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## RECOGNITION OF RENEWABLE ENERGY AMONG BUSINESS STUDENTS

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### Abstract

Using renewable energy sources is in the mainstream of environmental protection, including climate change. Non-professional opinions in the field are essential to explore for enhancing the acceptance and utilization level. This paper shows the evaluation of Hungarian business students (n=632) about renewable energy sources and their utilization. The results show that the students feel that the use of renewable energy lags behind the EU level, but there is a trust in convergence in the medium term.

### Introduction

Energy dependence is a complex social and technical challenge of the present age [1]. Forcing the use of renewable energy sources is beneficial to climate, but technical problems and availability must be managed [2], including the local access to them [3]. Moreover, there are human aspects to consider. The lack of knowledge and social acceptance [4] may deflect the use of technically right solutions.

EU has embraced the topic that gives legal justification for development and research efforts. The renewable energy directives [5-6] require the EU to fulfill at least 20% of its total energy needs with renewables by 2020 (at least 10% for each member country) and 32% for 2030. The statistics [7] show a remarkable increase in renewable energy use, but the target values seem to be ambitious. In the case of Hungary, a decline can be detected (Figure 1). Among others, this result draws attention to comprehensive research on renewable energy use. The problem goes far beyond one study; our paper aims to contribute to a better understanding of the possible development directions.

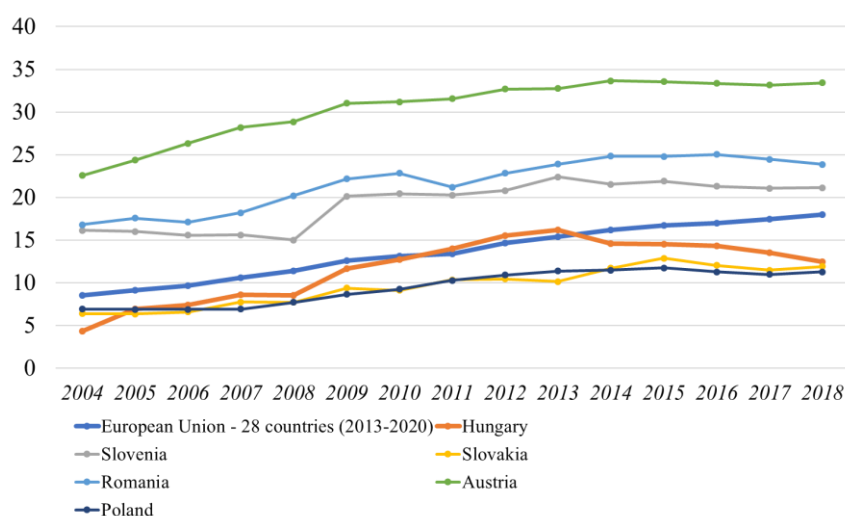


Figure 1. Share of renewable energy in gross final energy consumption in some countries  
Source: based on [7]

## Experimental

Data collection is performed by a voluntary online survey among higher education students between 2018 and 2019. The research sample includes 563 respondents who are studying business. 61.6% of them are females, and 38.4% are males. 54.2% of the respondents are studying bachelor or higher vocational students, 45.8% of them are at the master level. There are students without any work experience (38.4%), others with internship experience (20.4%) and employees (41.2%). It is to note that the responses are collected from business students of various Hungarian universities, but the representativeness of the sample structure is not ensured. Despite a large number of responses, the generalization of the results and conclusions are limited.

The presented results are based on two items of the survey. It includes a list of some energy sources (Figure 2) and asks to mark whether the respondents consider it as renewable or not. This part of the survey allows us to check the knowledge level and non-professional opinions about the perception of renewable characteristics. Besides, there are four questions formulated with a 5-point scale evaluation about the present and future position of renewable energies:

- Q1: How do you think we currently use renewable energy sources compared to other European countries? (1: much less, 5: in a much greater extent);
- Q2: Do you think people would pay more for energy if it were definitely from a 'green' source? (1: surely not, 5: surely yes);
- Q3: How much do you agree with the statement that people are increasingly striving to save energy in their everyday lives? (1: not at all, 5: fully agree);
- Q4: Do you think that in 10-15 years, we will use renewable energy sources compared to other European countries? (1: much less, 5: in a much greater extent).

The mean values of the responses represent the results of the evaluation.

## Results and discussion

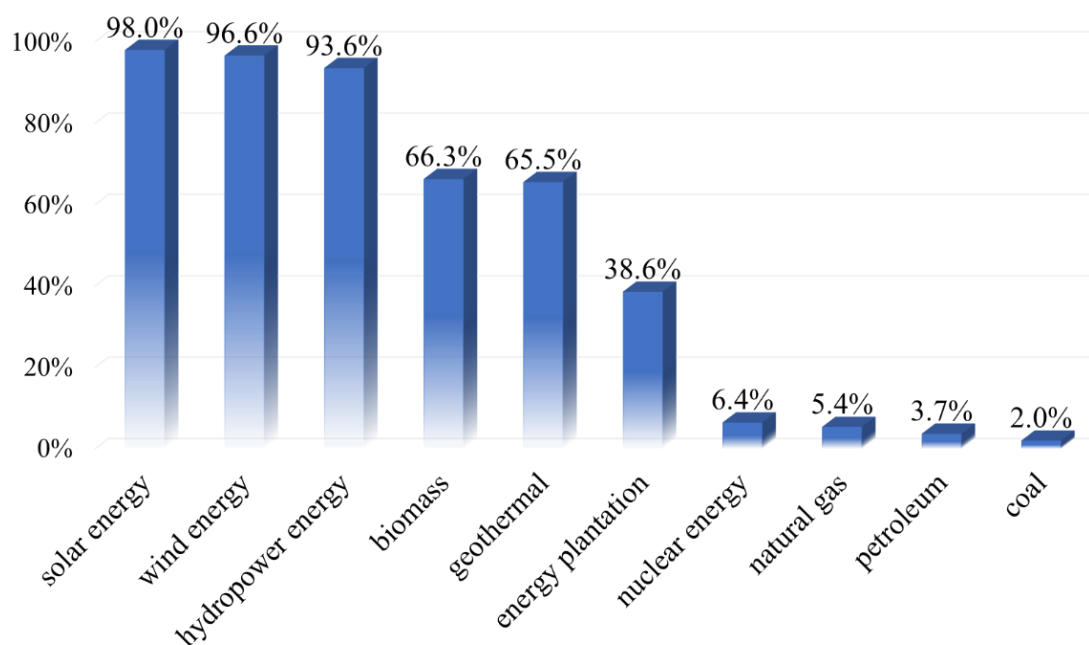


Figure 2: Evaluation of renewable characteristic of energy sources (marked by % of the sample)

The items of energy sources include both evident and questionable items. Compared to the professional opinion about the renewable characteristic, the results show some differences (Figure 2). Nuclear energy (6.4%) and natural gas (5.4%) are considered renewable by a small but remarkable minority. The results of solar, wind, and hydropower energy are in line with professional opinions. Biomass (66.3%) and geothermal (65.5%) energy sources are less

considered renewable. Energy plantations (38.6%) represent a surprisingly low share, especially that about half of the respondents marked it who marked biomass.

According to the evaluation of the present and future of renewable energy, ANOVA tests were conducted in order to check the grouping effect of gender, level of studies, and work experience. The analysis found significant effects in 2 of 12 cases (Table 1) by the non-parametric Kruskal-Wallis test. Various statistical tests were run for finding clustering the results to draw up characteristic patterns of opinions and to develop targeted strategies, but the outcomes were not significant or interpretable.

Table 1: Significant differences by grouping factors

Item	Factor	Mean values	Kruskal-Wallis H	df	sig.
<b>How much do you agree with the statement that people are increasingly striving to save energy in their everyday lives?</b>	Level of Studies	$x_{\text{bachelor}}=3.10$ $x_{\text{master}}=3.34$	8.274	1	.004
<b>How do you think we currently use renewable energy sources compared to other European countries?</b>	Work experience	$x_{\text{none}}=2.03$ $x_{\text{employee}}=1.84$ $x_{\text{internship}}=2.02$	6.709	2	.035

Other results are presented for the entire sample (Figure 3). The mean values of the responses suggest that the students are critical to present, but they have trust in the future. They think that the use of renewable energy sources will reach the EU level that in 10-15 years. Paying for greener energy does not seem to be an acceptable way; saving energy received a higher mean value.

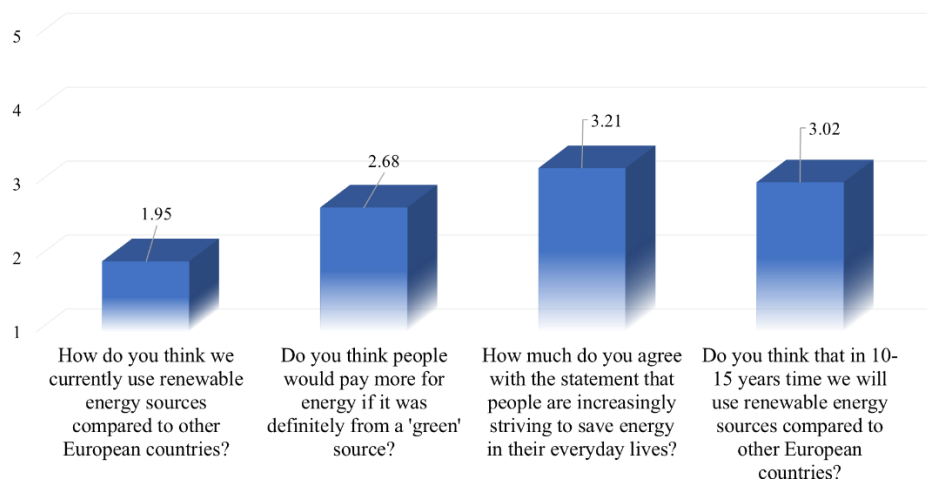


Figure 3: Mean values of evaluation (5-point scale)

Consequently, it is also worth examining the distribution of the evaluations due to the medium level of mean values (Table 2 and Figure 4). The present use of renewables compared to the EU is evaluated rather worse by 78.7% of the respondents, while 2.7% think that Hungary has a better performance. According to the future, the ratio of skeptics (evaluated 1 or 2) is 26.8%, while there are 28.9% optimists in the sample.

Table 2: Distribution of evaluations on the 5-point scale (% of the sample)

	1	2	3	4	5
<b>How do you think we currently use renewable energy sources compared to other European countries?</b>	30.17	48.55	18.07	2.60	0.61
<b>Do you think people would pay more for energy if it were definitely from a 'green' source?</b>	11.79	34.76	29.71	21.29	2.45
<b>How much do you agree with the statement that people are increasingly striving to save energy in their everyday lives?</b>	5.36	17.76	34.61	35.07	7.20
<b>Do you think that in 10-15 years, we will use renewable energy sources compared to other European countries?</b>	5.51	21.29	44.26	23.74	5.21

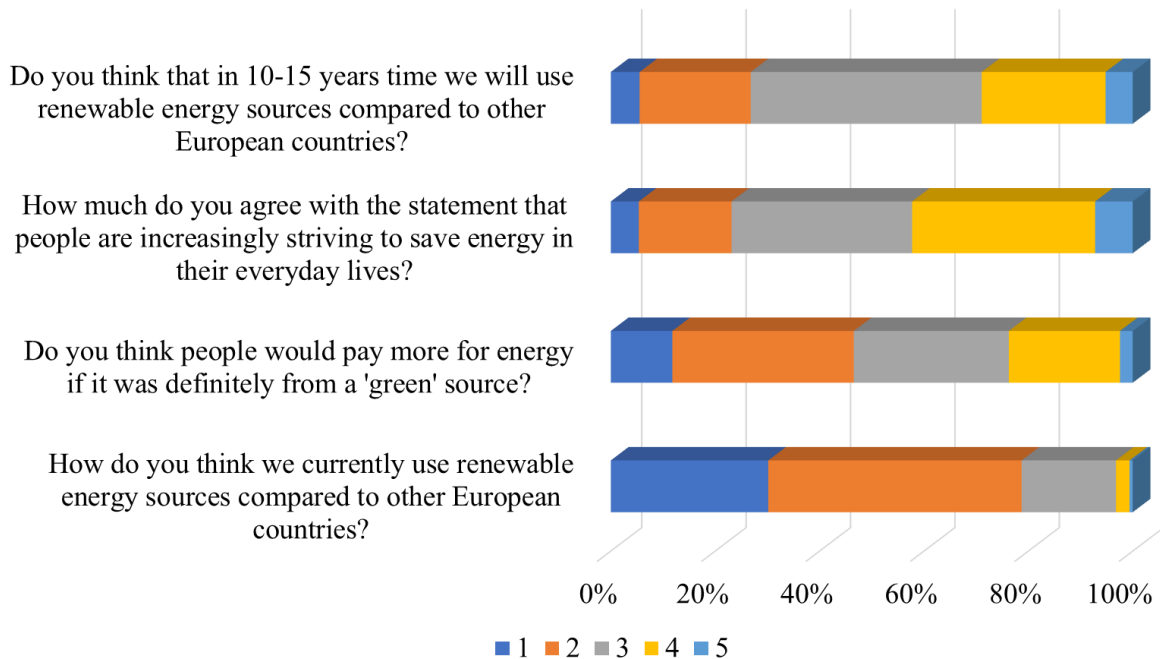


Figure 4: Distribution of evaluations on the 5-point scale (% of the sample)

Those who think that people would pay more for green energy represent 23.7% of the sample, while 46.6% consider still the opposite. At the same time, 42.3% rather trust that people will strive to save energy. This suggests that 'saving' covers both energy and cost-saving by the students.

The correlation between the responses (Table 3) shows weak and medium level but significant results. The highest value (0.372) is found between the present and the future use of renewable energy sources. Future use significantly correlates with strive to save energy (0.206) and willingness to pay more for green energy with strive to save it (0.217).

Table 3: Spearman's correlation between the questions

		Q1	Q2	Q3	Q4
<b>Q1 (present use)</b>	<i>Corr. Coef.</i>		.113**	.121**	.372**
	<i>Sig. (2-tailed)</i>		0.004	0.002	0.000
<b>Q2 (pay more for green energy)</b>	<i>Corr. Coef.</i>	.113**		.217**	.141**
	<i>Sig. (2-tailed)</i>	0.004		0.000	0.000
<b>Q3 (strive to save energy)</b>	<i>Corr. Coef.</i>	.121**	.217**		.206**
	<i>Sig. (2-tailed)</i>	0.002	0.000		0.000
<b>Q4 (future use)</b>	<i>Corr. Coef.</i>	.372**	.141**	.206**	
	<i>Sig. (2-tailed)</i>	0.000	0.000	0.000	

\*\* : correlation is significant at the 0.01 level (2-tailed)

### Conclusion

Professional and non-professional (student) opinions are not entirely overlapped. While solar, wind, and hydropower energy are considered renewable by most students, geothermal energy, biomass, and especially energy plantation are already in the background. A conclusion for teaching and education is given by the results that a higher emphasis should be given to the technical issues of renewable energy.

The positive approach to the future improvement in using renewable energies and convergence to the EU level is encouraging, but an essential experience of the survey is that progress is rather supported by energy savings than paying more for greening. Since business students are expected to become company decision-makers in the near future, consequently, their opinions and attitudes are prognostic.

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