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Prospects for Biomass Heat Energy in Kosovo: Environmental Considerations and Usage Limitations

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Abstract: The energy crisis has highlighted the need for a significant change in Kosovo's lignite-based electrical energy system, particularly greater investments in renewable energy sources. These sources would provide greater price stability, centralized accessibility, and relatively affordable investment costs. This research tries to analyze the basic attitudes behind the behavior of the students from the agricultural faculty in Kosovo in order to acquire a better understanding of their preferences for renewable energy source purchases, using the Best–Worst Scaling (BWS) method and cluster analysis. Students' perspectives on renewable energy show strong environmental and price conscientiousness in BWS methods (first and second rank), while the rate of eco-skeptic students reaches only 23% in the cluster analysis, which is a very promising sign of the younger generation's growing dedication to sustainability. Students, as future decision-makers, can play a critical role in making the transition to a more sustainable and resilient agricultural system. Green transition in Kosovo can be reached by combining the importance of dissemination and marketing tools with the pressing demand for renewable energy solutions, which might be interesting not only for Kosovo, but (considering the expectable enlargement) also for the EU.

Keywords: questionnaire; survey; student; BWS; cluster; education; price

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1. Introduction

According to previous estimations, the total biomass is approximately 1260 EJ/year, with 219 EJ/year allocated for actual utilization, suggesting a potential for unlimited energy in practice [1]. Concurrently, the conventional utilization of biomass for food production has demonstrated considerable variability in recent times, primarily attributable to shifts in demographics and changing dietary preferences [2]. It is also worth noting that an improvement in living standards is typically accompanied by an increase in energy supply, particularly in developing countries [3].

Energy plays a crucial role in the proper functioning of daily activities. As a member of the Energy Community, Kosovo is required to adopt basic EU legislation on climate, energy, and environment, given that Kosovo signed the Sofia Declaration on the Green Agenda for the Western Balkans in 2020, pledging to reach net zero CO_2 emissions by 2050 [4]. The current energy crisis and the unprecedented price increases in the electricity markets in Europe have also affected the electricity system of Kosovo. This energy crisis proved that Kosovo's electrical energy system must undergo a deep transformation, increasing

investments in renewable energy sources that have less price volatility, are more central, and have low investment costs [4]. The electricity sector of Kosovo relies on coal-fired power plants that had been affected by inherited issues after the war in Kosovo, and the transition period has had an immense effect on its progress. Households have the largest share in final energy consumption: in total, 4721.4 GWh of electricity was sold to the end consumers, of which 3131 GWh, or 61.2%, was sold to households and 1986 GWh, or 38.8%, to non-residential customers [4].

A relatively large amount of energy consumption is attributed to heating from electricity due to the fact that Kosovo does not have a natural gas infrastructure or market, despite the Energy Law and Energy Strategy requiring the development of this infrastructure through connections to gas infrastructure projects in southeastern Europe, such as the Trans-Adriatic Pipeline (TAP) and the North Macedonia-Kosovo Pipeline Interconnect Gas [5]. Even though Kosovo is not part of the European Union, its energy strategy places specific emphasis on fulfilling its obligations under the Energy Community Treaty (EnCT) regarding renewable energy sources [6].

Furthermore, Kosovo stands out for its small farms [7,8], so achieving self-sufficiency from these farms would be beneficial, as it would reduce energy consumption by households.

Biomass is a versatile feedstock, and its traditional use as food, feed, and forage limits the amount available for energy use. The availability of biomass for energy purposes is largely constrained by various factors inherent to agricultural settings, including the cropping structure of the farm, the number of animals present, the accessibility of suitable technology, and financial resources for harvesting. Concurrently, energy recovery is ordinarily the most valuable value-added recovery option.

The utilization of blockchain technologies is accompanied by a substantial energy demand and environmental impact, representing a notable disadvantage. The employment of renewable energy sources, predominantly wind energy, for data mining and large-scale computing can significantly mitigate these drawbacks [9]. In the Netherlands, there is a growing focus on renewable energy community heating, with 78 community heating projects and 1093 collective solar systems implemented in 2022 alone. According to a survey by Okur et al. [10] there remains a high level of private interest in this area.

According to Bai et al. [11] agriculture byproducts are best to be utilized for local energy supply due to their slight energy value. Furthermore, Kosovo must evaluate the potential in the overall system of managing agricultural biomass despite significant barriers, one of which is assuring additional income throughout the entire production structure. The systematic gathering and utilization of agricultural biomass for energy purposes would lead to the creation of new jobs [12–18] which would be crucial for the social and economic redevelopment of rural areas.

Biogas plants have many advantages in farming, but they cost a lot of money to set up, so they are not used in practice in Kosovo's farming industry [19]; however, it is noteworthy that they have the potential to contribute meaningfully to both sustainability and local economic development [20].

It has been demonstrated that certain by-products hold potential not only in the context of heat supply, but also in other areas. For instance, used cooking oils, tallow, animal fats, and greases have been found to contain FFA (Free Fatty Acid) levels ranging from 4 to 20%, which is considerably higher than the FFA content of oilseeds (1.5%) [21]. Following modification and at low concentrations, these by-products could be utilized as a substitute for diesel oil in powering agricultural machinery [22]. The utilization of by-products as a fuel also greatly increases the sustainability of the process [23]. In developed countries, pyrolytic utilization and carbonization of by-products, with their lignocellulose content, can also be a novel approach to by-product utilization [24].

The possibility of achieving full or partial local energy self-sufficiency as well as Kosovo's obligations to policies for renewable energy sources and climate change mitigation would both benefit from an increase in the share of utilized agricultural biomass.

The paper, therefore, is not about how to reconcile consumers' and citizens' behaviors; rather, it explores the main attitudes of students' behavior for a better understanding of the preferences of renewable energy source purchase through the Best–Worst Scaling method. The outcomes of this study will assist the education authorities in finding suitable means to integrate renewable energy education into the study process. This study will provide policymakers in Kosovo with insights and recommendations for future planning.

1.1. Energy Transition Priorities and Insights from BWS Studies

Due to rapid globalization, population growth, and advancements in contemporary civilization, the energy industry has experienced a constant increase in demand for energy from both industrial and non-industrial industries during the past few decades. Due to this, emissions of greenhouse gasses (GHGs) are the main cause of climate change and must be addressed to lessen its effects. Since the energy sector accounts for over 40% of global greenhouse gas emissions and 75% of the European Union [25], considerable effort is needed to support the sustainable energy transition. Numerous initiatives have been proposed at the national and international levels to meet the energy and environmental goals outlined in the 2030 Energy and Climate Framework. All of these initiatives, nevertheless, are predicated on two fundamental tenets: raising the output of renewable energy and enhancing energy efficiency. In addition, the Renewable Energy Directive by the European Commission aimed to raise the 32% target to at least 40% of the EU's total energy mix from renewable sources by 2030 [25]. In another perspective, a 2024 survey finds that Alberta (Canada) has considerable membership and investment potential, despite poor awareness of Renewable Energy Co-operatives (RECs). Furthermore, the data show that economic incentives (such as energy cost reductions and return on investment) and environmental reasons (such as promoting the renewable energy transition) are important factors in people's decisions to participate in or invest in RECs [26]. According to a BWS analysis from another study, citizens in five states in the USA prioritize contract flexibility, energy generation location, and carbon emission reductions as major GPP (green pricing programs) qualities. The data show that integrating these ideal GPP characteristics can significantly increase customer value. To be successful in GPPs, enrollment must be increased and public support secured. The next phase is considered to raise awareness and promote environmental consciousness through public education efforts and media campaigns [27]. The situation in Australia is that the shift from fossil fuels to renewable energy sources is essential for achieving this target and the development of large-scale renewable energy projects is rapidly expanding. Respondents identified taking responsibility for environmental risks as the most important governance principle, followed by benefits like affordable energy and job creation for the local community principles related to responsiveness and participation. Accountability in case of issues was also seen as important, though this concern was primarily emphasized by those residing in the area proposed to host the solar mega farm, while it was less significant for individuals living elsewhere in Australia [28].

By using Best–Worst Scaling (BWS), studies from diverse disciplines have shown that eco-friendliness is frequently ranked higher than price. This trend is seen even in industries such as food consumption, where price is traditionally highly valued due to the frequency and necessity of purchase. In this regard, for our research, the following hypothesis can be formulated: as "Students' concern about a 15% increase in heating prices reflects a significant level of awareness and responsibility regarding their energy consumption". This hypothesis aims to investigate the level of student reaction to the sensitivity of the increase

in the price of heating, with the aim of explaining that the level of student concern towards the increase in the price is a determining factor of environmental and economic awareness. Nonetheless, data show that, even in this approach, eco-friendliness takes precedence above price [29]. At the same time, the Best–Worst Scaling approach for a Danish study revealed that environmental sustainability is a top priority for Danes, with attributes related to environmental issues such as biodiversity loss, limitations on renewable energy, and climate change mitigation frequently selected as most important and rarely as least important [30].

1.2. Main Characteristics of the Kosovar Energy System, Highlighting RES Regulation and People's Attitude

Kosovo must concentrate on reducing environmental pollution because in the absence of prompt action, climate change would exacerbate the risks and hazards that will negatively affect people's livelihoods. Researchers are always working to create high-performance, energy-efficient resources to fulfill the world's rising energy demands and provide a steady supply of electricity. As a result of burning fossil fuels, greenhouse gasses like carbon dioxide, nitrous oxide, and methane are now being released at a high rate. This has led to significant air pollution, global warming, serious health issues, and previously unheard-of ecological imbalances [31]. The primary energy source in Kosovo is coal, which is used to generate 97% of the country's electricity. Kosovo's coal contributes to lignite coals with low heat of combustion (7800–8100 kJ/kg) in terms of quality [32]. It contrasts from dark brown to black in color. With an efficiency of around ηTEC = 30%, the amount of coal required annually to produce 800 MWh of electricity (roughly what is now produced by all power plants) is about 7.5 million tons. At the same time, an estimated 500,000 t/a of lignite are used for consumers or uses other than power plants [32]. In addition, during cold months, high reliance on individual domestic heating systems that rely on electricity or inefficient coal- or wood-burning equipment results in high greenhouse gas emissions and air pollution as well as a notable increase in the requirement for imported electricity.

To decrease the usage of coal and to lower the emissions of greenhouse gasses, Kosovo's goal is to achieve its electricity consumption from renewable energy sources (RES) by at least 35% and to gradually introduce carbon pricing by 2031 [4]. Coal use will be progressively replaced by new RES capacity using cutting-edge and current technology, with the goal of phasing out coal by 2050 at the latest.

Approximately 57% of houses are heated with wood, 39% use solely electricity, 0.5% use coal, 2% use district heating, and 2% use other sources. In addition, a study by Pestisha and Bai [33] researched the awareness and willingness of the population and farmers for renewable energy and showed that 30.5% of the population use firewood for heating, while for farmers, this number was 96.7%. In Kosovo, issues with air pollution are additionally exacerbated by household heating using coal and firewood in outdated stoves. In 2020, monitoring stations found that PM10 surpassed the permitted maximum limit in several situations. In certain places, the average annual concentration of PM2.5 exceeded the standard as well, primarily during the fall and winter months, when fuel was burned for heating. The World Health Organization (WHO) studied PM exposure in Kosovo to determine the population's health consequences. According to this report, 6 out of every 1000 deaths in Kosovo are directly related to air pollution, which sounds like an alert to take immediate actions [34].

Based on prices on HUPX—Hungarian Electricity Exchange, which is used as a reference due to its geographic proximity and liquidity—, the average electricity price reached the value of EUR 376/MWh, which represents a 563% increase compared to the beginning of 2021; in this regard, the energy sector in Kosovo was characterized by a sensitive increase in electricity prices in the second half of 2021 [5]. However, in 2022, the average electricity

price on HUPX was around EUR 271.66/MWh, while the annual average for 2023 was EUR 106.82/MWh, indicating a significant decline in import prices [35]. The energy crisis is primarily caused by cuts in Russian gas exports to Europe as a result of the conflict between Ukraine and Russia [4]. The investment in Kosovo's distribution network has resulted in considerable improvements in the quality of energy delivery as well as a reduction in system losses [36]. These upgrades improved the electricity grid's overall dependability and efficiency. Furthermore, the installation of modern power meters represents a significant breakthrough in terms of measuring precision. These new meters provide remote monitoring, exact invoicing, and faster readings, resulting in more efficient electricity usage control and better customer service. Together, these activities help to make Kosovo's energy infrastructure more efficient and reliable. Another notable accomplishment is the introduction of energy efficiency (EE) measures. The implementation of EE measures in public buildings (at the municipal level) resulted in annual electricity savings of 1.67 ktoe in 2023, while it was 0.78 ktoe in 2022.

The Energy Regulatory Office has also changed the retail tariffs for consumers. Until 2022, consumers paid the price of energy according to low and high tariffs (depending on the hour of energy consumption). In 2022, the Energy Regulatory Office decided that the price of energy would change for consumers who consume more than 800 kWh/month: these consumers would pay almost double the price [37].

However, in 2024, the price changed again, which has also affected consumers who consume less than 800 kWh/month [38], as can be seen in Table 1.

Table 1. Retail electricity tariffs for consumers over the years in Kosovo.

				Price 2022	Price 2024
0.4 kV (domestic 2-rate meter)	Standing (costumer) charge	€/customer/month		1.74	2.00
	0−800 (First block)	€c/kWh	High Tariff	6.75	7.79
		€c/kWh	Low Tariff	2.89	3.34
	>800 (Second block)	€c/kWh	High Tariff	12.52	13.39
		€c/kWh	Low Tariff	5.90	6.27
0.4 kV (domestic, 1-rate meter)	Standing (costumer) charge	€/customer/month		1.74	2.00
	0−800 (First block)	€c/kWh	Single Tariff	5.32	6.13
	>800 (Second block)	€c/kWh	Single Tariff	10.07	10.67

Source: Constructed by the authors based on [37,38].

Investments in the expansion and rehabilitation of Prishtina's District Heating (DH) network have resulted in developments in the heating industry. In total, 17,834 m of "Termokos" network pipes have been updated and expanded [36]. Subsidies have been implemented to help vulnerable families and other customers cope with the financial load. These include subsidies for vulnerable households to ensure they have access to inexpensive energy, as well as subsidies for electricity bills to help lower electricity costs for a wider variety of consumers. These policies seek to improve energy access and social welfare, ensuring that those in need receive better support during difficult economic times. Moreover, in 2024, the Ministry of Economy issued a Public Call for Subsidies for Efficient Heating Equipment for houses and apartments, sponsored by the European Union (EU) in Kosovo [36]. This effort seeks to assist household consumers, particularly those in need, by stimulating investments in installing efficient heating equipment. Heat pumps (30% subsidy of investment value), efficient air conditioners (40%), biomass boilers

(wood, pellet, and briquette) (70%), and individual biomass stoves are among the qualified equipment (70%). These measures are intended to enhance energy efficiency and lower heating expenses for households throughout Kosovo.

Although there are many financial and environmental advantages to using biomass for heating, there are several obstacles that may prevent its widespread use. In comparison to conventional heating systems, the initial capital expenditure for biomass heating systems can be substantial, encompassing both equipment and installation. Biomass fuels can occasionally be less expensive, but there can be hidden expenses associated with processing, storing, and maintaining them [39–41]. Furthermore, decision-makers and consumers may be unaware of the advantages of biomass heating systems. Adoption may be hampered by doubts about the dependability and effectiveness of biomass heating systems in comparison to conventional systems.

1.3. Public Perception, Education and Acceptance of Renewable Energy in International Surveys

Environmental social scientists are increasingly interested in the public's perception of renewable energy and how that perception subsequently influences the acceptance or rejection of particular technologies. Public perceptions of renewable energy technology are generally favorable, according to public opinion [42,43]. To successfully promote bioenergy, the public's acceptance of bioenergy as a renewable energy source (RES) is relevant to its development and may even be more essential than the environmental and economic obstacles; nevertheless, the public's adoption of bioenergy is given less attention than solar and wind power as RES [44].

According to one study [45], people are more likely to adopt energy-saving habits, like avoiding running the washer or dryer if it is not filled, if they are aware of how doing so lowers their carbon footprint. Due to a lack of awareness or comprehension of how bioenergy functions and what it can offer for the energy transition, it may not be well received. Possibly, global trends, better education, higher income, and environmental consciousness all help achieve a greater understanding of RES in Kosovo, according to Pestisha and Bai [33]. According to the study of Dijk et al. [46], the smell and noise of manure and organic waste processing near homes are considered a disadvantage in the acceptance of bioenergy. When the actual planning of a bioenergy facility takes place close to a residential neighborhood, these worries may be serious.

In the shift to sustainable energy consumption, the customer's desire to adopt renewable energy is important. Consumer attitudes regarding the use of renewable energy sources and their concerns about the environment are still influenced by the worsening effects of pollution, climate change, and global warming. Numerous studies examine how customers' environmental awareness influences their purchase decisions by considering environmental concerns like pollution levels and the reduction of CO_2 emissions [47] investigated how green practices affected restaurant establishments. According to their hypothesis, there are two types of green practices in the restaurant industry: those that are environmentally focused and those that are food focused. The impact of green restaurant practices on the development of green brand equity was examined by researchers. The findings showed that customers' opinions on environmentally and culinary green activities positively impact a restaurant's green brand image and customers' desire to engage in green behavior.

Another study in the Philippines looks into the knowledge, perception, self-assessment, and attitude of preservice teachers (PSTs) concerning renewable energy (RE) in a developing country that relies heavily on fossil fuels [48]. The results reveal that participants have a strong understanding of RE sources, with no significant gender disparities in awareness or perception, indicating progress in closing gender inequalities in environmental education.

The study emphasizes the need to include RE subjects in teacher education programs to provide PSTs with the skills and knowledge required to advocate for sustainable energy solutions. These programs, which combine theoretical learning with practical applications and encourage self-assessment, can equip future educators to inspire environmentally conscious habits and contribute to lowering fossil fuel reliance, ultimately building a more sustainable society. However, in Saudi Arabia, a study was conducted to look into public perceptions of renewable energy and environmental awareness [49]. According to the results, most respondents had a moderate understanding of renewable energy, and 79.2% of them were worried about the negative effects of pollution. This suggests that people are becoming more conscious of the possible advantages of using alternative energy sources to solve environmental issues. Moreover, the Theory of Planned Behavior (TPB) framework was used in a study to investigate the factors influencing Turkish university students' intention to adopt renewable energy (RE) [50]. As future decision-makers, these students play a critical role in shaping sustainable energy transitions. The results show that young people in Turkey are quite supportive of RE projects, with many stating that they would be willing to pay up to 10% extra for electricity that comes from renewable sources. This readiness demonstrates their concern for the environment and dedication to lowering dependency on fossil fuels. Policymakers and educators who want to encourage younger generations to adopt more sustainable behaviors and renewable energy sources might benefit greatly from knowing the behavioral factors that underlie their goals. Furthermore, two other studies from Iran have analyzed the attitude of students towards the use of renewable energy application. The Structural Equation Modeling (SEM) research found that variables such as "perceived benefits" and "self-efficacy" have a substantial influence on students' desire to use renewable energy [51]. These two reasons combined explain why 33% of the surveyed students are eager to adopt renewable energy. In another study from the same country, moral norms, attitudes, and perceived behavioral control are important factors impacting both readiness to use and public acceptability of renewable energy sources (RES), although subjective norms and self-identity have no discernible impact [52]. It is expected that stakeholders, such as government agencies, will play an important role in the future deployment of RES. As present engineering students, they are likely to become active energy project managers and make significant contributions to the energy transition.

A Kenyan study uses data from a nationwide poll of 1020 inhabitants to evaluate popular awareness, acceptance, and opinions regarding renewable energy [53]. According to the results, there is broad support for the growth of renewable energy, with 91% of respondents thinking it will lower electricity bills and 73% supporting its expansion. Furthermore, 69.5% of respondents showed a high level of familiarity with words connected to renewable energy. The study emphasizes the necessity for policymakers to abandon conventional energy techniques in favor of methods that incorporate public viewpoints, stressing the significance of public acceptance and awareness in creating inclusive and successful energy policies. The findings from a Lithuanian study show that respondents prefer solar energy, whereas biomass and water energy are the least popular options [54]. The regression analysis shows that the level of renewable energy development and financial capacity have the greatest influence on the intention to adopt renewable energy.

The study from Montenegro looks into the variables affecting Montenegrin consumers' attitudes and actions toward renewable energy sources (RES) [42]. The results show that, with 32.8% of the influence, perception is the largest predictor of conduct, followed by awareness (20.7%). These findings highlight how important it is to create favorable impressions and raise awareness in order to promote wider RES use. Policymakers and stakeholders may create focused plans to support renewable energy and propel sustainable energy transitions in Montenegro by having a better understanding of these dynamics.

Humans engage in learning processes, which include a variety of educational and teaching activities throughout their childhood. All conscious behaviors displayed by students as part of these learning processes are considered learning products or outputs. Education is crucial in addressing environmental issues created by humans' irresponsible activities and attitudes. Education should be utilized to enlighten people about environmental issues and raise their understanding of preventative measures.

As part of our research, based on the above-mentioned experiences, another hypothesis is formulated: "Students' preferences are increasingly influenced by environmental concerns in Kosovo" as a main factor that determines the sustainability of the country and well-being of the population.

1.4. Marketing and Renewable Energy

A wider public awareness of these technologies and their advantages is just as important to the success of businesses in the renewable energy sector as technological advancements. Despite its increasing popularity, some people remain skeptical about renewable energy. Businesses must successfully convey the benefits of renewable energy, such as sustainability, long-term cost-effectiveness, and less environmental impact, to close this gap [55]. Advertising is, therefore, essential for enlightening the public, dispelling myths, and boosting consumer trust in renewable energy sources [56]. Customers are more inclined to support and invest in these energy solutions if they have a better understanding of how these technologies operate and how they may profit from them [57]. Advertising's effectiveness in the renewable energy sector may, therefore, be evaluated based on how successfully it stimulates consumers' interest and encourages interaction. Consequently, audiences are greatly impacted by successful advertising. It arouses curiosity, draws attention, and evokes feelings in addition to providing information. However, it is worth mentioning that the success of advertising can be assessed by consumers based on their individual preferences and opinions, which can vary over time depending on things like attitude and recollection of commercials [58]. According to Wilcox et al. [59] advertising as a tool for influencing the market and advertising as a way to communicate information are two important components of effective advertising. Advertising's capacity to increase consumption rates and give businesses a greater proportion of the market is referred to when it is considered a tool for market influence. In this regard, the growth in sales volume or market penetration that advertising produces is frequently used to gauge its efficacy. In essence, the objective is to increase consumer demand through calculated marketing initiatives. Conversely, advertising as a source of information highlights how advertisements may educate consumers by providing insightful information about a business, its goods, or services. This strategy places a high priority on information sharing, assisting consumers in making defensible choices based on the information presented in the commercial [60]. A stated hypothesis in this regard related to the marketing side of our research can be assessed as follows: "Students with a positive perception of marketing's potential influence are more likely to support the transition to renewable energy".

2. Materials and Methods

As global discussions around climate change intensify, students in this field are uniquely positioned to explore the integration of renewable energy sources into agricultural systems. Their educational background equips them with insights into how renewable energy can enhance productivity, improve resource management, and contribute to rural development.

Understanding students' attitudes toward renewable energy is crucial for fostering a culture of sustainability within the agricultural sector. As future leaders in agriculture and

veterinary sciences, these students will play a vital role in shaping policies and practices that promote the adoption of clean energy technologies. Their perceptions can provide valuable insights into the potential barriers and opportunities for integrating renewable energy solutions, ultimately influencing the direction of sustainable development in their region.

The increasing global emphasis on renewable energy underscores the necessity for educational institutions to incorporate sustainability into their curricula. At the Faculty of Agriculture and Veterinary in Prishtina, students are encouraged to engage with contemporary issues surrounding energy use and its impact on agriculture. This engagement not only broadens their understanding of renewable energy technologies but also fosters critical thinking about how these solutions can be applied to real-world challenges. By linking theoretical knowledge with practical applications, students can better appreciate the role of renewable energy in enhancing agricultural efficiency and resilience. Moreover, the transition to renewable energy is not just an environmental imperative; it also presents significant economic opportunities. For students in agriculture and veterinary sciences, embracing renewable energy can lead to the development of innovative farming practices, such as solar-powered irrigation systems or biogas production from agricultural waste. These practices not only reduce dependency on fossil fuels but also contribute to cost savings for farmers. By understanding the economic viability of renewable energy, students can become advocates for its adoption, helping to shape a more sustainable agricultural landscape in Kosovo.

Another important aspect of student perceptions regarding renewable energy is the influence of cultural and social factors. In a region where traditional energy sources have historically dominated, there may be resistance to change or a lack of awareness about the benefits of renewable technologies. Educational programs that emphasize the social dimensions of energy transition such as community engagement, public policy, and the role of local stakeholders can help bridge this gap. By fostering discussions around these topics, students can gain a deeper appreciation for the collective responsibility in promoting renewable energy initiatives, thereby empowering them to become active participants in their communities' energy futures.

To effectively assess these attitudes, methodologies such as the Best–Worst Scaling method can be employed. This technique allows researchers to understand which aspects of renewable energy are viewed most positively and which are considered less favorable among students. By presenting respondents with various statements or attributes related to renewable energy and asking them to identify the best and worst options, researchers can gain nuanced insights into student priorities and concerns. This quantitative approach complements qualitative assessments, providing a comprehensive view of how these future professionals perceive renewable energy within the context of their studies. The Best–Worst Scaling (BWS) technique allows the study of personal preferences in a fictitious setting. Based on stated preference information, this method asks respondents to use one of three BWS methodologies (object case, profile case, or alternative case) to select the best and worst alternative, attribute, or attribute level among the alternatives [61–63].

Since it enables a clear ranking of preferences by identifying the most and least significant factors impacting students' views toward renewable energy, the Best–Worst Scaling (BWS) approach was a better choice for this study. In contrast to conventional techniques, BWS reduces bias and compels participants to make compromises, yielding more accurate and trustworthy results. Furthermore, it lessens the cognitive burden, which facilitates accurate responses from participants and provides information on priorities that may not be as well captured by other techniques. Because of this, BWS is especially well-suited to comprehend complex decision-making procedures in relation to preferences for renewable energy.

To generate the BWS decision situations, we used the R package "support. BWS" [64]. Authors applied object case BWS with the following introduction (also illustrated in Table 2): "In the following section, we would like to understand what is important to you when using renewable energy sources. You will be asked to indicate, in three different scenarios, the most and least important attributes that affect your purchasing decisions for a specific renewable energy source".

Table 2. Example of the BWS decision format.

What Factors Do You Consider Most Important and Least Important Regarding the Use of Renewable Resources?		
Feature	The most important	The least important
Price		
Availability		
Knowledge		

Source: Constructed by the authors.

The BWS method enables us to consider multiple factors in our research by highlighting the most important aspects that matter to participants. In our experimental design, we identified seven key attributes that influence consumers' decisions when purchasing renewable energy sources (see Table 3). To be as credible as possible in finding the most appropriate attributes, a literature review was initially conducted in the global and regional aspects [28,30,65–68] and then in the national one [4,33]. Proceeding to the next step, the situation of Kosovo was analyzed in detail, taking into account the current energy and environmental aspects. Considering the challenges Kosovo will face in its long-term strategy and the significance of these issues, the authors have unanimously agreed on seven key attributes. In each BWS choice task, the respondents were asked to select the attribute that they see as the most and least important for their attitude.

Table 3. Attributes used in the object−case BWS questions.

No.	**Attributes**
1	Eco-friendliness
2	Price
3	Investment cost
4	Convenience
5	Multifunction
6	Knowledge
7	Availability

Source: Constructed by the authors.

The initial stage in data analysis through this method is to identify the best and worst values for each criterion. This can be accomplished by subtracting the "best" and "worst" variables. It is vital to highlight that this can be achieved at both the individual (Equation (1)) and aggregate level (Equation (2)).

$$\textit{Best–Worst}\ \text{Score}_{n,k} = \textit{Best}\ \text{score}_{n,k} – \textit{Worst}\ \text{score}_{n,k} \quad (1)$$

When n is the respondent and k is the evaluated aspect taken into consideration.

$$\textit{Best–Worst}\ \text{Score}_{k} = \textit{Best}\ \text{score}_{k} – \textit{Worst}\ \text{score}_{k} \quad (2)$$

The last level (aggregate) Best–Worst scores are used to rank the importance of the criteria being considered. In the following step, we may determine the average Best–Worst values as well as the criteria's standard deviations. We can then calculate and plot Cohen's (2009) standardized Best–Worst values. This can be carried out both individually (Equation (3)) and aggregated (Equation (4)).

$$\text{Standardized } \textit{Best–Worst} \text{ score}_{n,k} = \frac{\textit{Best–Worst scoren}, k}{f}, \quad (3)$$

where f is the frequency of occurrence of the aspects taken into consideration.

$$\text{Standardized } \textit{Best–Worst} \text{ Score}_{k} = \frac{\textit{Best–Worst scorek}}{Nf}, \quad (4)$$

where N is the number of respondents.

To examine the factors, we also computed the square root of the Best–Worst ratio (Equation (5)) and its standardized version (Equation (6)).

$$\text{sqrt. } \textit{Best–Worst} \text{ score}_{k} = \frac{\textit{Best–scorek}}{\textit{Worst–scorek}}, \quad (5)$$

$$\text{sqrt. } \textit{Best–Worst} \text{ score}_{k} = \frac{\text{sqrt.Best–Worst scorek}}{\text{max.(Best–Worst score)}}, \quad (6)$$

where max. (Best–Worst score) is the highest value of sqrt. *Best–Worst* score_{k}. [69].

A detailed description of the BWS methodology can be found in Aizaki and Fogarty's article [70] written in 2023.

Due to the investigation of preference heterogeneity, we conducted further statistical analyses using individual-level Best–Worst values. We employed non-hierarchical (K-Means) cluster analysis to identify groups of respondents based on their attribute preferences for using renewable energy. In non-hierarchical clustering, several cluster numbers were examined, and the final cluster number was chosen based on the number of respondents in each cluster, the stability of the clusters, and the technical interpretability of the clusters. We used the Kruskal–Wallis test with ordinal measurement level variables (gender, age, field of study, region, type of residence, employment) to identify variations across the clusters. IBM SPSS Statistics 29 was used for K-Means clustering. To compare the clusters, a one-way ANOVA and Pearson's Chi^2 test were used.

Description of the Sample

In this study, the data were collected via a questionnaire with a sample of 100 students from the University of Prishtina, Faculty of Agriculture and Veterinary. The reason we analyzed this social group is that like in the study by Acikgoz and Yorulmaz [50], students will have acquired greater levels of education and experience in the coming years, which will equip them with the knowledge and skills necessary to make more informed decisions. Consequently, they will be expected to exert a greater influence on energy policy decisions.

Initially, the Faculty of Agriculture and Veterinary is the largest faculty of this type in the entire country and undoubtedly has students from all over the country. Furthermore, Kosovo is a relatively small country and there are no major differences in socioeconomic terms between cities or regions. Therefore, the sample tends to be significantly representative of the wider population. In total, having 100 students is also recommended by the type of method applied in this study and by the number of attributes. In this context, a best-case scenario has been achieved. Regarding the structure of the sample, official numbers were not available, but based on two local authors' personal experiences, the

sample characteristics are very close to the characteristics (share) of all students studying in the three fields of study.

To be as perfectly representative as possible, the authors first took into consideration the total number of actively registered students in each course. The total number of active students in 2023 was 874, of which 325 were students of the 'Food Technology' course, 209 were in the course of 'Agriculture Economics', and 179 students were in 'Plant Production'. However, other students were in other different courses, where the number of students was quite lower compared to these three courses. This is one reason why the authors concentrated on these courses and the other reason is related to the importance of RES to these courses. Then, based on the number of students per course, the authors applied quantitative research to the BWS questionnaire. In this regard, students from the 'Food Technology' course lead with 49% of the total questionnaire, followed by the students from the 'Agriculture Economics' course with 33%; 'Plant Production' students contributed with 18% of all questionnaires in our research. In the samples, females had higher participation, with an average age of 20.6. House-living respondents were the majority, whereas the Prishtina region had the highest number of residents. The main sample characteristics are reported in Table 4.

Table 4. The main sample characteristics for students of the Faculty of Agriculture and Veterinary.

Denomination	*Categories*	*Percentage*
Gender	Male	16
	Female	84
Field of study	Food Technology	49
	Agricultural Economics	33
	Plant Production	18
Region	Other region	39
	Prishtinë	61
Type of residence	Flat	15
	House	85
Employment	Unemployed student	80
	Employed student	20

Source: Own questionnaire.

Despite the global trend showing an unequal involvement of women in policy-making and decision-making processes in the field of renewable energy (as highlighted in the following references [71–73], it is expected that in the future, the main decision-making actors will mainly be individuals with a strong educational or academic background. The tables show higher female participation in the survey; in this context, both in Kosovo and globally, the participation of females in academic and professional institutions is increasing. In this regard, the authors can conclude that, in the near future, females will have a stronger and more active role in decision-making and policy-making processes.

Their observations are important in a country that is highly reliant on coal but wants to meet EU environmental criteria. As future leaders in food technology, plant production, and rural development, which are heavily influenced by energy policies, they have the potential to drive sustainable practices and promote biomass heat energy as a viable alternative. Analyzing their perspectives not only provides a glimpse of current awareness and attitudes but also throws light on the preparedness and problems of incorporating

RES into a coal-dominated energy sector. This distinguishes their perspective and makes it essential in influencing Kosovo's energy destiny.

3. Results and Discussion

The perceptions of renewable energy among students at the Faculty of Agriculture and Veterinary in Prishtina reflect a growing awareness of the importance of sustainable practices in addressing environmental challenges. The above-mentioned aspects can be found elaborated in the sections below. As global concerns about climate change and environmental degradation grow, renewable energy becomes increasingly important. This faculty's students understand that switching to sustainable energy sources is critical not only for the environment but also for future generations' economic and social well-being. The following section will go into greater detail about how renewable energy is perceived, understood, and incorporated into academic and practical activity at the Faculty of Agriculture and Veterinary. These sections will look at how students' awareness and attitudes about renewable energy affect future farming practices, community engagement, and sustainable energy policy creation (Table 5). The goal is to highlight the critical role that education plays in developing a generation of professionals committed to incorporating renewable energy solutions into their future jobs.

3.1. Student's Attitude Towards Renewable Energy

When students were asked about their environmental consciousness, the clear majority stated that they are very conscious (Figure 1). The fact that *96% of students reported being environmentally conscious* is an incredibly positive indicator of the growing commitment to sustainability among the younger generation. With *24% stating they are very conscious* and an additional *72% describing themselves as mostly environmentally conscious*, it is clear that environmental awareness is deeply ingrained in the student community. This overwhelming majority reflects a collective recognition of the importance of protecting the planet and adopting sustainable practices, the same level of perception and the sense of environmental conservation was mentioned in the study of Almulhim [49]. Such high levels of consciousness can lead to meaningful changes in lifestyle choices, from reducing waste and conserving energy to supporting eco-friendly products and advocating for greener policies. Moreover, a study by Aruga et al. [74] highlights the concern of respondents about climate change in Poland; however, they prioritize energy costs and employment impacts when choosing their preferred energy policy, with significant differences between groups. An important difference is observed based on age group, where younger respondents (<25 years old) show the highest willingness to pay (WTP), especially for reducing CO_2 emissions and speeding up the energy transition. Furthermore, the strongest and most urgent demand for policies aimed at reducing CO_2 emissions was identified among female respondents, individuals with higher levels of education, those without children, and middle- and high-income groups.

This significant percentage suggests that environmental consciousness is not just a passing trend but a core value for many students. The fact that such a large proportion identifies as either "very conscious" or "mostly conscious" speaks to a cultural shift towards sustainability that is becoming a defining feature of the generation. This awareness can translate into impactful actions, such as opting for public transportation, reducing plastic use, supporting renewable energy initiatives, or promoting sustainable consumption habits. Students who are attuned to environmental issues are also likely to be vocal advocates for change, pushing for more sustainable practices in their communities, universities, and workplaces. Furthermore, environmental protection is considered the main reason for investing in renewable energy among Greek respondents. The willingness to pay for

a greater expansion of renewable sources in electricity production is estimated at EUR 26.5 per quarterly electricity bill. Statistical analysis showed a relationship between the perceived benefits of using RES and the willingness to pay for renewable energy. Also, through the binary logit model, it was found that the willingness to pay is positively related to the level of education, energy subsidies, and state support [75].

In our quest to transition from fossil fuels to renewable energy sources, a significant number of students expressed the view that this is an important issue as can be seen in Figure 2. More than 40% of respondents rated it as very essential, demonstrating the younger generation's increased understanding and concern about environmental sustainability and the need for cleaner energy sources; the same case scenario was seen more or less Iran, as demonstrated by Yazdanpanah et al. [51].

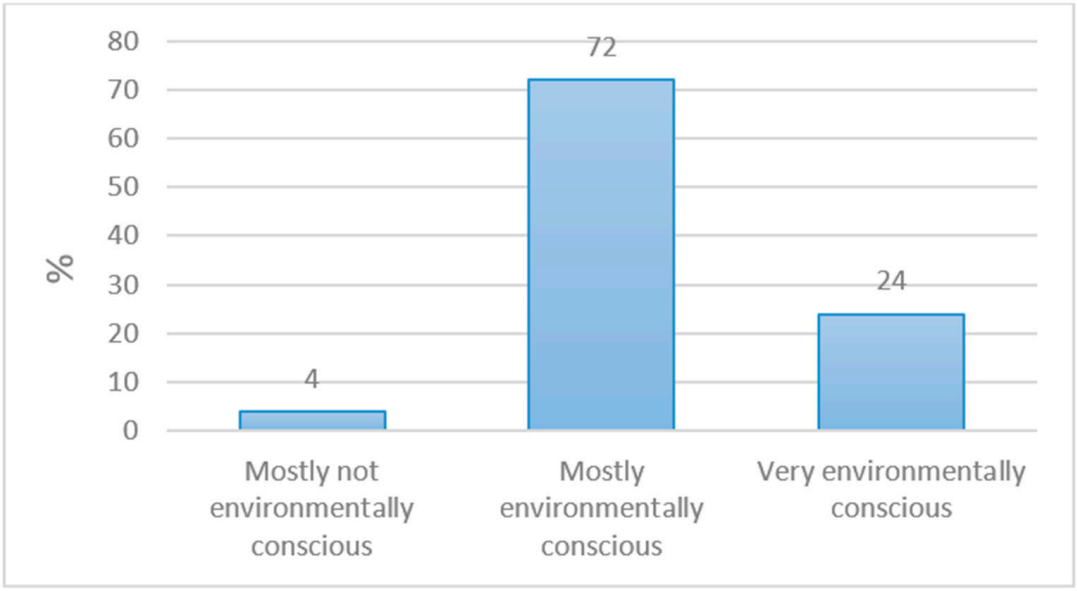

Figure 1. Students' opinion regarding the following question: "How environmentally conscious do you consider yourself?" Source: Own results.

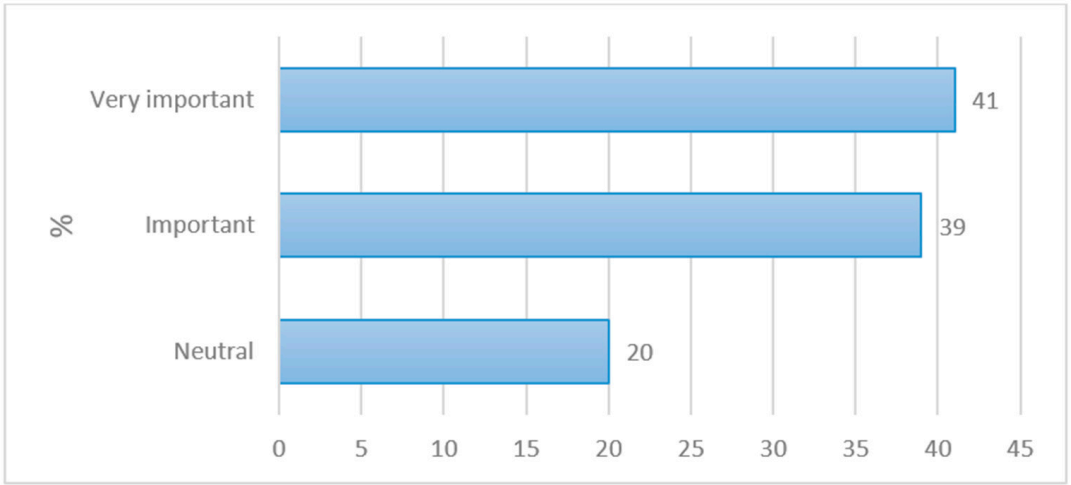

Figure 2. Students' opinion regarding the following question: "How important do you consider the level of knowledge to switch from fossil fuels to renewable energy?" Source: Own results.

Table 5. Students' awareness and attitudes about renewable energy aspects.

Question	Alternatives	Frequency
How environmentally conscious do you consider yourself?	Mostly not environmentally conscious	4
	Mostly environmentally conscious	72
	Very environmentally conscious	24
How important do you consider the level of knowledge to switch from fossil fuels to RE	Neutral	20
	Important	39
	Very important	41
If you use electric heating and the price of electricity will increase by 15%, would you consider changing the way of heating?	I would not change it	4
	Perhaps	48
	I would change it	33
	I would definitely change	15
In your opinion, do you think that adervtising (marketing) would play a big role in the energy transition?	I disagree	2
	Neutral	9
	I agree	51
	I totally agree	38
Based on the current energy supply patterns, do you think that renewable energy sources will be the most important energy source for Kosovo's enegy sector in 2040?	I disagree	6
	Neutral	27
	I agree	52
	I totally agree	15
In your opinion, do you think that the deployment of RES in Kosovo's energy mix would be more desirable than coal?	I disagree	3
	Neutral	10
	I agree	42
	I totally agree	45
Based on current energy supply patterns, what do you think would be the most important source of energy for heating in the future of energy sector in Kosovo?	Wood	9
	Electricity	19
	Solar panel	57
	Other energy source	15
Denomination	***Mean***	***Standard Deviation***
Age (year)	20.63	1.88
Subsidy for solar panel (%)	56	17.75
Multifunction	−0.57	1.65
Convenience	0.07	1.53
Availability	−1.14	1.14
Price	1.18	1.50
Knowledge	−0.89	1.38
Investment cost	0.13	1.69
Eco-friendliness	1.22	1.50

Source: Own result.

This shift in attitude reflects a wider worldwide realization of the importance of combating climate change. This positive trend of attitude was also found in Montenegro [42],

Kenya [53] and Lithuania [54]. As the effects of global warming become more visible through rising temperatures, extreme weather events, and biodiversity loss, many students consider the transition to renewable energy as critical not only to minimize these effects but also to ensure a sustainable future. Additionally, this change offers students the chance to innovate and create jobs, especially in fields like research, infrastructure, and green technologies. Energy security, economic opportunity, and environmental sustainability all work together to make the switch to renewable energy a top priority for coming generations.

A recent hike in electricity costs elicited significant reactions from people across all segments of society. Many consumers may express displeasure and anxiety about the increasing financial hardship these hikes impose on household budgets. Families, particularly those with restricted budgets, would be concerned about how rising utility costs will affect their daily life. In this regard, the authors of this paper aimed to assess household reactions to a 15% increase in electricity costs for those using it for heating purposes, as shown in Figure 3.

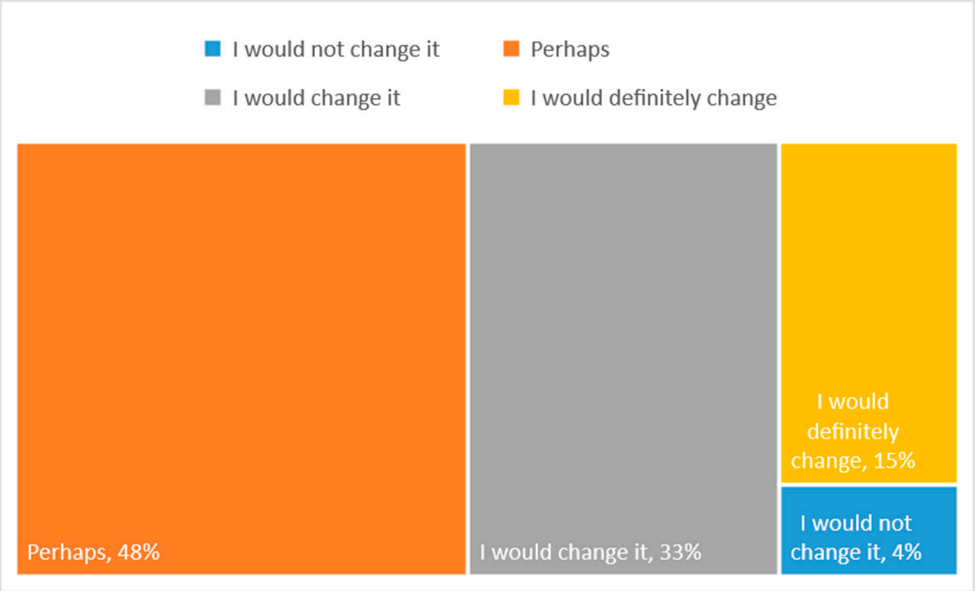

Figure 3. Students' opinion regarding the following question: "If you use electric heating and the price of electricity will increase by 15%, would you consider changing the way you heat your home with other sources?" Source: Own results.

This shift in attitude reflects a wider worldwide realization of the importance of combating climate change. The fact that *96% of students are concerned about the 15% price increase* for heating shows a remarkable level of awareness and responsibility regarding their energy consumption. This is an outstanding value, especially in developing countries, as seen in comparison to a Turkish survey [50]. The reason why the authors have taken the value of 15% as a reference is based on the recent trend of increasing energy prices in recent years as well as the fact that Kosovo still has the lowest price of electricity in the region. As Kosovo is expected to invest in a large capital project regarding energy and taking into account all these positions, the authors have taken the value of 15% as a reference. This high percentage indicates that students are not only mindful of the financial implications but are also keenly aware of how such price hikes can affect their daily lives. In an age where rising living costs are a growing concern, it is encouraging to see that so many students are actively thinking about ways to manage their energy usage more effectively. This collective concern can serve as a catalyst for wider discussions on energy efficiency and cost-saving measures, empowering students to take control of their heating choices and reduce unnecessary expenses.

Furthermore, the fact that *48% of students are certain they would consider changing the way they heat their homes* demonstrates a strong willingness to adopt more sustainable and affordable energy practices. This is particularly noteworthy, as it reflects a proactive mindset, students are not merely passive recipients of price increases but rather are looking for practical solutions. Whether it involves reducing heating times, investing in energy-efficient appliances, or exploring alternative energy sources, such a shift in behavior suggests that students are increasingly prioritizing cost-conscious and environmentally responsible choices.

This high level of awareness among students is not just a positive sign of engagement, but also an indication that there is significant potential for energy-saving initiatives to resonate within this demographic. With the right tools and resources, such as educational workshops on energy efficiency, access to rebates for energy-saving measures, and information on alternative heating solutions, students can be empowered to make informed decisions that not only help them cope with rising energy costs but also contribute to a more sustainable future.

Figure 4 reveals a generally positive perception (89%) of marketing's potential influence on the renewable energy transition, similar findings were found also in other renewable energy-oriented by marketing articles [76–78]. This shows that respondents believe marketing is a useful strategy for raising awareness, influencing public opinion, and encouraging the use of renewable energy sources. Particularly for audiences who might be less knowledgeable or driven, marketing campaigns can change the way of thinking, increase awareness of the environmental advantages of renewable energy, and instill a sense of urgency about the need for change. In a subject like renewable energy, where decisions can be influenced by both emotional and rational factors (including cost and efficiency) such as environmental impact and future generations, this process is crucial. Advertising thus serves as a catalyst for change, inspiring people to adopt actions that are advantageous to the environment and themselves.

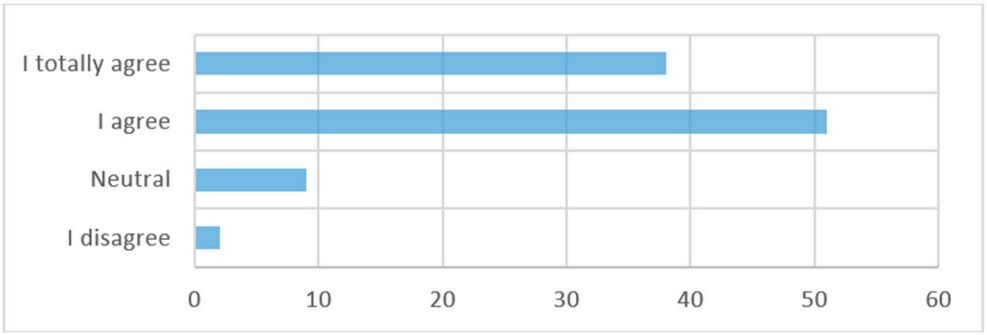

Figure 4. Students' opinion regarding the following question: "In your opinion, do you think that advertising (marketing) would play a big role in the energy transition?" Source: Own results.

This section provides a summary of the findings from students' perceptions of renewable energy. Table 6 shows the frequency of the best and worst results for each attribute. The findings clearly show that eco-friendliness and price of equipment were the most highly desired, ranked as the first and second most important factors. On the other hand, students ranked the availability of the equipment as the least important attribute. The table shows the partial results of Best–worst Scaling. The initial stage in data analysis was to determine the BWS values, just like other authors did in their articles [62,63,69]. To accomplish this, we determined the difference between the "most important" and "least important" factors. The study found that four out of seven characteristics earned good ratings (with only three BWS values being negative), and these features were regarded as "most important" rather than "least important". In the second phase, the BWS values were

divided by the number of participants in the sample (100) and the frequency of presentation of the analyzed aspects in the experimental design. This resulted in standardized values, which were then ranked. In the third phase, a best-ratio scale was built $\sqrt{\frac{\text{Best}}{\text{Worst}}}$, which can be determined by square rooting the ratio of the "most important" and "least important" cumulative numbers. The attribute with the highest value (eco-friendliness) was at the top of the scale (100%), and the other aspects were measured against it. Based on this, we developed another ranking process.

Table 6. Best–Worst scores for RES attribute importance in students' view.

Designation	Eco-Friendliness	Price	Investment Cost	Convenience	Multifunction	Knowledge	Availability
The most important	24.14	23.57	14.57	16.43	11.00	6.14	4.14
The least important	6.71	6.71	12.71	15.43	19.14	18.86	20.43
BWS value	122	118	13	7	−57	−89	−114
Standard value	0.41	0.39	0.04	0.02	−0.19	−0.30	−0.38
Rank order	1	2	3	4	5	6	7
Square root [a]	1.90	1.87	1.07	1.03	0.76	0.57	0.45
Relative [b] **%**	100.00	98.81	56.46	54.42	39.98	30.10	23.75
Rank order	1	2	3	4	5	6	7

[a] "The most important/the least important" results after the square root. [b] Relative values of "the most important/the least important" results after the square root %. Source: Own results.

Based on the data, the authors can deduce that respondents ranked eco-friendliness as the most important factor. The ranking is followed by the second and third most essential qualities, pricing and investment cost, which have nearly similar values with each—other. Convenience came next, with a slightly different value than the prior qualities. The ranking's final three components, multifunction, knowledge, and availability, had negative BWS ratings. This is explained by the fact that a relatively large percentage of respondents ranked these as the least significant qualities, whereas just 11%, 6.14%, and 4.14% rated them as the most important.

Figure 5 displays the standardized BWS values for the aspects Cohen performed [79], making it easier to grasp the feature order. It may be mentioned that eco-friendliness was of extreme importance (0.41), but the price of the equipment (0.39) was also a critical factor. In addition, investment cost (0.04) and convenience (0.02) were deemed indifferent. The least popular features were multifunctionality (−0.19), knowledge (−30), and availability (−0.38).

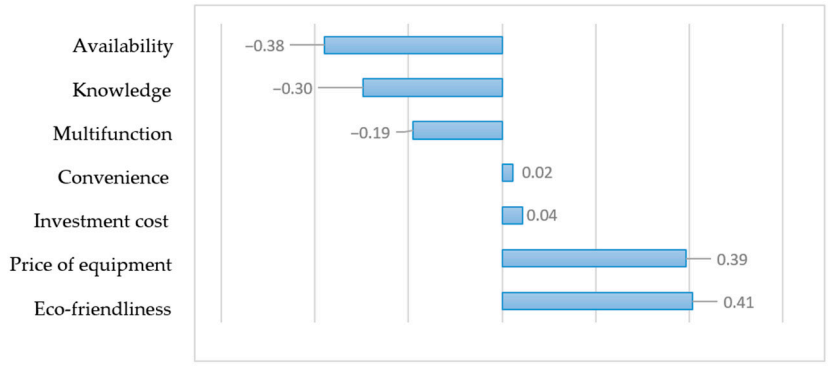

Figure 5. The standardized BWS values of the renewable energy aspects. Source: Own results.

Figure 6 illustrates the varying priority levels assigned by respondents to different qualities of renewable energy, with values ranging from 23.75% to 100%. These disparities suggest that respondents perceive some factors as significantly more important than others when evaluating renewable energy options. For instance, the factor with the highest value, "eco-friendliness", stands at a substantial 100%, indicating that environmental considerations are of utmost importance to the majority of participants. Similar results were shown in the study by Pestisha and Bai, in which respondents were asked to rate the most important attributes [33]. In contrast, the factor with the lowest priority, "availability", had a value of just 23.75%, suggesting that this aspect is relatively less important in comparison to other qualities.

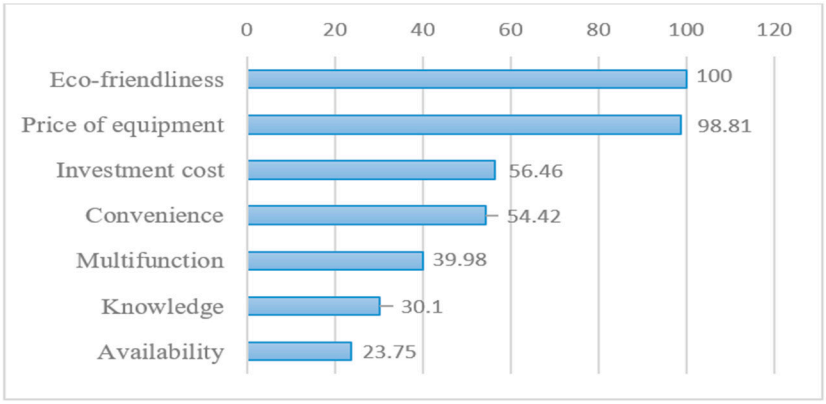

Figure 6. The relative best values of the renewable energy aspects (%). Source: Own results.

It is particularly noteworthy that the most highly prioritized quality, eco-friendliness, holds nearly double the weight of the third-ranked component, "*investment cost*" (56.46%); furthermore, this aspect was considered to have a strong influence in the adoption of renewable energy in a Lithuanian study [54]. This stark difference emphasizes the critical role that environmental sustainability plays in shaping respondents' perceptions of renewable energy, far outweighing concerns such as financial investment or convenience. The gap between the highest and lowest priorities further highlights the diversity in how different factors influence decision-making. The least significant factor, "*availability*", being more than four times lower than "*eco-friendliness*", points to a potential underestimation of logistical challenges or accessibility issues associated with renewable energy sources.

To acquire more thorough information about the significance of the evaluated characteristics, we computed the average of the Best–Worst values as well as their standard deviation. The results show that eco-friendliness has the highest average value, implying that this feature is considered the most significant by the respondents. The high average score indicates the growing global concern for sustainability, with people increasingly valuing environmental effects when choosing products or services. On the other hand, the cost of equipment appears to be a significant component, although it does not outperform eco-friendliness in terms of overall value. This demonstrates that, while environmental concerns are crucial, economic factors such as the initial cost of acquisition remain a significant consideration for many respondents.

The investment cost and convenience categories have nearly equal relevance, as seen by their closely aligned average values. These elements highlight the trade-off that respondents frequently make between long-term sustainability and short-term practical considerations. However, it is vital to emphasize the varying levels of agreement on these issues. Although investment costs and convenience have similar average values, the standard deviation for investment costs is significantly higher. This shows that respondents' perceptions of the importance of investment expenses vary more widely. In other words,

some respondents see the initial financial outlay as a substantial barrier to adoption, but others may value the long-term economic benefits. However, availability has the lowest average (−1.14) and a moderate standard deviation (1.14), indicating that respondents consider it the least essential feature (Figure 7). While availability remains an important consideration, it appears to be far less influential than environmental and economic factors.

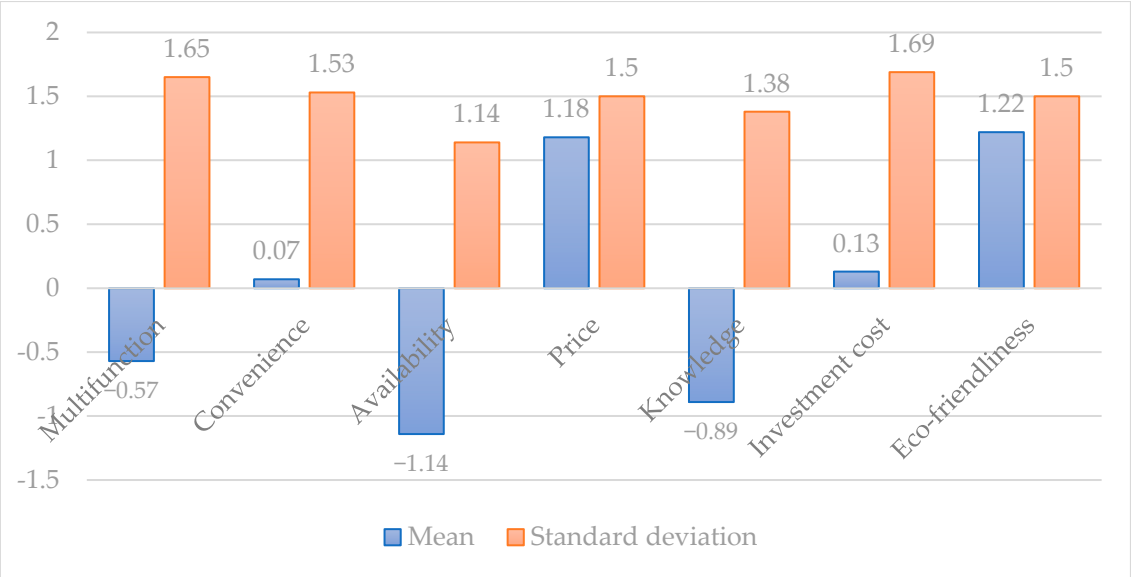

Figure 7. Two-dimensional plot of means and standard deviation of BWS values. Source: Own results.

Multifunction (−0.57) and knowledge (−0.89) have lower average values, indicating that these qualities are less important than the higher-ranked aspects. The standard deviations for these two criteria are moderate (1.65 for multifunction and 1.38 for knowledge), indicating some diversity in how respondents view the value of these qualities.

3.2. Evaluation of Cluster Analysis Results

To investigate preference heterogeneity, we conducted further statistical analyses utilizing individual-level Best–Worst values (Table 7). This approach allowed us to evaluate the variation in preferences throughout the sample. We performed non-hierarchical clustering using the Best–Worst values for the seven factors under consideration. By experimenting with several cluster solutions, we determined the appropriate number of clusters to capture the underlying patterns in the data. After examining other cluster configurations, the four-cluster method emerged as the most professionally explainable. This method produced a consistent and interpretable segmentation of preferences, revealing various groups of people with different priorities and attitudes toward the factors we investigated. These clusters not only provided insight into the diversity of preferences but also identified possible areas for focused treatments or individualized methods within the context of the study.

In our final analysis, we looked at the outcomes of the four clusters generated by the K-Means clustering process, which the authors presented in a table for clarity. The distribution of respondents among the clusters was fairly balanced, with similar numbers in each (30, 22, 23, and 25 respondents, respectively). The four cluster analysis groups consisted of students with an average age ranging between 19.92 and 21.09 years, with an overall average age of 20.63 years, and a strong female representation in all clusters. The highest number of participants belonged to the first cluster, “Greenies”, while the lowest number was in the second cluster, “Passive Environmentalists”. Additionally, 67% of participants across all clusters were from the “Food Technology” course.

Table 7. Description of clusters according to different factors.

Denomination *		Cluster 1 'Greenies'	Cluster 2 'Passive Environmentalist'	Cluster 3 'Eco-Skeptics'	Cluster 4 'Moderate Adopters'	Test-Value	Significance Value
Respondent number (100)		30	22	23	25		
BWS Convenience ****		−1.20 c	1.27 a	0.61 ab	0.04 b	F = 29.32	$p < 0.001$
BWS Availability		−1.73 b	−1.23 ab	−0.48 a	−0.96 ab	F = 6.49	$p < 0.001$
BWS Price ****		1.90 a	−0.18 b	1.96 a	0.80 b	F = 12.59	$p < 0.001$
BWS Knowledge		−1.3	−0.36	−1.13	−0.64	F = 2.58	$p = 0.058$
BWS Investment cost		1.20 a	0.09 b	0.78 ab	−1.72 c	F = 27.03	$p < 0.001$
BWS Eco friendliness ****		1.53 ab	2.23 a	−0.39 c	1.44 b	F = 17.56	$p < 0.001$
Age (year)	Mean: 20.63	20.97	21.09	20.52	19.92	F = 2.04	$p = 0.113$
Gender	Male (n = 16)	6	3	2	5	$\chi^2 = 1.66$	$p = 0.646$
	Female (n = 84)	24	19	21	20		
Field of study	Food Technology (n = 67)	20	15	16	16	$\chi^2 = 0.19$	$p = 0.980$
	Agricultural Economics (n = 33)	10	7	7	9		
Knowledge fossil fuels to RE (rank means)		62.67 a	46.02 ab	46.22 ab	43.78 b	Kruskal-Wallis H value: 8.85	$p = 0.031$
Environmentally consciousness (rank means)		54.9	43.59	51.37	50.5	Kruskal-Wallis H value: 3.19	$p = 0.362$
Electricity price increase by 15% (rank means)		52.98	47.82	48.43	51.78	Kruskal-Wallis H value: 0.67	$p = 0.879$
Marketing energy transition (rank means)		54.28	49.8	45.48	51.2	Kruskal-Wallis H value: 1.51	$p = 0.680$
RES Kosovo 2040 (rank means)		58.3	52.27	39.2	49.98	Kruskal-Wallis H value: 6.88	$p = 0.076$
RES vs. coal (rank means)		59.15	54.68	45.59	40.96	Kruskal-Wallis H value: 7.78	$p = 0.051$

* Different letters show significant differences; in One-way ANOVA, the letters represent Tukey's HSD post hoc tests results. ** The Levene test was significant ($p < 0.05$), therefore, the F value represents the Welch test's results, and the letters represent the Games–Howell post hoc test's results. Source: Own results.

The first cluster, "Greenies", included people who indicated a high level of understanding regarding the transition from fossil fuels to renewable energy. This group also showed a strong environmental conscience, emphasizing the necessity of sustainability in energy policies. Furthermore, they anticipated that advertising and marketing would play an important role in assisting the energy transition, implying that public awareness and communication tactics are critical for encouraging change.

An important feature of this cluster was respondents' response to price signals: many stated a desire to switch to a different heating source if heating prices rose by 15%. This indicates a level of sensitivity to energy costs as well as a willingness to implement more sustainable solutions when economically feasible. Furthermore, this group highly supported the role of renewable energy in the future of Kosovo's energy sector, with the majority of participants expecting that renewable energy sources would become the primary energy source by 2040. They also voiced a preference for renewable energy in Kosovo's energy mix, seeing it as a better alternative to coal. This cluster's opinions are consistent with the ideas of sustainability and energy independence, indicating forward-thinking, environmentally conscious students who see renewable energy as critical to the country's future energy landscape. The second cluster, "Passive Environmentalist", included respondents with a low level of understanding regarding the transition from fossil fuels to renewable energy incomes and very low environmental consciousness. Moreover, respondents of this

cluster showed a certain amount of reluctance to adopt new, potentially more sustainable technologies, particularly when price increases could cause financial discomfort. These members were less likely to consider changing their heating source in response to a 15% price increase. Although they were not as likely as some other clusters to consider marketing to be a significant influencing factor, this group did exhibit a moderate focus on the role of marketing in the energy transition. They did acknowledge that marketing could contribute to increasing awareness about renewable energy options. It is interesting to note that this group reported a high level of support about the future role of renewable energy in Kosovo's energy sector, despite their comparatively poor engagement with the economic or environmental aspects of energy transitions. The majority of respondents in this cluster concurred that by 2040, renewable energy sources would be Kosovo's primary energy source, demonstrating a passive but understanding awareness of the long-term trajectory of regional energy policy. Additionally, they thought that coal was a less attractive option for Kosovo's energy mix than renewable energy sources.

The third cluster, "Eco-Skeptics", consisted of students who were very concerned about the environment but who had serious doubts about how marketing could help with the energy transition. They showed a lack of knowledge of the technical and financial elements of switching from fossil fuels to renewable energy, despite their great environmental concerns. This group also showed uncertainty regarding the potential dominance of renewable energy in Kosovo's energy industry and was hesitant to move to alternative energy sources in reaction to price hikes. A hesitant or unsure attitude about the viability and practicality of such a transition was also seen in their lack of complete conviction that renewable energy would be a more desirable component of Kosovo's energy mix than coal. Lastly, students in the fourth cluster, "Moderate Adopters", had a moderate awareness of the environment and a moderate conviction in the contribution of marketing to the energy transition. Even though they cared about the environment, they did not know much about the transition from fossil fuels to renewable energy. This group demonstrated some reactivity to economic considerations by demonstrating a strong readiness to switch to alternative energy sources if prices increased. They were less certain of the significance of renewable energy in Kosovo's energy mix than coal, though, and showed less thought given to the future role of renewable energy in the country's energy industry.

The energy policy situation in Kosovo is characterized by a specific set of challenges and opportunities. The country's energy strategy must align with the sustainability and energy strategy criteria of the EU, with a particular emphasis on renewable energy sources and achieving energy self-sufficiency. This is crucial for facilitating EU accession. However, lignite, which is currently the most prevalent and cost-effective energy source in Kosovo, is also a highly polluting form of energy, similar to that observed in developing countries [80]. In this context, the role of renewables is primarily focused on enhancing the competitiveness of the agricultural sector and the local economy. The type of renewable energy sources utilized varies considerably from country to country. In Kosovo, the most significant renewable energy sources are utilized for local heating (district heating and small domestic boilers) and photovoltaic power generation. In contrast, in India, biogas is the most important [76], and in Brazil, bioethanol from sugar cane is the most significant [77]. This highlights the necessity for prompt adaptation of energy policy to the potentially abundant feedstocks and available infrastructure and population needs in the candidate countries, with the objective of enhancing sustainability. This adaptation could be facilitated through EU co-financing to support accession, thereby aligning more closely with the objectives of the community. Potential avenues for collaboration include joint RD projects, technology transfer, and infrastructure co-development, reminiscent of the period preceding the 2004 EU enlargement.

4. Conclusions

In summary, the survey's findings unequivocally show that students' preferences are increasingly influenced by environmental concerns, with "eco-friendliness" standing out as the most highly regarded quality. The overwhelming emphasis on sustainability indicates that people are becoming more conscious of how their decisions affect the environment and are prepared to compromise in other areas, including availability, in order to support environmentally friendly goods and services.

It is because students' growing awareness of global environmental issues, such as pollution, resource depletion, and climate change, lends credence to this notion. On the other hand, the comparatively low ranking of "availability" indicates that, in light of the increasing significance of environmental impact, convenience is no longer the main factor influencing consumer choices [81]. This change in consumer behavior is a reflection of larger cultural tendencies toward sustainability, where values such as supporting environmentally responsible firms, reducing waste, and supporting environmentally conscious equipment are increasingly important when making judgments about what to buy.

By incorporating sustainability into their curricula, universities may significantly contribute to the development of environmental consciousness. Environmental science, eco-friendly business practices, and sustainability should be the main topics of courses and degree programs offered by educational institutions. Universities will be positioned as leaders in sustainability if they support interdisciplinary research that investigates creative answers to global environmental problems. Universities may help create a new generation of environmentally conscious leaders and professionals by educating students to address environmental concerns. Universities can demonstrate their dedication to sustainability by collaborating with government agencies, non-profits, and companies that share their values. Research projects, internships, and sustainability-themed events that provide students with practical experience in the green economy could all be a part of these partnerships. Universities can support more general environmental objectives and give students worthwhile educational opportunities that correspond with market trends by establishing these collaborations. Moreover, universities may lessen their environmental effect and equip students to lead responsibly and sustainably in the workplace by implementing these measures.

Ultimately, cultivating a positive attitude toward renewable energy among students at the Faculty of Agriculture and Veterinary is essential for driving change in both the agricultural sector and the broader society. Through targeted education, practical experience, and community involvement, these students can emerge as informed advocates for sustainable energy practices. By aligning their knowledge and skills with the pressing need for renewable energy solutions, they can contribute significantly to the transition towards a more sustainable and resilient agricultural system in Kosovo and beyond.

On the other hand, the profiles of the four clusters varied, ranging from students who were well-informed and concerned about the environment to students who knew very little about and were not as involved with sustainability issues. The first cluster was most likely to support the adoption and transition methods of renewable energy because of its high level of environmental awareness and understanding. The second and third clusters, on the other hand, showed skepticism about the marketing role and the actual shift; the third cluster was especially skeptical about changing energy sources in reaction to price rises. The fourth grouping demonstrated receptivity to change when driven by economic incentives, despite having a moderate awareness of environmental issues and lacking in-depth knowledge and forward-looking perspectives about the energy sector.

In this study, the authors fully accept all the listed hypotheses because they correspond to examining students' awareness, preferences, and perceptions of energy usage and sus-

tainability. The authors do recognize that students' concerns about a 15% price increase for heating reflects their increased understanding and responsibility for energy consumption. Furthermore, the results support the premise that environmental concerns are increasingly impacting students' preferences in Kosovo, affecting the country's sustainability and general well-being. Moreover, students who have a positive opinion of marketing's potential influence are more likely to support the shift to renewable energy, highlighting marketing's role in creating sustainable decisions.

To enhance the global relevance of this study, by tailoring awareness and marketing campaigns, as well as financial and educational incentives to the characteristics of each group, policymakers can maximize the effectiveness of their initiatives. "Greenies" can be empowered as sustainability leaders or ambassadors, using their environmental values to promote policies that emphasize sustainability, long-term benefits, and ecological responsibility. "Passive environmentalists" are pushed to action by addressing trust issues by improving transparency in policy-making, including all stakeholders in renewable energy programs, and dispelling misinformation. They can also make a difference by striving for tailored educational interventions that focus on real-world examples of cost savings, grid stability, and economic benefits from renewables. "Eco-Skeptics" are engaged through economic reasoning, for example, by establishing price stability mechanisms such as long-term fixed tariffs for renewable energy to alleviate concerns about cost fluctuations with the help of marketing campaigns. Moreover, educational programs can include evidence-based discussions by engaging industry experts to explain the economic logic behind renewable energy adoption in ways that resonate with their financial priorities. "Moderate Adopters" are appeased by practical solutions, such as expanding financial incentives like subsidies or low-interest loans for renewable energy adoption, as this group is motivated by economic factors. In this regard, educational activities can include cost–benefit analyses and simulations of energy-saving methods.

It is worth mentioning that, based on the development trend of the new generations in Kosovo, as well as the country's ongoing efforts to harmonize long-term development strategies with those of the European Union, Kosovo aims to become part of this community in the future. Therefore, the authors estimate that similar results could be generated regarding students' perspectives on renewable energy in other faculties, especially in engineering.

Offering financial incentives or subsidies for implementing renewable energy technologies, such as heat pumps and solar panels, could promote more environmentally friendly energy choices, as many respondents indicated that they would be prepared to switch energy sources as a reaction to price increase.

The findings of this study provide a solid foundation for a comparative analysis of the significance of education in the context of sustainable energy management within the overall population. This analysis should involve a distinct examination of the knowledge and attitudes of individuals with tertiary education in comparison to other social groups. Moreover, the authors suggest that the inclusion and elaboration of renewable energy sources within the curriculum of the Faculty of Agriculture and Veterinary is an important process, as it would provide students with new and adequate knowledge, especially since the agricultural research field itself has a close connection with renewable energy. Another thing we should emphasize is the vertical depth of the course content. The faculty can create new subjects, including electives, for different forms of RES to arouse students' interest, foster development, and stimulate their internal motivation. In this regard, it is very important to include courses that aim at the digitalization of various agricultural techniques. The authors also take into account that the aspect of global warming is a challenge that is being addressed in most countries, and agriculture is an important link towards mitigating negative effects on the environment. Furthermore, as a result of learning

new knowledge and mastering information, students are more likely to have a positive approach towards environmental protection and sustainability.

In terms of limitations, even though the sampling was performed only in the biggest institution in terms of agriculture education, it should be taken into consideration that Kosovo is a small country with no significant differences in terms of cultural factors, given that the majority of the population belongs to a single nationality. Moreover, the average age of the population is representative of the young generation, which makes the study even more reliable. To this end, it is recommended that a questionnaire survey be conducted in other countries on issues related to sustainable energy management, where different social characteristics are analyzed according to education, vocational training (agriculture), and other country-specific factors like GDP and EU membership.

From a global perspective, this survey contributes to a well-established debate on the following strategic issues:

- The relative merits of environmental friendliness and convenience in relation to energy production and utilization. The authors have previously published two academic papers on this topic [72,76].
- What is worth growing on arable land: food, feed, or energy [82]?
- What is the role of education in sustainability?
- The latter article may be particularly useful in elucidating the manner in which economic development and country-specific factors influence the utilization of renewable energy sources.

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Abbreviations

The following abbreviations were used in this manuscript:

ANOVA	Analysis of Variance
BWS	Best−Worst Scale
$\chi 2$	Chi-Square
DH	District Heating
EE	Energy Efficiency
FFA	Free Fatty Acid
GPP	Green Pricing Program

GHGs	Greenhouse Gasses
GWh	Gigawatt hours
HUPX	Hungarian Electricity Exchange
Kj/kg	Kilojoule per kilogram
Ktoe	Kilotonnes of oil equivalent
KWh	Kilowatt-hour
MWh	Megawatt hours
PM	Particulate matter
PST	Preservice Teachers
RECs	Renewable Energy Cooperatives
RES	Renewable Energy Source
SEM	Structural Equation Modeling
SPSS	Statistical Package for the Social Sciences
TPB	Theory of Planned Behavior
WTP	Willingness to pay

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