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ORIGINAL RESEARCH PAPER

Preferences and knowledge of farmers and internet-orientated population about renewable energy sources in Kosovo

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ABSTRACT

Our results introduce the preferences and attitudes of farmers and the internet-orientated population regarding renewable energy sources (RES) in Kosovo. The research included 243 internet-orientated participants and 30 farmers. The data was gathered through questionnaires (in both groups) and deep interviews (just in farmers). The results showed that the awareness of RES was high for especially solar, wind and hydro energy, the relationship among them was very strong. It was justified that firewood was typically used by respondents with low income, but not considered as renewable energy source, similarly to Hungary and the USA. A special feature of Kosovo is that electricity has very high importance for the man in the street, even for heating. Better education, higher income and environmental-consciousness definitely support better knowledge of RES, similarly to international tendencies. Males and employed participants had more knowledge about RES than females, or unemployed ones. Moreover, the results showed that the participants prefer environment rather than convenience, which is also typical of less wealthy countries. Our results might be useful as a typical less developed country case study for international comparison and helps to eliminate the unknown willingness in RES for the development of future agricultural strategies in Kosovo.

KEYWORDS

agriculture, knowledge, firewood, comparison, pellet, education, income, environment, employment, gender

JEL CLASSIFICATION CODE

Q40, Q41, Q42

1. INTRODUCTION

Energy is an essential and significant factor for social, economic and industrial development. Economic growth comes together with an increasing energy demand, especially with electricity.

Renewable energy has been known for a long time in Kosovo, but still not used to be applied a lot in the capacities of the country. Even though Kosovo is not part of the European Union (EU), the energy strategy follows the obligations of the Energy Community Treaty regarding RES. Kosovo is abundant in lignite, and it possesses around 12.5 billion tons in geological reserves, which places Kosovo as the country with the second largest lignite reserves in Europe and the fifth largest in the world, supplying 97% of total generation of electricity in Kosovo [1]. Moreover, it is an agricultural country and half of its terrain consists of arable land, cultivated mainly in family farms with significant potential also for energy production.

One of the possible reasons for using renewable energy sources is to move closer to EU legislation. Both the Kosovar and EU decision-makers are in a quite complicated situation,

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considering that several other challenges of the 21st century – including environment and climate protection – should also be solved, and if possible, as soon as possible and simultaneously [2].

Since attitude and knowledge is the basis of the future spreading, this article aims to study the motivation and behaviour of the Kosovar population toward the use of renewable energy sources with special attention to farmers. Natural potential and the need for a better environment can strengthen the country's position through innovation, development and sustainability with a direct impact toward joining the EU.

Renewable energy would be a tremendous instrument for sustainable development in Kosovo. In the current situation, the share of renewable energy is negligible and the information about it is poor. Still, it is important to have a purpose and to follow the light toward the use of RES.

2. LITERATURE REVIEW

2.1. Introduction of relevant Kosovar data

The Republic of Kosovo is a country in the southeast of Europe, with a total area of 10,905 km^2, while the area of agricultural land is 512,000 ha [3]. According to the Green Report [4], in 2019, the total arable land turned out to be 0.11 ha per capita, while the average of the total utilized agricultural area per capita was 0.24 ha. Its strategic position makes it very favorable for the use of the potential for renewable energy. The report finds that wind and solar energy are the best options for moving toward using renewable energy in the future.

Agriculture is a crucial sector, and it plays an important role in the GDP of Kosovo. According to a study of [5], the share of the agricultural sector in GDP was around 11% in 2018 and it shows a slight upward trend [6]. The farm structure has four classifications: farm size of 1 up to less than 5 ha represents 50.9% of the total area of arable land, followed by the size of 5 up to less than 20 ha (29.7%), farm size less than 1 ha (9.9%) and farms with a size of 20 ha participated with 9.5% of arable land. Regarding the number of agricultural holdings, 30.3% are subsistence in farm size 0 up to less than 0.5 ha of arable land [4]. Large-scale farming is untypical in Kosovo due to the lack of capital and other financial sources (subsidies and grants).

In general, the sector is characterized by small farms, fragmented lands, low efficiency and not adequate infrastructure. According to [7], Kosovo has the potential for production of up to 15.43 ktoe electricity based on the combustion of crops-based biomass.

Innovations and growing efficiency in agriculture play a major role in increasing the potential for food and fuel production and resolving the conflict between the multifunctional use of agricultural products [8]. Moreover, a recent review study [9] concluded that many elements of precision technologies can be applied by small scale farms typical in Kosovo.

2.2. Energy background in Kosovo and the neighbouring countries

The ratio of RES is still low in a considerable number of countries in the world; however, other countries are very successful in this regard, and some of them have experienced some problems due to the overproduction of electricity from these sources [10]. Generally green energy consumption is directly proportional with GDP and inversely proportional with population density [11] and it is near true also for Kosovo.

The electricity sector of Kosovo relies on coal-fired power plants (97%) and is considered one of the sectors with great potential for development. However, the quality of the coal is very low, and the consequences are high. Moreover, two main power plants in Kosovo that are lignite-fire are very outdated and are causing significant heavy air pollution and environmental problems. Due to the use of these power plants, 129 deaths happened, with the impact on the highest costs – EUR 209 million [12], whereas due to the decrease in productivity because of limited activity days and work days lost as a result of being sick amounted represented to EUR 6.4 million. Although sewage sludge and agricultural biogas plants have many advantages, due to the high investment costs [13], they have no significance in Kosovar electricity production.

Despite all of the above mentioned, lignite is considered the only source to be able to produce electricity to fulfil the consumer's needs. Electricity prices are lower in Kosovo than in other countries in the region [14]. In connection with this, in 2012, the average consumer tariff for electricity was €0.0688 per kilowatt-hour (kWh) after taxes, significantly below the regional average of €0.0797; however, Kosovo's households spent a larger share of their expenditure on energy than households in almost any other country in Europe or Central Asia. Currently, an increase in the global level of energy prices has occurred due to the enormous increase in gas demand. This situation affected Kosovo since we are importers of electricity due to a negative balance between production and consumption. With this regard, Kosovo's energy regulator established new electricity tariffs, more concretely an increase in household electricity tariffs which will be applied until the end of March 2023 [15]. The price of electricity for households has doubled for those over 800 kWh consumption per month, concretely 5.9 cents during the low overnight tariff and for the rest of the day billed with 12.52 cents. So far, 22–30% of households in Kosovo consume less than 800 kWh of electricity monthly. For this category, the prices will be unchangeable, 2.89 cents for low and 6.75 for higher tariffs.

Although the price of electricity in Kosovo is low in comparison to surrounding countries, the cost of electricity consumes a disproportionately higher share of income for Kosovar households [16]. While European households rarely pay over 6% of their income for electricity, in contrast, Kosovar households that purchased an average amount of electricity in 2015 paid just over 9.6% of their annual income for electricity. The most attacked by this phenomenon were

low-income families who purchased a smaller quantity of electricity and spent 29.7% of their incomes on payments for it. Moreover, 44% of Kosovars had trouble paying their bills for housing, electricity, taxes and heating in 2014, based on the Kosovo Agency of Statistics.

The government is working toward the use of clean energy in proportion to EU requirements, but there is a lot of work to be done. According to the Energy Community Treaty, Kosovo has a renewable energy target of a 25% share in the final gross consumption of energy by 2020. In 2017, it achieved 22.9% of renewable energy, putting it on track to meet its target [17]. There were registered 76 MW (MW) of hydropower, 34 MW of wind and 7 of MW solar in the total capacity by the end of 2018.

Coal remains to have a major significance for Kosovo as it provides direct and indirect employment for thousands of people in the coal mining and electricity generation industry. Even though Kosovo is wealthy with energy sources, electricity production is provided by imported fossil fuels, especially during the winter season [18].

Consumption of energy in Kosovo has increased continuously. The most important challenges in Kosovo's energy system are the low efficiency in operation and the high release of GHG emissions.

Despite some advances in renewables, the Kosovar energy sector remains heavily reliant on coal. By the end of 2019, Kosovo registered 76 MW of hydropower, 34 MW of wind and 10 MW of solar energy for a total capacity of around 120 MW, marking a 6% annual increase in renewables' capacities [19]. Due to this activity, the electricity produced from renewables accounts for 5.5% of the total production. By the end of 2015, only a marginal amount of photovoltaic energy (PV) and the wind had been deployed in Kosovo based on the report of South-East Europe [20]. Moreover, the largest share of renewables is based on biomass heating. Regarding the wind power plant, seven wind energy applications are in the permitting process, with an overall installed capacity of 170 MW. Considering the geographical position of Kosovo, it has significant wind potential. Still, only a part of this is deemed cost-effective due to the mountainous terrain and wind speeds ranging from only 4–6 m s^{-1} in most of the identified suitable areas [20].

Among the Balkan countries, Albania, Bosnia and Hercegovina's situation is very similar to Kosovo in generating its electricity by exploiting lignite, without a high share of the hydropower sector. In North Macedonia, the electricity production is based on the use of coal, with the expansion of solar energy, 5.5 MW of solar PV were added into operation in 2019. The European Union reached a 22.1% share of its gross final energy consumption from RES in 2020, around two percentage points above its target [21]. Listed by countries, the highest share of energy from RES had Sweden (60%) among the EU Member States in 2020, followed by Finland (44%) and Latvia (42%). At the opposite end of the scale, Malta (11%), followed by Luxembourg (12%), and Belgium (13%) had the lowest proportions of renewables in energy production.

2.3. Attitude for renewable energy in other countries

Promoting sustainability through the use of energy sources is considered to be an actual strategy by several countries worldwide in order to mitigate climate change and improve the generation of energy from renewable sources [22]. According to their results, the factors of WTP (willingness to pay) for RES are different depending on the types of renewable energy sources, and citizens of more developed countries have more positive values in terms of RES energy. Regarding types of RES, the WTP is considered higher for solar, biomass and wind energy, whereas hydropower is considered less.

According to the article of [23], wind power source plays a vital role in the share of electricity production; specifically, one-third of the electricity is generated from this source in Denmark. Based on the results of this article, two important attributes when choosing a product by consumers are price and the percentage of renewables. Moreover, electricity suppliers and contract characteristics are considered significant factors. It shows that most consumers know the importance of renewable energy and are willing to pay for an increase in the ratio of RES.

According to the study of [24], the participation of citizens in mitigating climate change and the transition of energy contributes positively in this regard. The same article explores and evaluates the willingness of citizens to participate in energy cooperatives in Germany. Even though the cooperatives seem to be really interesting options, this study indicates that the citizens' intentions to participate are low due to the fact that there is a lack of familiarity with the term "energy cooperatives". This is a response to the fact that in Germany there is a small number of energy cooperatives, specifically 900 of them compared to 10,800 municipalities.

Nevertheless, a study by [25] explored the attitudes of the Hungarian population in 2020 about RES. Based on its results, more than 92% of the population have knowledge about solar, wind and hydropower energy. Moreover, three sources were checked for significance in terms of different variables such as: age, education, occupation, and environmental consciousness. Education, intellectual activity, and health consciousness are influential factors in the knowledge of RES by the Hungarian population. Whereas for biomass, the increase in the level of health awareness, environmental preoccupation and level of education can be linked with the correct understanding of this term. An interesting fact shown in this article, which is similar to the Kosovar case in terms of RES, is that the distinction between the solar panel and solar collector was a blurred situation in both countries. Whereas firewood was considered an expensive energy source, inconvenient in usage and a pollutant of the environment, more interestingly, it was considered a non-renewable energy source. Another Hungarian study [26] shows that respondents' opinion about biofuels (biodiesel and bioethanol) is optimistic and positivistic. However, it should be emphasized that current, conventional biofuels do not provide a long term solution [27, 28]. An interesting article on the evaluation of RES preferences was done in one

of the most underdeveloped agricultural areas in terms of economic, social and infrastructural instruments, Hernad Valley in Hungary. The ratio of knowledge by people who heard about burning biomass in half of the settlements exceeds 40%. In contrast, the term "biomass" was not known at all; only a low rate of people associated it with wood or straw, even though more than 60% of the respondents used it as a heating energy source [29].

When it comes to Western Balkans Countries, a study of [30] about attitudes and preferences for RES was conducted in Montenegro. This paper shows that the importance of energy sufficiency is so low in comparison with price and location when deciding to purchase home equipment. Moreover, there is a gap between the actual behaviour and consumers' attitudes. This study concluded that the consumers are informed below the average regarding RES, with greater awareness of hydro energy and the least for geothermal sources.

Whereas a study in Greece has found that the awareness of the respondents regarding the benefits of RES is really high, about 72%, and they believe that these sources are the key answer against climate change [31]. On the other hand, the same study shows that just 10% of the respondents expressed the willingness to take part in a renewable energy improvement.

It is very important to highlight that biomass energy utilization has high income-generating potential especially in the countries with intensive high-level, mechanized and automatized agriculture, however, the social role is limited [32].

3. METHODOLOGY

The main question of the research is: "What are the preferences and attitudes of the population of Kosovo regarding the use of renewable energy?" The research question was answered and analyzed through questionnaires with the population and farmers.

The respondents are residential inhabitants of Kosovo and were recruited through a simple random sampling method, where each member of the population of Kosovo had an exactly equal chance of being selected, regardless gender, age, nationality or ethnicity. The participation which is highly valued was voluntary, anonymous and confidential. The data were analyzed in a group and not individually, with the main aim to be used for the purpose mentioned above. The online questionnaire was divided into two main parts; the first one regarding the personal data and the information regarding the environment, the second part about the knowledge regarding the RES. The questionnaire could be filled approximately for 10 min and it could have been discontinued at any time without the need for any additional justification. The questionnaire was completed only once by the individuals and the data gained was used only once.

Farmers were recruited through a snowball sampling method due to the difficulties in reaching them through the internet. The contact of farmers was given from the office of Ministry of Agriculture in Kosovo. Farmers were coming from all regions of Kosovo in order to be more representative. The process of gathering data through questionnaires was carried out from December to January 2020/21.

The online questionnaires have served as a path in obtaining and understanding better the thoughts and beliefs hidden behind the interviewees. Moreover, it is a widely used method, where the physical contact is impossible but it shows the opinion of the interviewees from different groups such as gender, age, education differences and so on.

The sample was divided into two groups:

- The first group was the internet-orientated population, analyzed for their preferences of RES through online questionnaires. The percentage of households with access to the internet from home in 2020 was 96.1%, letting us know that online questionnaires are representative of the population [33]. The number of respondents is 243. The respondents are residents of Kosovo and were recruited through a simple random sampling method, where each member of the Kosovo population had an equal chance of being selected, regardless of gender, age, nationality or ethnicity. The reason of using the internet is that the possibilities for research on consumers attitude and preferences are very limited in developing countries [34].
- The second group included the farmers of the Republic of Kosovo. The data from farmers were collected through questionnaires and interviews. First, farmers had to fill out a questionnaire regarding their preferences for using the RES on their farms. Then the author conducted deep interviews to get the best opinions regarding RES on farms. The interviews consisted of eleven questions about the importance of RES in farms, specifically, the usage of biomass on the farm, straw usage, sustainable energy on the farm and management of energy (costs, environment characteristics, comfort). The number of farmers is 30, unspecified farms; farmers were engaged in the cultivation of various vegetables, cereals, and fruits, as well as those who owned animal farms. Four farmers interviewees were the owner of dairy farms, seventeen of them were in combined production (dairy farms and crop production) and nine of them were crop production farmers. Moreover, in terms of the representativeness of farmers based on the age groups, it is observed that the age group 35 to under 45 years is the largest (33%), whereas the second group is the age from 45 to under 55 years (25%) [35]. Based on Table 1, farmers who were part of this study mainly belong to this group.

Data obtained from questionnaires were analyzed through the statistical program SPSS 26 version, using descriptive statistics, a chi-square test, one independent sample *t*-test and one-way ANOVA to find out the significance between the factors (gender, level of education, income, age groups, occupation and environmental-consciousness) in the preferences of RES. The questions that measured the knowledge about RES had to be rated on a five-point Likert scale, while there were also questions with dichotomous ("yes/no") answers and multiple-choice questions. For nominal (categorized) questions, the comparison

Table 1. Distribution of the sample according to the most important demographic variables ($N = 243$, $N = 30$)

Label	Sample distribution			
	Internet-orientated population		Farmers	
	Count	%	Count	%
Male	74	30.5	26	86.7
Female	169	69.5	4	13.3
18–29	196	80.7	0	0
30–39	32	13.2	6	20
40–49	10	4.1	16	53.3
50–59	5	2.1	6	20
Above 60	0	0	2	6.7
Primary school	5	2.1	0	0
High school	63	25.9	23	76.7
University studies	117	48.1	5	16.7
Postgraduate studies	58	23.9	2	6.7
Employed	110	45.3	17	56.7
Unemployed	30	12.3	13	43.3
Student	103	42.4	0	0
Can live on it very well and can also save	71	29.2	1	3.3
Can live on it but can save little	114	46.9	20	66.7
Just enough to live on but cannot save	48	19.8	9	30
Sometimes cannot make ends meet	2	0.8	0	0
Have regular daily financial problems	2	0.8	0	0
Don't know/No answer	6	2.5	0	0

Source: Own results based on the responses from the questionnaires.

was performed using a chi-square test of independence. Independent sample *t*-tests were used when two categories were separated in the responses obtained from the different socioeconomic groups. Whereas in terms of more than two categories, one-way ANOVA was performed.

Web surveys are generally used for collecting answers on preferences despite the low level of sample control, control of data collection, as well as lower response rate and representativeness. Still, high flexibility of data collection, high speed and low costs can also be considered as advantages [36]. This type of data collection suffers less from the "warm-glow effect" and is less influenced by the interviewer [37].

4. RESULTS

4.1. Awareness of renewable energy sources

The results indicate that the awareness of RES is outstanding in solar, wind and hydro energy in both cases: internet-orientated population and farmers (80–100%). The reason might be the knowledge from media, school education and trainings. Based on Table 2, solar energy is outstandingly heard from both groups, especially from farmers, which is proven by its zero standard deviation.

Wood pellet can be regarded as another generally known renewable energy source, which is widely used for heating in Kosovo. Whereas biogas is less heard from farmers compared to the internet-orientated population (there is no agricultural biogas plant in Kosovo), and it proves that not just financial position but also the level of knowledge is a determinant factor in recognition of RES. Awareness of transportation biofuels is negligible in both groups because there is low usage of biofuels in daily life. Biodiesel is slightly higher with higher fluctuation.

The Pearson correlation was performed and there was found a significant relationship between solar energy and wind ($r = 0.51$, $P < 0.001$), hydro ($r = 0.47$, $P = 0.00$), wood pellet ($r = 0.23$, $P = 0.00$) and geothermal energy ($r = 0.23$, $P = 0.00$). Those people who have heard of solar energy have tended to have also heard of wind, hydro, wood pellet and geothermal energy.

- Significant differences between groups in gender, level of education and employment were found in RES heard by the internet-orientated population. While regarding farmers, if they have heard about RES, there were no significant differences between males and females, age

Table 2. Types of renewable energy sources heard by the population ($N = 243$, $N = 30$)

Types of RES	Internet-orientated population %			Farmers %		
	Have heard about it	Mean	Standard deviation	Have heard about it	Mean	Standard deviation
Solar	89.7	0.9	0.3	100	1	0
Wind	85.6	0.86	0.35	90	0.9	0.3
Hydro	83.5	0.84	0.37	80	0.8	0.4
Geothermal	37.4	0.37	0.48	30	0.3	0.46
Heat pumps	28	0.28	0.45	30	0.3	0.46
Bio-briquette	23	0.23	0.42	66.7	0.67	0.47
Wood pellet	68.3	0.68	0.46	86.7	0.87	0.34
Biogas	27.2	0.27	0.44	16.7	0.17	0.37
Biodiesel	22.2	0.22	0.41	33.3	0.33	0.47
Bioethanol	16	0.16	0.36	13.3	0.13	0.34

Source: Own results based on the responses from the questionnaires.

groups, level of education, occupation and income. The only significant difference for farmers was environmental consciousness ($\chi^2 = 47.07$, df = 20, $P = 0.001$).

- Significant differences were found in employment for the general population ($\chi^2 = 39.07$, df = 20, $P = 0.007$). Based on these analyzes, students have heard more of RES, followed by employed and unemployed people. Incomes and environmental awareness did not differ significantly in that if they had heard or not about RES ($P > 0.05$).
- Based on gender and whether they had heard of RES, differences were significant in terms of the internet-orientated population ($\chi^2 = 30.11$, df = 10, $P = 0.001$), however in general comparisons for both groups, males were in a better position regarding the RES that they heard, especially for biomass (wood pellet and biobriquette), biofuels (bioethanol and biodiesel) and geothermal energy even that in terms of farmers the differences were not significant ($P > 0.05$).

Following self-reported knowledge, the awareness regarding biomass was really high. In this term, farmers were in a better position in comparison with the internet-orientated population as a result of working on farms and being in contact with biomass (agricultural residues) every day (Table 3). In contrast, the opposite was found to be true for solar collectors since most people automatically think of solar panels when considering solar energy (Fig. 1, Table 4).

Concerning the energy source produced by solar collectors, significant gender differences were found in the internet-orientated population ($\chi^2 = 13.42$, df = 4, $P = 0.009$); males possess much higher knowledge than females, whereas, in terms of farmers, there were no significant gender differences. Moreover, a significant difference was found in the environmental-consciousness factor in the internet-orientated population, $\chi^2 = 27.05$, df = 16, $P = 0.04$, while for farmers, the differences were not significant. The distinction between these two sources (solar panel and solar collector) is still blurred between respondents in Kosovo. The increase in the level of education and environmental awareness can also be linked to the correct understanding of solar collectors.

Notice: Taking into consideration that farmers and internet-orientated population could choose more than one option listed in the questions the total numbers of the related categories (internet-orientated population, farmers) are higher than 100%.

Biogas can produce three products: electricity, thermal energy and fuel. However, the most reported answer by the general population was fuel, followed by thermal energy and electricity. Regarding farmers, they have reported for electricity, followed by fuel and thermal energy. There were significant differences in the general population in terms of the knowledge of energy production from biogas between males and females ($\chi^2 = 11.61$, df = 4, $P = 0.02$); males had more accurate knowledge than females. Regarding the level

Table 3. Knowledge of population for the term "biomass" ($N = 243$, $N = 30$)

	Distribution of Responses	Internet-orientated population		Farmers	
		N	%	*N*	%
Have you heard about biomass?	Yes	112	46.1	23	76.7
	No	131	53.9	7	23.3
Biomass definition	Any kind of organic material	96	56.8	10	43.5
	Plant material	37	21.9	7	30.4
	Wood	2	1.2	1	4.3
	Herbaceous plant	3	1.8	1	4.3
	Don't know/No answer	31	18.3	4	17.4

Source: Own results based on the responses from the questionnaires.

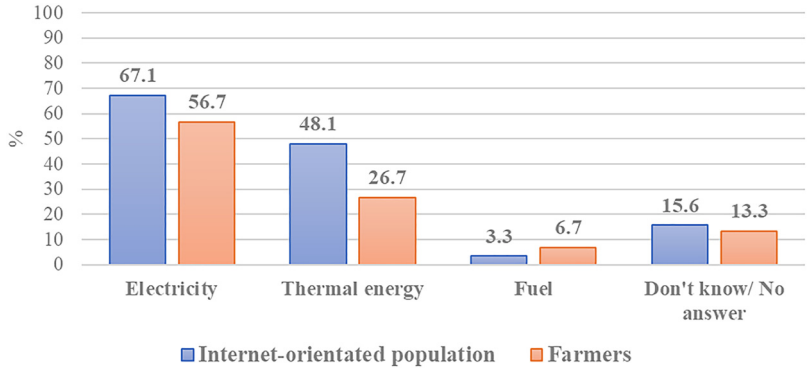

Fig. 1. Knowledge of internet-orientated population ($N = 243$) and farmers ($N = 30$) for energy sources generated by solar collectors
Source: Own results based on the responses from the questionnaires.

Table 4. Knowledge of energy sources that can be generated by biogas ($N = 243$, $N = 30$)

	Distribution of Responses			
	Internet-orientated population		Farmers	
Energy sources	*N*	%	*N*	%
Electricity	66	27.2	20	66.7
Thermal energy	95	31.2	16	53.3
Fuel	130	53.5	19	63.3
Don't know/No answer	71	29.2	4	13.3

Source: Own results based on the responses from the questionnaires.

of education, income, occupation and environmental consciousness, there were no significant differences in terms of the general population ($P > 0.05$). In contrast, for farmers, significant differences were found concerning education. The right answers were from respondents with university studies, followed by those with high school ($\chi^2 = 15.51$, df = 8, $P = 0.05$).

4.2. Attitudes and preferences for using renewable energy sources

More than 40% of the internet-orientated respondents and the vast majority of farmers accepted that they use RES in their households. From both groups of respondents, wood was the most reported source to be used, followed by the wood pellet. Wood is a cheap source used mostly for heating purposes, which in the mind of respondents is a separate source from other RES, and in many cases, it is considered a non-renewable energy source. In the case of farmers, access to wood is easy as a result of living in rural areas and having access to the wood of the mountains. With regard to wood pellet, farmers use it in quite similar percentages like the internet-orientated population due to the awareness that its raw material comes from agriculture. Almost every farmer was aware of the positive aspects of using RES equipment. They acknowledged that there is a relatively high and unaffordable cost on their part in installing solar panels on farms.

- Gender, age groups, income, level of education, and environmental consciousness were not significant factors in the use of RES for both groups ($P > 0.05$); significant differences were found in terms of the general population concerning living in a home or flat ($\chi^2 = 34.26$, df = 6, $P = 0.000$).
- The use of wood (63.7%) and wood pellet (37.3%) is higher for those living in the home compared with those living in the flat (33.3% for wood and 14.8% for wood pellet). Regarding the environmental aspects of using energy sources, the wood pellet was preferred by those as "very environmentally-conscious" 37.9% and "mostly environmentally-conscious" 30.4%.

When respondents of both groups were asked what RES would like to use in the future, most reported solar panels, followed by wind energy, wood pellet and bio-briquette (Table 5). When respondents were asked about the heating material that they use in their households (Fig. 2) wood was the most reported source, with a higher percentage by farmers. In terms of the internet-orientated population, the second most used heating material was electricity, whereas for farmers was the wood pellet. Coal use has been a very low percentage reported by respondents. Such a low use of coal is a result of the respondents' awareness about health and environmental protection.

The respondents were asked about the expenses for heating during one month in the winter season; the majority of the general population spent "above 60 euro" for heating during one month in winter whereas most farmers spent "30–45 euro".

Environmental consciousness is considered to be the most important aspect in both groups (internet-orientated population and farmers). Most respondents found the purchase of renewable energy equipment expensive, except for wood, which is a pollutant of the environment and a cheap source. The same opinion is shared by farmers who include wood pellets in this category as expensive regarding the equipment purchase.

The respondents answered a 10-point scale question to measure what is important for them when purchasing RES equipment, where 1 stood for "convenience" and 10 meant "eco-friendliness to the environment". Based on the opinion of the internet-orientated respondents, the mean score was 6.87 (SD = 2.63, min = 1 & max = 10), whereas, for farmers, the mean score was 6.4 (SD = 2.19, min = 1 & max = 10). According to means 6.87 and 6.4, it can be understood that respondents consider more the eco-friendliness of the type of energy than the convenience of using them. Whereas according to [25], the mean of the Hungarian population was

Table 5. The use of RES and their desired types for future use ($N = 243$, $N = 30$)

	Distribution of Responses for Internet-orientated population				Distribution of Responses for Farmers			
	Use of RES		Would like to use it in future		Use of RES		Would like to use it in future	
Type of sources	*N*	%	*N*	%	*N*	%	*N*	%
Solar panel	7	2.9	180	74.1	4	13.3	23	76.7
Wind energy	1	0.4	84	34.6			3	10
Firewood	74	30.5	40	16.5	29	96.7		
Bio-briquette	3	1.2	18	7.4			4	13.3
Wood pellet	42	17.3	41	16.9	5	16.7	9	30
Heat pumps			35	14.4			2	6.7
Other	30	12.3	8	3.3			1	3.3
Don't know			7	2.9				
None			9	3.7				

Source: Own results based on the responses from the questionnaires.

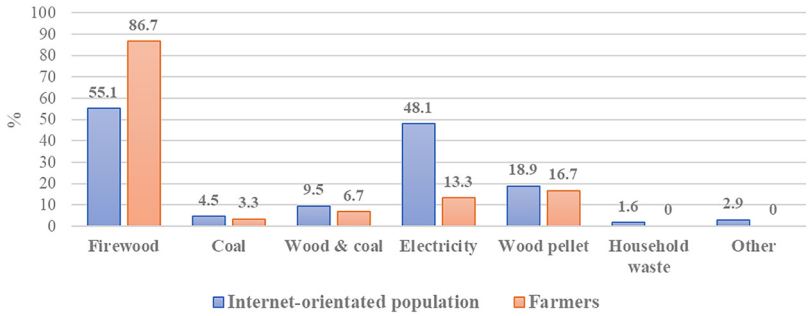

Fig. 2. Materials used for heating by internet-orientated population and farmers ($N = 243$, $N = 30$)
Source: Own results based on the responses from the questionnaires.

4.92, suggesting that convenience and environmental protection are given similar importance when choosing the type of energy, understanding that Kosovo stands better regarding the environmental-consciousness.

4.3. Farmers' preferences for RES in deep interviews

Regarding what farmers think about the use of RES, everyone reported that it is a very good, efficient and effective practice with positive advantages financially and ecologically (environmental protection). Farmers mentioned that there are very high costs of installation but operation is very economic. Some farmers reported that regarding RES (biomass), there are advantages in the reuse of agricultural wastes from farms.

When asked if they had seen the equipment of RES, the vast majority of farmers reported about solar panels, whereas a low percentage reported wind energy. During the in-depth interviews, the farmers' awareness about the benefits of using RES was highly noticed; two of them had solar panels installed on the farm and at home (one farmer had 40 panels and another 12 panels) and mentioned the benefits regarding cost reduction in terms of electricity.

The main source of energy used in farms was electricity, with the main reason that there are high RES installation costs; otherwise, they would use them. This is considered to be a disadvantage and they stated that there is a need of more financial support from government in terms of grants and subsidies in this field.

In terms of straw, the majority reported using it on farms for personal purposes, for laying cattle bedding. But there were also those who did not use it at all, just put it in the field or burn it. When asked if they would like to sell it, almost all responded positively to the sale of unnecessary and leftover straw on the farm.

When farmers were asked which is the main factor in the operation of energy sources (cheap costs, convenience, environmental aspects), the most common answers were environmental aspects.

5. DISCUSSION

The awareness regarding the environment and health consciousness has created conditions for an increase in the generation of energy from RES. Kosovo is a small country, very wealthy in lignite, used by old lignite-fired power plants, with some hydropower energy production and ambitious intention for generating electricity from RES. The situation is similar to the Polish and Balkans coal-dominated energy structure but totally different from the EU average, where the ratio of RES in 2016 accounted for 86% of new power installations [38].

Energy is an important factor in terms of the development of agriculture and farms. Our study explored the attitude of farmers in terms of the use of RES as a source of energy for their farms. Based on the opinion of the farmers, there does exist a willingness toward the use of RES equipment, and they are well informed about the importance of renewable energy, from which 76.7% would like to install solar panels in the near future, it is very similar to internet-orientated population (74.1%, Fig. 3).

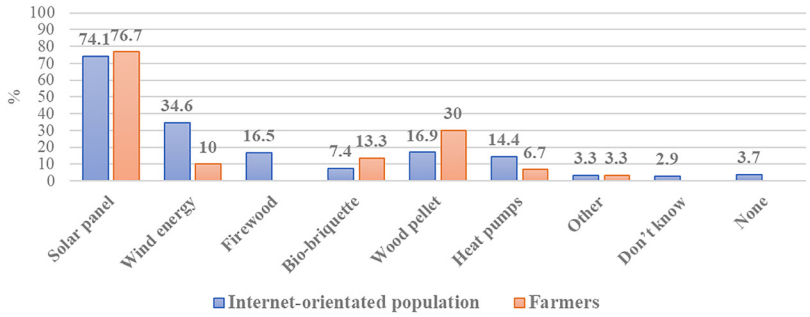

Fig. 3. The willingness of internet-orientated population and farmers to use RES in the future
Source: Own results based on the responses from the questionnaires.

It was justified that both groups typically used firewood, but electricity also has high importance for the man in the street for heat production, which is a special feature of Kosovo; the reason may be the low price of electricity generated from cheap domestic lignite. However, firewood is not considered a renewable energy source, which is very similar to the Hungarian experiences [25, 29]. Farmers agree to adopt this method if there is help (grants & subsidies) from the government and NGOs. The attitude is more favorable in Kosovo than in the Czech Republic, where almost half of the farmers considered agro-energy a very profitable way of doing business, contributing to farm stabilization and diversification, supported more by the younger generation of farmers [39]. Above 80% of the Internet-orientated population in Kosovo have heard about solar, wind and hydro-energy. Solar energy enjoyed the highest approval for future use, followed by wind energy and biomass. This corresponds with the results of [40], which explored the preferences for RES in Germany, France and the Swiss Upper Rhine region. According to the findings, 85% of the respondents supported the use of solar panels. In contrast, geothermal and bioenergy were ranked the lowest amongst RES, exceptionally in the French region, where hydropower rank is the lowest. Better education, higher income and environmental-consciousness definitely support better knowledge of RES, corresponding to previous research.

Moreover, the results showed that the participants prefer environmental friendliness rather than convenience when using renewable energy, which is also typical in less wealthy countries [25].

6. CONCLUSIONS

This study reviewed the preferences and attitudes of alternative renewable energy sources such as biomass, solar, geothermal, wind, biogas, hydro and biofuels by looking at their limitations, prospects and current applications for general purposes and in agricultural practices.

Knowledge of RES by the internet-orientated population and farmers is very high (80–100%) regarding three energy sources (solar, wind and hydro). However, farmers have heard more about solar and wind energy and less about hydro-energy compared to the man in the street. In addition, males had heard more about those three energy sources than females and those educated than those non-educated ones. Biodiesel and bioethanol are typically unknown because of the lack of information and their small use in daily life.

Most of the lower-income respondents use firewood for heating due to lower costs. Moreover, firewood is generally considered a non-renewable energy source, similar to Hungary and the USA. Additionally, people with higher incomes use wood pellets for heating due to their convenience.

Environmental consciousness is outlined as the most important reason for future installation of RES technologies, and the population's awareness of the quality of the environment is relatively high. On the other hand, the respondents reported that high equipment purchase costs are the dominant reasons for not installing any kind of RES technologies.

Awareness of RES also varied among demographic segments of the population surveyed, where males had higher levels of awareness and self-assessed knowledge than females. Employed people showed greater awareness and self-assessed knowledge in RES than unemployed people (probably due to financial reasons). Environmentally conscious people had a significantly higher knowledge in RES than those that do not care about the environment. According to the findings, the population is open to alternative options; however, old routines, misinformation, and lack of capital and financial resources keep them away from possible new solutions.

The majority of the internet-orientated average man and farmers plan the use of RES in future, especially solar panels (74.1% and 76.7%, respectively). The reasons why farmers would like to use solar panels and wood pellets in the future are reducing production costs, increasing self-reliance and taking care of the environment. Solar collectors can help dry crops, heat homes, livestock buildings and greenhouses and power irrigation systems. However, the available municipality funds are low and insufficient, the economics of using RES in agriculture is not obvious and will be the topic of a new research.

In Kosovo, there is a gap between the willingness to use RES and the actual utilization level, which can be reduced through good informative campaigns and proper agricultural policy. The structure of our questionnaire was based on a previous Hungarian research, so it was easy to make a comparison between the Kosovar and Hungarian situations. It may be useful for other international surveys in the future. Our results may be typically true for the small countries of South-East Europe, so they may also be a reasonable basis for international comparisons.

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LIST OF ABBREVIATIONS

ANOVA	Analysis of Variance
df	degrees of freedom

EU	European Union
EUR	Euro Currency
GDP	Gross Domestic Product
GHG	Greenhouse gases
ha	Hectare
km^2	Square kilometer
Ktoe	Kilotonne of Oil Equivalent
kWh	Kilowatt-hour
$m\ s^{-1}$	meter per second
MW	Megawatts
N	Number of people participated in the questionnaires
NGOs	Non-governmental organizations
P	probability value
PV	Photovoltaic
r	Correlation Coefficient
RES	Renewable Energy Sources
SD	Standard Deviation
SPSS	Statistical Package for the Social Sciences
USA	United States of America
WTP	Willingness to pay
χ^2	chi-square

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