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## The importance of educating households on energy savings for reducing energy consumption and pollution

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# **THE IMPORTANCE OF EDUCATING HOUSEHOLDS ON ENERGY SAVINGS FOR REDUCING ENERGY CONSUMPTION AND POLLUTION**

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## **Abstract**

*This study explores the impact of educating households on energy savings and its subsequent effect on reducing energy consumption and pollution. The research was conducted on a sample of 10,044 household owners in the Tuzla Canton of the Federation of Bosnia and Herzegovina. During the first round of household visits, data on individual household electricity consumption for the past twelve months were collected, education on possible energy savings in households was conducted, and four standard light bulbs were replaced with four LED light bulbs. After one year, a second round of data collection on household electricity consumption for twelve months was conducted. The paper presents comparative indicators of electricity consumption before and after education, achieved savings in consumption, and the calculation of reduced harmful emissions into the air.*

*The research results showed that educating household owners about possible energy savings resulted in an increase in their efforts to achieve energy savings. The value of the achieved energy savings amounts to 4.47% in percentage terms, 1,962,676.50 kWh in absolute terms, the recalculated value of savings in EUR amounts to 166,079, while the value of reduced air emissions amounts to 2,345,398.42 kg CO<sub>2</sub>. The highest energy savings were achieved in the municipality of Kalesija at 8.76%, while the lowest were in the city of Živinice at 2.64%.*

*The results of this study will contribute to the literature gap in understanding the importance of educating the population, their behavioural characteristics, potential energy savings, and the cost-benefit analysis of such energy-saving projects.*

**Keywords:** education of household owners, energy savings, reduction of energy consumption, reduction of air pollution.

**JEL classification:** P18, P28, P36, M40.

## **Introduction**

We are witnessing accelerated changes around us. Climate change represents one of the countless challenges posed by human activity to the environment and will probably dominate international development and sustainable perspectives for a long time to come. Various economic activities affect these processes, mostly in the field of energy, agriculture, industry, waste management, etc. However, the production and use of energy represents, nevertheless, the biggest challenge for the quality of the environment. This raises a number of questions, primarily regarding the so-called "greenhouse effect" and in connection with this the possibility of global warming, which results in an increase in global temperature, a rise in sea level, changes in the water regime, impact on ecosystems, agriculture, forest fund, etc. The largest emission of carbon dioxide is made by thermal power plants. According to some estimates, the human population will number around 9 billion people by 2050, who need to be provided with food, the number of inhabitants in cities will increase by 2 billion, and the entire human population will need access to energy while reducing greenhouse gas emissions and ensuring a sustainable future. At the same time, if the problem of global warming is not solved, floods and droughts will intensify, sea levels will rise, water and food security will be more threatened, and the number of natural disasters will increase, which, according to the World Bank's estimates, will "suppress about 100 million people into poverty in the next 15 years". (The World Bank, 2020.)

The most comprehensive international agreement on reducing greenhouse gas emissions was verified in Paris at the end of 2015. At that time, the representatives of 196 countries agreed to take all measures to keep the level of global temperature increase below 2°C by the end of the 21st century, with the aim of aiming for an increase of 1.5°C. Scientists estimate that the 1.5°C warming option is much safer for our civilization than the 2°C warming option, and that humanity is on its way to a catastrophic 3°C warming.

There is a consensus among scientists that global warming of dramatic proportions will occur if forces are not joined at the global level to prevent it, that is, adequate mechanisms of direct investment for this purpose are not implemented. Regardless of the fact that many countries have already defined different strategies and action plans for mitigating climate change - in which cost-effective measures to reduce emissions are proposed (that is, with which it is possible to keep emissions below the level established by the Kyoto Protocol), until their practical implementation mostly hard to come by. In the next decades, a significant growth in world energy production, i.e. consumption of all energy sources, is forecast.

The world is rapidly switching to the use of renewable energy sources and discarding old technologies in the production of electricity. However, less developed countries are still dependent on traditional producers, such as solid fuel thermal power plants, and face numerous development and environmental problems due to this production. Electricity generation has a significant impact on the environment, particularly through the emissions of harmful gases such as CO<sub>2</sub> and SO<sub>2</sub> (Majumder 2023; Kaldellis et al. 2004). Coal-fired power plants that use high-sulphur coal, such as the Ugljevik Power Plant, are major polluters (S. Stajić & Čepić, 2020). An analysis of the Kuznets environmental curve in transitional countries shows that in some states, there is a positive correlation between energy consumption and CO<sub>2</sub> emissions, indicating a need for policies to improve energy efficiency (Pejović, 2022). Although highly developed countries are the biggest polluters of the environment, according to World Bank

estimates, climate change will cause the most damage to underdeveloped and developing countries in the future.

One of the ways to reduce energy consumption is to influence consumer behavior in order to achieve savings in energy consumption. Therefore, this paper is an attempt to determine to what extent the education of household owners can influence the reduction of electricity consumption, and what are the potential savings in energy consumption, household income and the reduction of CO<sub>2</sub> emissions into the air, which such education projects can achieve in Bosnia and Herzegovina.

Bosnia and Herzegovina is an upper-middle income country, facing many social, political and economic issues (such as low productivity, migrations of working population, high unemployment, low investments, corruption and low transparency, etc.). It was interesting to investigate the impact of education on the reduction of electricity consumption in the larger entity of the state - the Federation of Bosnia and Herzegovina, especially in light of recent increases in electricity prices in this area (in August 2024, the price of electricity for households increased by 23%).

The first part of the paper includes a literature review in the field of education and savings in electricity consumption. The second part of the paper refers to the detailed Research Methodology and Data Sources, while the third part of the paper presents Research Results and Discussion, after which the main conclusions of the research are presented.

## **1. Literature review**

There is a growing scientific research fund highlighting education and energy consumption nexus. Many authors have shown that there is a positive impact of education on the reduction of electricity consumption, while on the other hand, there are studies that show that education has no effect on the reduction of electricity consumption. Inglesi-Lotz and Morales (2017) analysed the causal and empirical relationship between primary energy consumption and education for a group of developed and developing countries, as well as an aggregate panel of these groups for the period from 1980 to 2013. The results confirm a unidirectional relationship from education to energy consumption. Nahmens and Joukar (2014) investigated how education changes the behaviour of low-income consumers who most often live in energy-inefficient households. They came to the conclusion that such households need effective training programs that will lead to the adoption of new energy-efficient habits that will ultimately lead to a reduction in electricity consumption, where it is very important to use effective educational strategies (demonstration techniques - which take into account the unique socioeconomic and demographics of low-income residents). Effective educational strategies, like practical demonstrations, were highlighted as essential for sustainable behavior change.

Studies such as Jovanović et al. (2013) underscore education's role in building awareness about energy efficiency. Their survey examined how formal and informal education systems address public knowledge on energy savings. The study was motivated by Serbia's energy consumption levels, which are two to three times higher than its GDP relative to EU averages. Results revealed that while formal education does not sufficiently cover energy-saving practices, citizens gain much of their knowledge on this topic through media, highlighting a gap in formal educational coverage. Similarly, Hiramatsu et al. (2014) found that environmental education

for children can positively influence household behaviour. The authors state that „children treated with environmental education in school encourage their families to engage in pro-environmental behaviours including energy-saving behaviours“. There is a growing interest in the introduction of education in schools aimed at saving electricity consumption. Gill and Lang (2018) using a comprehensive panel analysis among school children in the USA in the school year 2015/2016 showed that there is a connection between the lessons learned at school and behaviour at home when it comes to a set of instructions regarding saving electricity consumption and that "energy education" can be a valuable instrument for policy makers in terms of increasing energy efficiency. On the other hand, they also showed that it is very difficult to influence permanent behaviour change.

Education targeted at young students has shown promising results. Pietrapertosa et. al (2021) investigated the impact of education of young people on electricity consumption with the aim of increasing energy efficiency in public buildings. The education of young people was carried out in public schools in Italy during the 2018/2019 school year, and the target group was children between 3 and 14 years old. The results showed that "an average decrease of 4% in natural gas consumption was observed in the school in which energy saving measures complemented technical interventions and a limited increase in electricity consumption (between 0.5% and 4.3% per capita), which led to savings on the energy bill of about 1,122 Euro". Similarly, Keller et al. (2022) examined energy literacy of young participants, more precisely 6,000 respondents in primary and secondary schools in Austria. Energy literacy was investigated on a „cognitive, affective and behavioural level, and it compares the putative energy-saving effectiveness of the workshops to that of conventional energy audits“. Results indicated that after ETSIT (Austrian Education Energy Initiative) workshop students' energy literacy was raised as well as their claim that they will make changes in energy consumption behaviour in the future.

Findings indicate that educational methods should be adapted to regional development stages to effectively promote low-carbon lifestyles. Findings of Wang et al. (2020) imply that policymakers should adopt educational methods and interventions to promote low-carbon knowledge and awareness that reflect the different stages of educational development in regions. This approach can encourage residents to adopt low-carbon lifestyles, thereby reducing energy consumption and mitigating CO<sub>2</sub> emissions. Similarly, according to the study Amin et al. (2024) renewable energy and education lower CO<sub>2</sub> emissions by 0.46% and 0.22%, respectively. Financial development, urbanisation, and natural resource depletion all have a 0.14%, 0.03%, and 0.08% impact on the environment, respectively. The heterogeneous causality analysis reveals the feedback effect, i.e., bidirectional causal links between education, carbon emissions, and the use of renewable energy. According to research conducted in 27 OECD countries, empirical evidence suggests that countries should increase investment in education and renewable energy sectors and plan for research and development in renewable energy for ensuring environmental sustainability Zafar et al. (2020).

Some countries are trying to influence the responsible behaviour of the population with regard to the consumption of electricity not only through education but also through the approval of discounts as a reward for the rational use of energy. Ristić & Vučković (2023) describe a government initiative offering discounts to households for rational electricity use, which successfully motivated a reduction in consumption. Namely, in the period of the global energy crisis due to rising gas prices, before the winter period of 2022-2023, the Government of the Republic of Serbia adopted a Conclusion, which recommended the Public Company "Elektroprivreda Srbije" Belgrade to calculate a discount for customers from the "household"

category for rational consumption of electricity. Discounts range from 15 to 30% depending on energy savings of 5 to 30%.

Some countries are trying to reduce electricity consumption through smart metering systems. Stanojević (2018) presented a system for analysing electricity consumption and generating bills for smart metres, allowing subscribers detailed insight into their usage. A study in Cyprus found that households using smart monitors to track electricity costs achieved average savings of 25%, while those receiving verbal information saved about 10% (Georgiou et al., 2013). However, Filipović et al. (2019) found that providing information on energy-saving methods had little impact on consumer behaviour when electricity prices are very low, as in Serbia. Their controlled experiment with 330 households demonstrated that non-price factors alone were insufficient to significantly change consumption patterns in this context.

In Bosnia and Herzegovina, a study on the residential building stock highlighted substantial energy savings potential, emphasising the importance of data-driven policy-making and the implementation of energy-saving measures at the individual household level (Zagora et al., 2017). The quantitative analyses presented in this paper show that the most significant energy saving potential at the level of Bosnia and Herzegovina lies in the single-family housing residential typologies. In comparison to the energy saving potential of 7.93% in collective housing, the implementation of EE measures in single - family housing may result with the absolute savings of 47.30%

Contrary to the research presented above, research by Chen et al (2023) on data on electricity consumption in developing countries in the period from 1990 to 2019 showed that education, that is, education leads to an increase in electricity consumption and that "a 1% increase in education causes an increase in energy consumption of 0.496353%".

According to the study by Wang et al. (2022), empirical results show that financial development significantly increased the use of renewable energy; however, education did not make a positive difference. Additionally, bidirectional and unidirectional causality were observed for financial development and education, respectively, toward renewable energy. This suggests that policymakers should combine financial development policies with educational initiatives to improve the efficiency of renewable energy use. According to the research of Cihan & Değirmenci (2024) the long-term average schooling rate has a negative effect on energy consumption in house-holds, but income level has a positive effect on a panel basis. On the other hand, it was also found that the error correction mechanism works and that the income level has a positive effect on the energy consumption in the households in the short term, but the average schooling rate does not have a significant effect on the energy consumption in the households in the short term.

Considering the various findings of the previously mentioned research, it was interesting to investigate the impact of education on the reduction of electricity consumption in the Federation of Bosnia and Herzegovina.

## **2. Research Methodology and Data Sources**

The main goal of this research was to determine the extent to which education of household owners can influence the reduction of electricity consumption, and the potential savings in energy consumption, household income and reduction of CO<sub>2</sub> emissions into the air, which such

education projects can achieve. The research was conducted through two visits and consultation of 10,044 household owners living in the area of the Tuzla Canton, in the cities/municipalities of: Kalesija, Tuzla, Lukavac, Živinice, Banovići and Gračanica. During the first visit to households in 2020, a survey was conducted and insight into electricity consumption for the period August 2019 - July 2020 was carried out, and advice and recommendations related to savings were given, with the aim of motivating households to take measures to reduce energy consumption and change your habits. During the first visit, each household received a symbolic package of "energy saving" in which, in addition to thematic promotional material, there were also 4 LED light bulbs. Energy advisors immediately installed the light bulbs in households.

In order to determine the effect of advising household owners on energy saving measures, after one year, data on individual household electricity consumption was collected again for the period August 2020 - July 2021. The total duration of the project for collecting data on electricity costs before and after consultations on energy savings lasted from August 2020 to August 2021.

Education regarding energy savings in households covered various aspects of the savings budget, from replacing ordinary light bulbs with energy-saving and LED bulbs to thermal insulation of residential spaces. Also, the energy efficiency labels on household appliances were clarified, and the attention of household owners was drawn to how much can be saved by buying more energy efficient household appliances.

The research sample consisted of 10,044 respondents from the area of Tuzla Canton (hereafter TK). Out of a total of 10,044 respondents, 25% or 2,509 are from the area of the city of Tuzla. This is followed by: Kalesija 1,505 (15%), Živinice 1,505 (15%), Banovići 1,514 (15%), Lukavac 1,508 (15%) and Gračanica 1,502 (15%). In question, the convenience sample was created according to the availability of household owners at the time of the visit by the energy advisors. Most respondents live in family houses (one unit) 73% of respondents, followed by residential buildings 15.3% of respondents, family houses with several separate units 11.1%, while 0.3% of respondents live in other buildings (barracks, prefabricated buildings and fig.). When it comes to the age of the buildings in which the respondents live: 14.3% of them live in buildings over 50 years old, 41.3% in buildings 29-50 years old, 22.9% of them live in buildings between 21 and 28 years old age, 15.6% of them live in buildings between 11 and 20 years old, while only 5.4% of residents live in buildings up to 10 years old. When it comes to the area of the living space: 25% of respondents live in a building with an area of 101-150 m<sup>2</sup> of living space, 24.12% of them live in a building of 76-100 m<sup>2</sup>, slightly more than 23% of respondents live in a building of 51-75 m<sup>2</sup>, 10.54% of them live in an area of 25-50 m<sup>2</sup>, and 4.36% of them live in buildings larger than 201 m<sup>2</sup> of living space. All the above data will help to better understand the sample on which the research was conducted.

The main limitation of the conducted research is the insufficiently large research sample. In order for the research sample to be relevant, it needs to include 5% of respondents from the total population of Tuzla Canton. Observing the number of inhabitants by municipalities/local communities according to the last population census in Bosnia and Herzegovina from 2013, we can say that our research sample is less than 5% and amounts to 3.195%. Another limitation of the conducted research is the emergence of the covid-19 pandemic and changes in behaviour patterns in the period when data on electricity consumption was collected after the education.

The results were processed with a descriptive text. Data on electricity costs per month before and after education and replacement of 4 ordinary light bulbs with 4 LED bulbs will be shown

in EUR. We ensured the accuracy of data on electricity consumption by looking into the electronic database of “Elektroprivreda” Bosnia and Herzegovina, along with knowing the user code of each household. Namely, “Elektroprivreda” BiH offers its users an electronic insight into the state of the account as well as an overview of all transactions on the client's analytical account. On the basis of value savings and knowledge of the emission factor for Bosnia and Herzegovina, we calculated the reduction of CO<sub>2</sub> emissions.

### 3. Research Results and Discussion

Table 1 presents the results of collected data on the average monthly price of electricity in households by individual municipalities and cities of the Tuzla Canton. The data in the table are presented in euros and represent weighted average electricity costs for the period from August 2019 to July 2020. These are actual data on electricity consumption for 10,044 households before education on potential energy savings.

*Table 1. Average electricity costs measured in the period August 2019 - July 2020 before education*

Municipality /City	August	Sept.	Oktob.	Nov.	Dec.	January	Febr.	March	April	May	Jun	July	SUM (AVG)
Banovići	30.50	31.16	31.84	32.69	33.43	33.91	32.81	33.21	32.53	31.86	31.42	31.44	386.81
Gračanica	33.38	33.60	34.29	34.94	36.28	35.91	34.86	34.71	34.63	33.80	33.09	33.88	413.36
Kalesija	31.80	32.06	31.23	32.45	34.15	35.54	32.58	31.96	32.52	31.73	30.92	32.18	389.12
Lukavac	28.85	28.54	28.69	29.15	30.76	30.95	29.27	29.63	30.22	29.30	28.62	29.31	353.28
Tuzla	26.40	26.36	26.77	27.09	29.12	28.68	27.33	27.79	28.70	27.76	27.18	27.07	330.27
Živinice	29.84	29.93	30.10	30.94	33.17	33.26	32.19	31.39	31.62	30.76	30.04	30.52	373.77
Total	29.76	29.89	30.12	30.80	32.45	32.61	31.09	31.09	31.41	30.56	29.91	30.37	370.05

*Source: author's processing*

After the energy advisors educated household owners about the possibilities for energy savings and replaced four ordinary light bulbs with LED bulbs, data on electricity consumption was collected again. The weighted average costs of electricity, expressed in euros, after the training are presented in table number 2.

*Table 2. Average electricity costs measured in the period August 2020 - July 2021 after education*

Municipality /City	August	Sept.	Oktob.	Nov.	Dec.	January	Febr.	March	April	May	Jun	July	SUM (AVG)
Banovići	28.99	29.63	30.32	31.20	32.13	32.21	31.33	31.74	31.00	30.36	29.95	29.95	368.83
Gračanica	32.52	32.72	33.17	33.99	35.30	34.97	34.34	33.85	33.34	32.70	32.31	32.27	401.49
Kalesija	29.76	29.68	29.58	29.89	30.41	30.66	29.93	29.51	29.68	28.92	28.46	28.56	355.02
Lukavac	27.40	27.58	27.58	28.23	29.45	29.48	28.64	28.37	28.58	27.93	27.25	27.03	337.52
Tuzla	25.96	25.97	26.41	26.91	27.97	27.87	26.77	26.70	26.60	25.95	25.30	25.29	317.71
Živinice	28.37	28.58	28.98	30.16	33.00	32.65	31.85	31.67	31.54	29.53	28.72	28.84	363.90
Total	28.55	28.73	29.06	29.76	31.04	30.97	30.11	29.96	29.78	28.91	28.34	28.33	353.51

*Source: author's processing*



On the basis of the data presented in table 1 and table 2, the calculation of savings in electricity consumption by municipalities and cities of TK was made, and the data on the percentage value of the savings are shown in table 3.

*Table 3. Calculation of savings in electricity consumption expressed in percentages*

Municipality /City	August	Sept.	Oktob.	Nov.	Dec.	January	Febr.	March	April	May	Jun	July	SUM (AVG)
Gračanica	2.59%	2.62%	3.24%	2.71%	2.70%	2.61%	1.49%	2.46%	3.74%	3.26%	2.35%	4.74%	2.87%
Kalesija	6.42%	7.45%	5.27%	7.91%	10.98%	13.72%	8.15%	7.66%	8.74%	8.84%	7.96%	11.25%	8.76%
Lukavac	5.04%	3.35%	3.85%	3.14%	4.27%	4.75%	2.16%	4.24%	5.42%	4.67%	4.77%	7.78%	4.46%
Tuzla	1.66%	1.48%	1.33%	0.68%	3.94%	2.84%	2.07%	3.92%	7.34%	6.54%	6.92%	6.55%	3.80%
Živinice	4.95%	4.50%	3.75%	2.51%	0.49%	1.84%	1.03%	-0.89%	0.26%	3.98%	4.40%	5.51%	2.64%
Total	4.07%	3.88%	3.52%	3.40%	4.34%	5.03%	3.15%	3.64%	5.19%	5.40%	5.27%	6.72%	4.47%

*Source: author's processing*

Electricity savings on average, at the level of all municipalities/cities, amounts to 4.47%. Of these, the largest recorded saving of electricity was recorded in the municipality of Kalesija and is on average 8.76%, while the smallest saving was recorded in the town of Živinice at 2.87%. The fact that, due to the Covid-19 pandemic, during the period of data collection (from August 2020 to July 2021), a large number of people working from home could also have an impact on electricity consumption. All family members spent more time at home, so this certainly had an impact on higher consumption of electricity and less realised savings.

An overview of savings in electricity costs and consumed kilowatt hours, before and after education in average and total value is presented in table 4.

*Table 4. An overview of savings in electricity costs and consumed kilowatt hours, before and after education in average and total value*

Municipality /City	Before the education		After the education		Savings		Total savings	
	Average consumption	kWh	Average consumption	kWh	AVG	kWh	Total	kWh
	(EUR)		(EUR)		(EUR)		(EUR)	
Banovići	386.81	4,571.18	368.83	4,358.67	17.98	212.51	164,501.23	321,736.44
Gračanica	413.36	4,884.95	401.49	4,744.65	11.87	140.30	17,843.91	210,874.08
Kalesija	389.12	4,598.55	355.02	4,195.53	34.10	403.02	51,325.27	606,546.83
Lukavac	353.28	4,174.92	337.52	3,988.76	15.75	186.16	23,755.38	280,734.02
Tuzla	330.27	3,903.02	317.71	3,754.56	12.56	148.46	31,519.17	372,484.17
Živinice	373.77	4,417.10	363.90	4,300.48	9.87	116.62	14,851.24	175,507.55
Total	370.05	4,373.11	353.51	4,177.70	16.54	195.41	166,079.34	1,962,676.5

*Source: author's processing*

The total savings in electricity consumption in 10,044 households that were in the sample amounts to EUR 166,079.34, or 1,962,676.5 in kWh. According to Pietrapertosa et. al (2021) and contrary to Chen et al (2023) and Wang et al. (2022) this research showed positive impact of education on reduction of electricity consumption as well as reduction of CO<sub>2</sub> emissions. The calculation of the reduction of CO<sub>2</sub> emission is done according to the formula:

Emission reduction of CO<sub>2</sub>=Energy saving (kWh)×Emission factor (kg CO<sub>2</sub>/kWh)

The emission factor in the production of electricity is the amount of emissions of carbon dioxide (CO<sub>2</sub>) or other pollutants emitted into the atmosphere per unit of electricity produced. This factor is usually expressed in kilograms of CO<sub>2</sub> per kilowatt-hour (kg CO<sub>2</sub>/kWh) or megawatt-hour (kg CO<sub>2</sub>/MWh). The emission factor for BiH is 1,195 tCO<sub>2</sub>/MWh, which means that the emission factor for energy production in BiH is 1,195 kg CO<sub>2</sub>/kWh.

Emission reduction of CO<sub>2</sub>=1,962,676.5 kWh×1.195 kg CO<sub>2</sub>/kWh = 2,345,398.42 kg CO<sub>2</sub>

The total savings in CO<sub>2</sub> emissions resulting from the reduction in electricity consumption amounts to 2,345 tons of CO<sub>2</sub>.

A reduction of CO<sub>2</sub> emissions by 2,345,398.42 kg results in a decrease of approximately 1117.81 global hectares (gha) in ecological footprint. This means that the amount of biologically productive land required to absorb CO<sub>2</sub> emissions has been reduced by 1117.81 hectares. Considering the average ecological footprint per person globally (which is around 2.7 gha annually), this reduction neutralizes the ecological footprint of more than 400 people on a global scale within one year.

## **Conclusion**

The aim of the work was to determine whether education of household owners about possible energy savings can encourage greater savings in households. The sample consisted of 10,044 households from the area of Tuzla Canton in the Federation of Bosnia and Herzegovina. The results of the research showed that after the education and the replacement of 4 ordinary bulbs with 4 LED bulbs, households actually saved more electricity. Electricity savings on average, at the level of all municipalities/cities, amounts to 4.47%. The total saving in electricity consumption amounts to EUR 166,079.34, i.e. 1,962,676.5 in kWh. The total savings in CO<sub>2</sub> emissions and contribution to reducing pollution amounted to 2,345 tCO<sub>2</sub>. A reduction of CO<sub>2</sub> emissions by 2,345,398.42 kg results in a decrease of approximately 1117.81 global hectares (gha) in ecological footprint. The results of the research suggest that educating household owners about potential electricity savings results in savings in electricity consumption. This is particularly significant in the context of the 23% increase in electricity prices for households from August 2024. The mentioned price increase is just the beginning, because by the end of 2024, an additional increase in prices is expected for both households and business entities. In light of such an increase in prices, household owners will have an even greater incentive to achieve savings in energy consumption. The results of the research point to the fact that the total savings in electricity consumption and reduced pollution greatly exceed the costs of education for household owners. The results of the research are particularly significant when placed in the context of the country and the emissions trading system. Bosnia and Herzegovina have a high emission factor because electricity production is mainly obtained from the burning of fossil fuels. The results of the study in Tuzla Canton are consistent with broader findings in the literature on the impact of education on energy consumption reduction. Education initiatives aimed at raising awareness and encouraging behavioural change have been shown to lead to reduced energy usage in various contexts.

When it comes to the limitations of the conducted research, it is first of all a relatively small sample because 10,044 households make up only 3,195% of the population of Tuzla Canton.

Another limitation in the research is the emergence of covid 19, which caused a greater change in behaviour patterns and a greater stay of people in their homes, which could affect the higher consumption of electrical energy and the lower displayed value of energy savings that education and replacing four ordinary light bulbs with four LED bulbs in households. A recommendation for future research on the impact of education on energy savings on the value of savings in electricity consumption is to increase the research sample in times of more stable external conditions, which will not have a major impact on the change in people's behaviour.

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