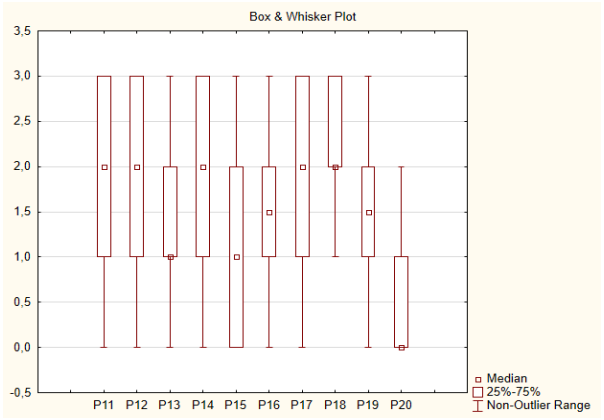

Fig. 7. Frequency of application of patterns of energy-efficient behavior P11 – P20

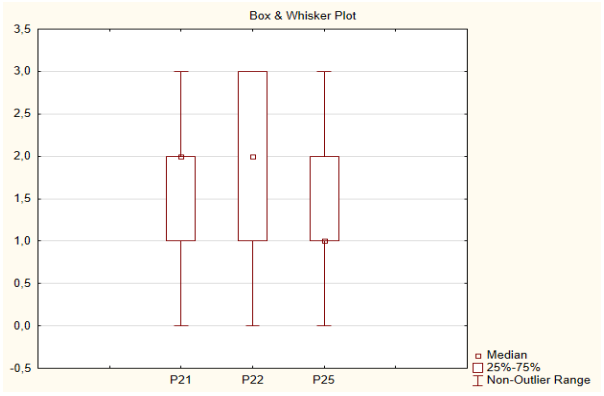

Fig. 8. Frequency of application of patterns of energy-efficient behavior P21, P22, P25

It is easy to note, that the most popular are "weak" patterns that have little effect on the growth of energy efficiency and are rather established household habits. The least popular are some of the "strong" patterns, which require conscious effort and additional information to form. Most popular energy efficient patterns are either those that are traditional everyday habits or those that are economically profitable.

The most common reasons for not using the energy-efficient pattern in practice are the respondents' lack of knowledge

about the usefulness of this skill (P6, P20), the lack of necessary conditions for use (P3), which in reality also indicates a lack of knowledge, and unwillingness to reduce their comfort (P5, P15, P25).

Series of Kruskal-Wallis tests (Kvam et al., 2022) have revealed the statistically significant differences in the value of the Eco-index in groups of respondents with different income levels (H=8.74, p=0.068) and occupation (H=12.41, p=0.029). The dependence of the Eco-index on the level of income is non-linear. The highest value of the ecological self-awareness index is shown by people with an average income level (group 2). People who refused to answer the question about the level of income and people with low income have the lowest values of the Eco-index (Fig.9).

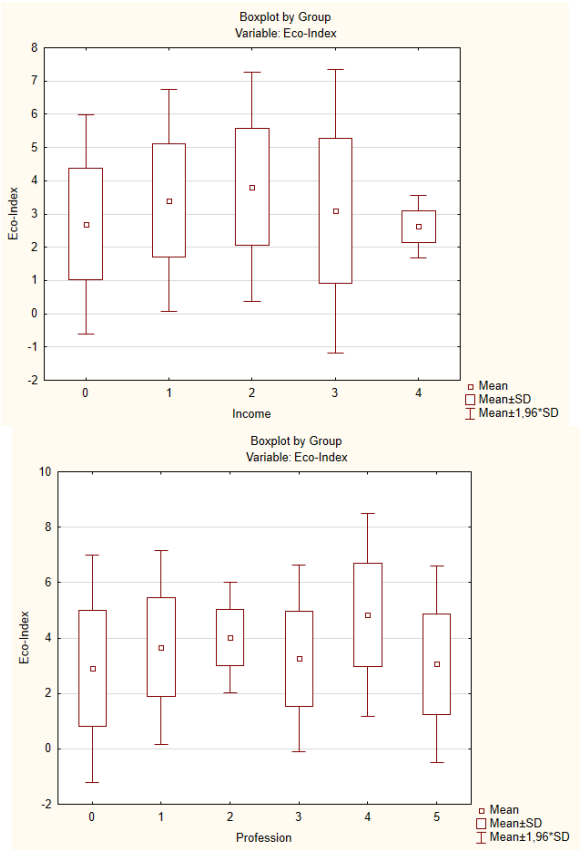

Fig. 9. Box and whisker diagrams for Eco-index, grouped by income level and profession

Regarding the distribution according to occupation, it can be mentioned that the highest value of the index of ecological self-consciousness among people not employed in the economy (pensioners, housewives, women on maternity leave, etc.). They are followed by a group of respondents working in the field of science and education (group 2) and students (group 1) (Fig. 9).

No dependence of the Eco-index on age, gender, and place of living was found. As for the Energy Efficient Behavior Index, it also does not depend on gender (Mann-Whitney test), does not depend on place of residence (Kruskal-Wallis test), but depends on profession (H=35.72 p=0.0000), and income level (H=16.6, p=0.0023) (Fig. 10).

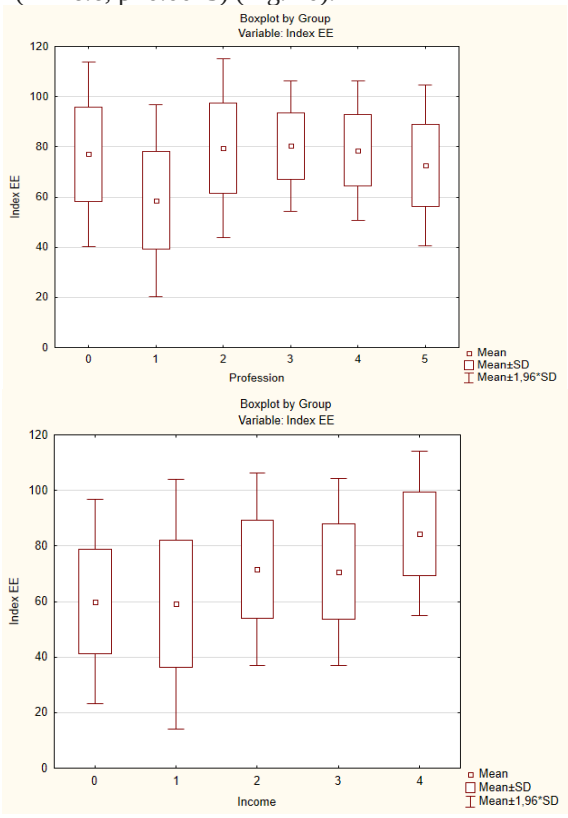

Fig. 10. Box and whisker diagrams for EE-index, grouped by profession (occupation) and income level

Those, who employed in education and science, as well as entrepreneurs, demonstrate the highest scores of the Energy Efficient Behavior index. Students have the lowest EE-index, which is mainly due to their financial dependence on their parents and their inability to make independent decisions on changing their behavior to more energy-efficient patterns.

The dependence of the EE-index on the level of income is close to linear. The lower the income level, the higher the EE-index. This result was also confirmed by calculating the Spearman non-parametric correlation coefficient ($R=0.28$, $p<0.05$). Besides, a positive correlation was found between the age of the respondent and the EE- index ($R=0.35$, $p<0.05$).

In addition, by calculating the Spearman non-parametric correlation coefficient, the hypothesis of the presence of a positively directed statistical relationship between the Eco-index and EE-index was confirmed ($R=0.266$, $p<0.05$). This allows us to draw the main conclusions regarding the formation of the state policy for improving energy efficiency in the household sector.

At the next stage of the study, using nonparametric correlation, the following hypotheses were tested:

H1: Eco-index affects the frequency of using individual patterns,

H2: Age affects the frequency of application of individual patterns,

H3: Income level affects the frequency of application of individual patterns.

The test results are summarized in Table. 2

Table 1. The test results

Pattern	Rank order correlation with *Eco-index*	Rank order correlation with *Age*	Rank order correlation with *Income*
P1	0.05	0.08	0.03
P2	-0.03	0.22**	0.12
P3	0.23**	0.19	0.05
P4	0.12	0.44**	0.26**
P5	0.22**	0.07	0.09
P6	-0.05	-0.15**	-0.09
P7	0.01	-0.21**	-0.11
P8	0.09	0.33*	0.17**
P9	0.14	0.14	0.08
P10	0.14	0.29**	0.16**
P11	0.19**	0.06	0.02
P12	0.02	-0.01	-0.04
P13	-0.03	0.25**	0.28**
P14	0.18**	0.30**	0.17**
P15	0.05	0.39**	0.26**
P16	0.02	0.14	0.18**
P17	0.03	0.45**	0.32**
P18	0.17	0.35**	0.28**
P19	0.20**	0.33**	0.04
P20	0.03	-0.09	-0.02
P21	0.27	-0.18**	0.12
P22	0.18**	0.31**	0.29**
P25	-0.04	0.29**	0.25**
P27	-0.09	-0.21**	-0.07

Statistically significant results at p=0.05 are marked with **

Our calculations demonstrate positive correlation with age of following patterns: P2 (Reducing opening and closing the door of the refrigerator), P3 (Refrigerator temperature control), P4 (Putting hot food into the refrigerator after preliminary cooling), P8 (Turning off lights in empty rooms), P10 (Turning off the TV when people are not watching), P13 (Setting a lower shower temperature), P14 (Adjusting the temperature of the radiator), P15 (Reducing time for a shower), P17 (Water heating of the required volume in an electric kettle), P18 (Covering the pan with a lid when cooking or boiling water), P19 (Buying energy efficient appliances), P22 (Using LED lamp instead of a fluorescent lamp), P25 (Manual cleaning instead of using a vacuum cleaner). These results suggest that older people are more responsible when it comes to saving energy in the home.

Negative correlation with age demonstrate following patterns: P7 (Adjusting the temperature of the air conditioner), P21 (Using public transportation), P27 **(**Using solar PV panels). An analysis of the reasons for this behavior shows that the rare use of the pattern by older people can often be explained by their fear of breaking the refrigerator, and the refusal to use public transport is due to health problems.

Negative correlation with income level (the lower income, the more often apply) show following patterns: P4 (Putting hot food into the refrigerator after preliminary cooling), P8 (Turning off lights in empty rooms), P10 (Turning off the TV when people are not watching), P13 (Setting a lower shower temperature), P14 (Adjusting the temperature of the radiator), P15 (Reducing time for a shower), P16 (Avoiding over-volume cooking), P17 (Water heating of the required volume in an electric kettle), P18 (Covering the pan with a lid when cooking or boiling water), P22 (Using LED lamp instead of a fluorescent lamp), P25 (Manual cleaning instead of using a vacuum cleaner). These results indicate the potential risk that as wealth increases, the population of a country may become less responsible for energy saving.

Positive correlation with Eco-Index show following patterns: P3 (Refrigerator temperature control), P5 (Using stairs instead of elevators), P11 (Using energy-saving mode or turning off when not in use), P14 (Adjusting the temperature of the radiator), P18 (Covering the pan with a lid when cooking or boiling water), P19 (Buying energy efficient appliances), P21 (Using public transportation), P22 (Using LED lamp instead of a fluorescent lamp). Most of the identified practices are "strong" in terms of their impact on energy efficiency growth and are relatively more difficult to apply in practice (requiring certain knowledge, skills and efforts).

5. Discussion

Therefore, our results show that most common energy-efficient patterns are either traditional everyday habits or economically profitable choices. These findings are quite consistent with the results of studies using a similar methodology conducted in Russia (Lazanuyk et al., 2021) and Uzbekistan (Salnikova, 2023).

The findings that people who do not participate in economic activities are more responsible for the environmental aspects of their behavior corresponds well with the results of the papers (Newell et al., 2015; Fuerst and Singh, 2018), which show that people that have free time are more engaged in energy-saving pro-environmental behavior.

Note that in our study we did not directly take into account the level of education, but the fact that people working in the field of education and science have higher energy efficient behavior indirectly correlates with the research results from European countries (Meyer, 2015) and some Latin America countries (Fuhrmann-Riebel, 2021).

6. Summary and conclusion

The results of the study allow us to draw two main conclusions that are most important for the development of government programs to stimulate energy efficiency in the household sector. First, the level of general environmental consciousness of the population has a direct impact on the frequency of practical application of various patterns of energy-efficient behavior. In addition, the higher the level of ecological consciousness of the population, the more "strong" patterns of energy-efficient behavior it demonstrates. Therefore, the main direction of energy efficiency policy can be education of the population and raising its level of environmental self-awareness.

Secondly, an increase in the level of well-being of the population can have a twofold effect: on the one hand, the higher the level of well-being of the population, the more expensive energy-efficient technologies people can afford (solar panels,

solar water heaters, electric cars, dishwashers). On the other hand, as wealth increases, the incentive to save energy decreases and people abandon a number of energy-efficient patterns in favor of greater comfort. Therefore, for the stratum of the population with a high level of income, it is necessary to provide additional incentives for the entire range of energy-efficient patterns. This can be achieved through social advertising that generates more sustainable consumption trends. For a low-income country, concessional financing programs (or tax breaks) should be provided for the purchase and installation of more energy efficient devices.

Combined with ongoing measures to improve the energy efficiency of the country's manufacturing sector and its infrastructure, the proposed incentives will enable Armenia to achieve more ambitious decarbonization targets.

Our study is limited due to our moderate sample size. This prevented us from conducting a more in-depth analysis of regional behavioral differences. Additionally, our study did not consider the influence of cultural values and social norms on fostering pro-environmental consumer behavior. As a direction for further research, we note for ourselves the introduction of more latent variables reflecting the respondent's eco-consciousness.

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