

# Assessing the Public Knowledge Structure Towards Renewable Energy Sources in Hungary

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**Abstract-** The aim of this study is to investigate the knowledge structure of the Hungarian population towards Renewable Energy Sources (RES) in order to lay the foundations for environmental- and energy policy decisions. 1066 individuals were included in the representative survey. The word association method was used to assess whether the population was aware of the meaning of the expression 'RES', their potential uses, what they think about their application and whether they see the advantages and potential difficulties. A Conceptual Network (CN) was compiled, based on the relative frequency of the associations made with the concept "renewable energies" which led to the conclusion that the most widely known RES are solar, wind and hydro energy. It was revealed that public attitudes are unanimously positive, however, based on the associations given, it can also be seen that the cost of the construction of RES systems is considered high. It was also determined that almost 20% of the population do not know what the concept of RES means. The gender of the responders had no significant effect on the knowledge structure, however, in terms of age, there were stronger differences – it was revealed that younger generations are more knowledgeable about the subject. There were significant differences in terms of education. People with the lowest level of education demonstrated a significant lack of information.

**Keywords** energy policy, renewable energy sources, knowledge structure, conceptual network, word association method.

## 1. Introduction

The increase in the use of RES is an important task for several reasons. Firstly, by using RES we can significantly reduce the amount of GreenHouse Gases (GHG) emissions resulting from energy production, which is the most important objective in the fight against climate change, and secondly, they generally have a significantly lower environmental impact than that of traditional fossil fuels. A

further benefit can be that their use can generally reduce a country's energy dependence, and their widespread application may contribute to the decentralization of energy production.

The document ratified by the General Assembly of the United Nations in 2015 [1] includes the plan for sustainable development to be accomplished by 2030. In this document a total of 17 objectives were determined, among which there are also objectives related to renewable energies and

arresting climate change. Objective 7 includes access to affordable, reliable, sustainable and modern energy for everyone. In this objective, in addition to an increase in energy efficiency, it was stated that the ratio of RES should be significantly increased in the global energy mix; however, no specific numbers were provided regarding what is considered a significant increase. Objective 13 relates to taking urgent measures in order to combat climate change and its effects. In this struggle RES are expected to play an important role.

It was also in 2015 that the Paris Agreement [2] was signed, in which the signatory countries agreed that they have to reduce their emissions of GHG if they want to stop climate change and decrease the expected negative consequences. The specific plan of action is compiled by each country, in which RES will supposedly play an important role [3].

There are nearly 2000 national-level legislation and strategy documents directly related to climate change worldwide [3]. Climate strategies typically have three pillars: reducing greenhouse gas emissions (mitigation), adapting to unavoidable impacts (adaptation), and the Horizontal Tools which include the Climate Awareness Plan. In complex climate strategies, all three areas appear in a complementary way.

Hungary was among the first countries who prepared its National Climate Change Strategy in 2008, and then renewed it in 2018 [4], setting tasks for 2030. Tasks included conducting regular surveys of climate awareness among the population. The strategy focuses on increasing the population's knowledge of RES and raising energy awareness.

RES are today becoming more and more easily accessible to the public as well, since over recent years more efficient and relatively rapid pay-off solutions have appeared in the market [5, 6, 7]. RES are becoming a more and more competitive alternative, and therefore more and more people have started to use them. In their research performed in the US, Reference [8] concluded that in the public sphere, when it comes to a decision about whether to use RES the most important factor for individuals is their own economic benefit, while environmental protection and social aspects are not that important to them. A survey carried out in Qatar arrived at the same conclusion: when deciding whether to use RES, the most important factor is the costs of using them [9]. Reference [10] research findings also show that investment costs play a decisive role. According to a survey of rural and urban areas in Tamilnadu, India, those with higher incomes are much more open to the use of solar energy than those with lower incomes. In addition to the investment costs, what is also important is the extent to which the public trusts the organizations which control the projects related to RES [11, 12].

The increase in the use of RES is primarily a governmental task [13, 14, 15, 16]. With appropriate tender constructions and other regulatory mechanisms, corporations and various governmental organizations, as well as the public, can be motivated to use RES.

In Hungary, over recent years significant measures have been taken, primarily in terms of solar energy use, especially in electricity production. While in 2013 only 25 GWh of electric energy was produced in total using solar cells, this increased to 349 GWh in 2017 [17]. In Hungary, among the public the most widely used renewable energy source is definitely solar energy, but in addition to public use, the number of solar power plants with an output above 0.5 MW has been growing at a rapid rate over recent years.

Based on Eurobarometer surveys conducted over the past 15 years, it can be stated that the environmental awareness of the Hungarian population has increased, but even so it can only be said to be moderate in Europe [18]. During this period, three national representative surveys were conducted, which mainly examined the population's knowledge about climate change [19, 20, 21]. It was found that climate change as a process is basically known to the population, but the details are rather vague. However, a representative survey of the population's knowledge of RES has not yet been carried out.

Our research, which forms the basis of this study, tries to reveal the knowledge structure of the population related to RES in a representative way. This is a very important question, because in order to significantly increase the use of RES among the public, it is necessary that people are familiar with the concept of RES, and their benefits and potential difficulties. It is expected that only those who have the necessary information about the subject and are familiar with the benefits of using RES will invest in such a project [22, 23, 24]. It is also important that the public is well-informed regarding renewable energies because even large-scale governmental projects can be endangered if the public protests against such an investment (often due to a lack of necessary information) [25, 26].

This study aims to determine how well-informed the public is regarding RES, what is the general attitude toward their use, and whether they see the benefits and potential difficulties. It also attempts to determine whether there are misconceptions about these sources. The increased usage of RES is a priority of Hungarian energy policy, and in terms of this objective, it is important to make progress regarding the public, as well.

Several methods are available to answer the questions above, but based on experience, the best results may be produced by using the word association approach [27, 28, 29, 30, 31, 32]. Word association studies are entirely appropriate for assessing the knowledge, attitudes and potential misconceptions of the target group involved regarding the calling concept, as has been demonstrated by several papers published on the subject [33, 34, 35]. Reference [36] investigated the development of a Conceptual Network (CN) of students with this method and they were able to draw conclusions regarding the efficiency of education. Reference [34] also used the word association method to investigate the CN of Hungarian (4th and 7th grade) elementary school students regarding RES. Unfortunately, the results were generally unfavorable. The authors concluded that students have only superficial knowledge of the topic, and they lack

the practical skills which could be applied in their everyday lives.

Therefore, the situation in elementary schools is far from satisfactory, and we assume that the adult population do not have in-depth knowledge regarding RES, either. In order to verify our hypothesis, we carried out a questionnaire assessment in 23 settlements. In total, 1066 questionnaires were filled out, from the results of which the word association evaluation will be presented in this paper.

The practical aim of our study is to provide support for environmental and energy policy makers and to lay the foundations for the awareness-raising measures set out in the National Climate Change Strategy, which aim to increase the knowledge of the population. In order to increase the effectiveness of awareness-raising campaign we have to have an accurate knowledge of what variables (gender, age, education) and how they affect knowledge about renewable energy sources.

The aims of the study are:

- To create a CN of the Hungarian population related to renewable energy.
- On the basis of irrelevant associations, to reveal the misconceptions and knowledge gaps of the population related to RES.
- To explore the attitude of the population towards renewable energy sources on the basis of positive and negative associations.
- To explore the role of the examined social background factors (age, gender, education) in the development of the knowledge structure of the population.
- Make proposals to increase the effectiveness of awareness-raising measures.

## 2. Materials and methods

During the investigation we carried out questionnaire assessments in Hungarian settlements of various sizes, in which we included 23 settlements located in Hajdú-Bihar and Heves counties (Figure 1). When selecting the settlements, we took into account the population size and we attempted to make them representative of the Hungarian settlement pattern. Based on the above, the questionnaire assessment was performed in four settlements with a population of less than 1000, six settlements with a population of between 1000 and 2000, five settlements with a population of between 2000 and 5000, three settlements with a population of between 5000 and 10 000, three settlements with a population of between 10 000 and 50 000 and two settlements with a population of more than 50 000. In certain settlements, the number of questionnaires was determined based on the population size; in the smallest settlements the number of questionnaires filled out was 25, whereas in Debrecen 205 468, [37] 185 questionnaires were filled out. Beside the population size, based on the 2014 statistics database of the KSH (Hungarian Central Statistical Office), we also considered the gender and age distributions, and in this regard we applied a quota-based sampling to make sure

the questionnaire was representative of the population above the age of 19 in the 23 settlements included in the survey. In total, 1066 questionnaires were filled out by responders who were visited in their homes by the surveyors during a so-called random walk using the Leslie Kish systematic sampling [38].

The questionnaire included several questions; however, in this study we focus only on the results of the word association question.

During the word association test, we mapped the CN of the population of the settlements regarding RES, and its structure. We investigated the strength, quantity and nature of the relationship between the calling concept (RES) and the associated concepts. We also analysed how the background factors investigated (gender, age, level of education) affect the number and nature of associations, on the basis of which we were able to draw conclusions regarding how familiar the responders are with the concept of renewable energy.

In the word association test, we asked the responders to tell us about the concepts they can think of when hearing the phrase RES. They had to list a maximum of three words. This was the first question; therefore, the responders could not be biased by previous questions. The surveyors were not allowed to help, or list examples. The 1066 responders in the 23 settlements could have listed 3198 words in total, however, only 41% of the responders could mention three associations, many people said nothing at all, or only named one or two associations; therefore a total of 1965 associations were listed, which is 61.2% of the potential associations. Then, we determined that 373 different word associations were mentioned in total, from which 252 items were listed only once, while 121 items were listed more than once. The number of repeated associations was 1704 in total, which is 87.1% of all the listed associations.

The strength of each associations was determined on the basis of the number of times they were listed. Associations carrying almost the same meaning, such as 'renewing, renewable, always renews, inexhaustible, renewal, not exhausted, eternal, never runs out' or 'sun, sunshine, sun is shining, ray of sunshine, sun radiation, sunlight' or 'inexpensive, cheap, cheap energy, cheaper, cheapness, lower expenses' were merged together in order to realistically evaluate the strength of each association. As a result of these combinations the number of different associations was reduced from 373 to 198. We drew the CN using these 198 associations. We only included terms which had a relative frequency of at least 3% during the test. The relative frequencies of associations were determined in such a way that the number of each associated concept was divided by the number of responders and multiplied by 100; therefore a concept could reach a relative frequency of 100% if each responder mentioned it. The CN was compiled based on the frequency values included in Table 1 [36].

The strongest associations, the strong associations, the moderately strong associations, the weak associations and the very weak associations have a relative frequency of above 20%, 10.1-20%, 5.1-10%, 3-5% and under 3%, respectively. In the CN we usually did not include the

associations with a frequency of under 3%. Therefore, in the CN we described the most frequent associations with the calling concept “renewable energies”. The most important

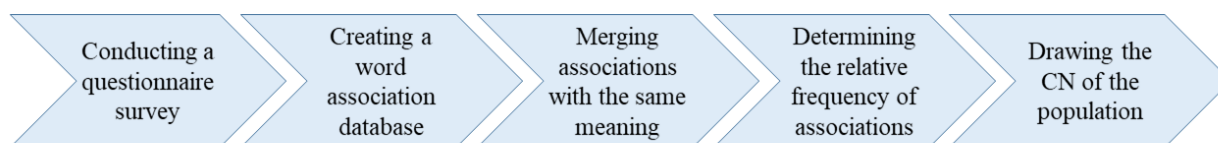
methodological steps of the word association test are summarized in Figure 2.



**Fig 1.** Location of the settlements included in the assessment

**Table 1.** Strength and indication of relative frequencies in the CN

Relative frequencies of associations	Strength of connection	Indication
Below 3%	Very weak	Not included
3.0-5.0%	Weak	abc
5.1-10.0%	Moderate	abc
10.1-20.0%	Strong	abc
Above 20.0%	Very strong	abc



**Fig 2.** The main methodological steps of the word association test

Then we established other groups based on the different associations in order to further clarify the CN of the

responders and the nature of the relationship with RES. To that end, we grouped the associations into seven distinct

categories: The categorization of the associations helped to evaluate public attitudes to RES, as well as to draw conclusions on the depth of knowledge and potential misinformation. In the study we also investigated the impact of age, gender and the level of education on the CN of inhabitants regarding RES.

### 3. Results and discussion

As a first step, we determined the factors which had the strongest impact on the success of responses, i.e. whether the responder could mention three different associations with the calling concept “renewable energies” (Table 2).

**Table 2.** The relationship between the investigated background variables and the number of associations given

	Background variables	Number of responders	Maximum number of associations	Number of associations given	%
Highest educational level	Lower than elementary school (8th grade)	35	105	31	29.5
	Elementary school (8th grade)	196	588	279	47.4
	Vocational school	211	633	311	49.1
	Secondary school	148	444	256	57.7
	Grammar school	226	678	510	75.2
	Technical school	73	219	150	68.5
	College or university	177	531	419	78.9
Gender	Men	504	1512	970	64.2
	Women	562	1686	986	58.5
Age	18-25	162	486	354	72.8
	26-40	270	810	562	69.4
	41-55	256	768	488	63.5
	56-65	142	426	258	60.6
	Above 65	236	708	294	41.5

Since surveyors were not allowed to provide any help to responders in this question, many people could not name three associations; moreover, 19.2% of the responders could not mention even one association. In terms of the level of education we have found a clear relationship: the higher the level of the responder’s education, the more associations they could name. While the responders with an education level lower than elementary school listed approximately 30% of the potential associations, this proportion was almost 80% among those who had college or university level education. The results were in accordance with our expectations; however, it is worth considering that even among those who had a college or university level education there were people who could not mention three associations regarding RES.

We observed certain differences between men and women, as well, in the sense that men tended to be braver when making associations; so they listed 64.2% of the possible associations, whereas the figure was only 58.5% for women (Table 2).

The number of associations were significantly affected by the age of the responders, as well. It was clear that the youngest generations showed the best performance, providing 72.8% of the possible associations, and with increasing age the number of associations listed gradually declined. This ratio was only slightly above 40% in the over 65 age group (Table 2).

#### 3.1. The conceptual network of the population

Based on the relative frequency data of 1956 associations mentioned by the responders, we compiled the CN of the population (Figure 3). In the case of two concepts, the relative frequency value was very strong, i.e. above 20%, regarding the calling concept. The responders most frequently associated renewable energies with the sun, which was mentioned by almost every third person (32.7%), with the second and third most common associations being wind (26.2%) and water (19.4%), respectively. In summary, people primarily associate the calling concept with three traditional RES. Geothermal energy, with a relative frequency value of 4.3%, was also included in the CN; however, biomass with a relative frequency value of 1.9% indicated a very weak relationship, and was therefore not included in the CN. Apparently, biomass is not the first renewable energy source which comes to people’s minds, even though this is the most widely used renewable energy source in Hungary – firewood is used in many households, many of whom may not be aware that they are actually using a renewable energy source. This is supported by research studies concluding that in the eyes of the public biomass is related to fossil fuels and is therefore not considered a renewable energy source [39, 40]. Solar cells, which are devices for utilizing solar energy, also have a strong relationship with the calling concept, with a relative frequency of 14.7%. This further supports the idea that in

terms of RES, the population primarily associate them with solar energy and the equipment used to utilize solar energy. This is also evidenced by the fact that in seventh place were solar cells, with a relative frequency above 5% (6.4%) which indicates a moderately strong relationship.

The association with environmental friendliness also shows a moderately strong relationship, which is encouraging, since most people associate with this positive

attribute, therefore the public is aware that using renewable energies is advantageous from an environmental point of view. In a society which is becoming more and more environmentally conscious, this increases the chance that people will use these types of energy sources, if possible. The moderately strong relationship category also includes wind turbines; therefore not only wind, but the equipment required to utilize wind energy also occurred to people.

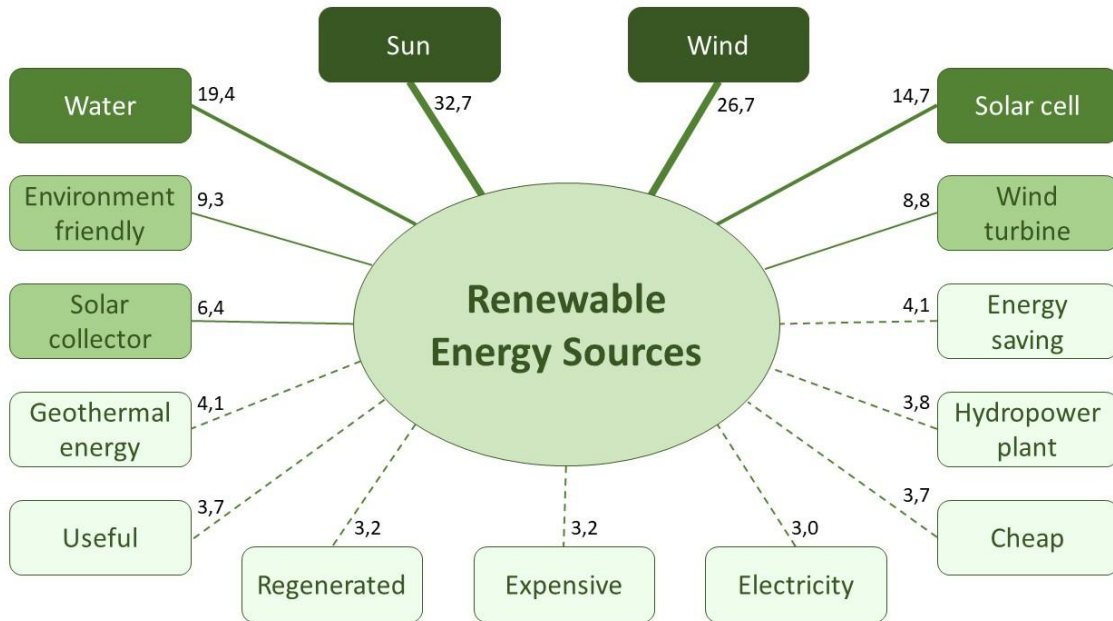


Fig. 3. The CN of the population with regard to RES, with relative frequency values (%)

In total, the relative frequencies of eight associations were between 3 and 5%, and these can therefore be considered weak relationships. Geothermal energy was discussed previously, but this category also includes hydropower plants; therefore, in association with the first three RES with the highest relative frequency, the equipment required to utilize these energy sources was also mentioned, although with a lower relative frequency. With two exceptions, the associations included in the CN all refer to a positive attribute, such as energy conservation, useful, cheap, or regeneration. The only negative attribute included in the CN was “expensive”, which had a relative frequency of 3.2%. This means that the first thing that occurs to the public about RES is not that they are expensive, but that they are aware that utilizing RES is a relatively high cost investment. It is interesting to note that the term “cheap” had almost the same relative frequency, indicating the opposite attribute. This contradiction, however, is only superficial, because responders may think that using RES is expensive and cheap at the same time, since in most cases the initial investment costs are indeed high which not everybody can afford, but after the system has been set up, energy production is cheap or in certain cases requires almost no further investments. “Electricity” was only included in the CN with a relative frequency of 3.0%. This indicates that the public associate RES with electricity production rather than heat energy production. Even though people frequently use firewood for heating purposes which produces heat energy, most of them

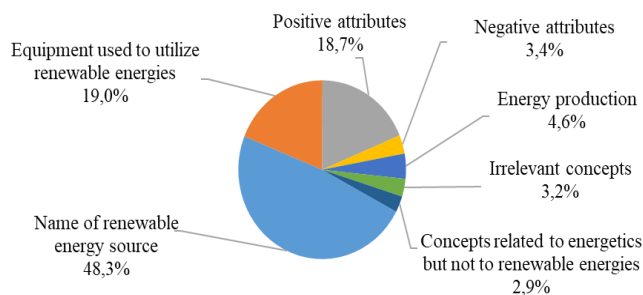
do not consider biomass a renewable energy source, or at the very least they do not associate it with RES.

Using the CN compiled on the basis of the relative frequencies of associations, we described the most frequent associations, although they only include associations with a relative frequency of higher than 3%. However, the analysis is worth expanding to associations with a relative frequency of lower than 3%, because the assessment of these may help us to draw further conclusions about the knowledge, attitudes and possible misconceptions of the public with regard to RES. As described in the chapter on methodology, the associations were grouped into seven distinct categories:

1. Name of the type of renewable energy source,
2. Equipment required to use RES,
3. Positive characteristics associated with RES,
4. Negative characteristics associated with RES,
5. Concepts related to energy production,
6. Irrelevant concepts,
7. Concepts related to energy, but not RES.

Important conclusions can be drawn on the basis of the percentage distribution of the associations in each group (Figure 4). Understandably, when thinking about renewable energies most people associate with one of the RES or the equipment required to utilize these energy sources. Two thirds of all associations are in this category; however, it is

fortunate that almost 20% of the associations referred to a positive attribute, clearly indicating that the public is aware of the benefits of using RES. They know that they are environmentally-friendly, cheap, and at the same time sustainable, methods of energy production.



**Fig. 4.** The distribution of associations in each group, considering the entire sample

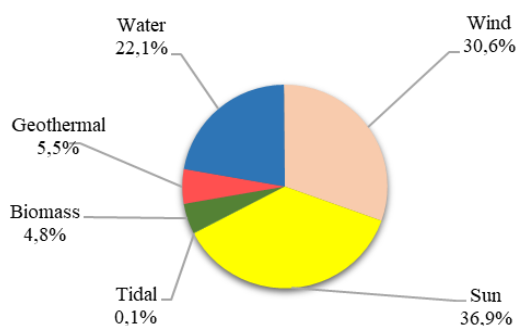
The proportion of associations referring to negative attributes is much lower, at only 3.4%, and in this category the most frequently listed item was the word “expensive”. More than half of the negative associations referred to this concept. Responders are right about this, since the equipment and devices required to utilize RES do indeed tend to be expensive, therefore the initial investment cost is relatively high, and in most cases is more expensive than setting up traditional energy production systems. Therefore, if we want to increase the use of renewable energies among the public, this is the first problem which should be solved in an efficient way. Regarding further negative associations, responders did not form a negative opinion of RES themselves, but thought of concepts such environmental pollution and global warming, which are the very problems which can be solved through renewable energies, or alternatively, they mentioned corruption, which is also not a criticism which applies specifically to renewable energies. Based on the results, we can conclude that the public does not reject the idea of RES, and has no negative feelings about them; the only issue is that their investment costs are considered high.

It is very interesting to evaluate the last two groups, in which we collected the irrelevant concepts and other terms which are connected to energetics, but not to RES. Generally, among this group we included the answers of responders who did not understand the concept of renewable energy and therefore were not able to name appropriate energy sources. Only 2-3% of the associations are in these groups; however, it should be taken into account that 19.2% of the responders could not list any association at all, and therefore presumably had no clear understanding of renewable energies. In summary, the results show that approximately one fifth of responders do not understand this concept and do not know which energy sources are included in this category. At the same time, this also means that 80% of the responders are more or less aware of the meaning of the concept.

Even though the CN clearly shows which RES are most widely known among the public, it is worth taking a closer look at the results of the first and second groups, because in that way we can draw a more accurate picture of the issue

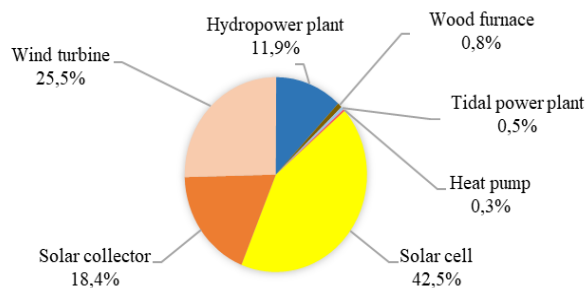
and can also discover which methods of utilization the public is more familiar with.

In the first group we included the associations related to the name of the renewable energy source type. The percentage distribution of the association within the group is included in Figure 4. We have seen from the CN that the public primarily associated renewable energies with solar, wind and hydro energy, but geothermal energy was also among the most frequent associations. However, the term “biomass” was mentioned by fewer people. Figure 5 shows that biomass is represented among the associations, with approximately 5%. The reason biomass was not included in the CN is that its different types (firewood, organic manure, energy grass, plant and animal waste, sewage sludge etc.) could not be grouped together because they cannot be considered to be terms with almost identical meaning.



**Fig. 5.** The percentage distribution of associations regarding the names of RES

Among the equipment required to utilize RES, the predominant concepts were related to the utilization of solar, wind and hydro energy. The proportion of equipment required to utilize solar energy was extremely high (Figure 6). Solar cells and solar collectors made up more than 60% of the group’s associations, which is understandable, since almost everyone sees this equipment in their everyday life. However, associations referring to the utilization of biomass and geothermal energy did not reach 1 percent, indicating that these are less known by the public, or at the very least, they do not occur to them in connection with RES.



**Fig. 6.** The percentage distribution of associations regarding the utilization of RES

3.2. The effects of gender, age and education on the conceptual network of the public

Investigating the differences between genders, we can conclude that in most groups there is no significant difference between the associations made by men and by women (Figure 7). There are only two groups where significant differences can be seen; however, it is important to note that in these groups the sample size was much smaller, therefore even a low number of associations could have an impact on the results. In the case of men, the proportion of irrelevant associations was approximately half (2.3%) that of women (4.2%); however, we cannot draw far-reaching conclusion from this, since of the total of 1956 associations irrelevant associations made up only 22 and 41 among men and women, respectively. The ratio of negative associations, however, was higher in the case of men, but these are also based on relatively small numbers.

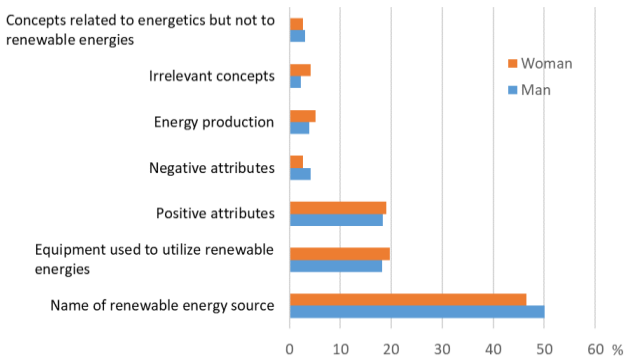


Fig. 7. Percentage distribution of associations classified among each concept group by gender

A few differences can be observed in terms age, as well. The ratio of associations regarding the names of RES was the highest among younger generations. However, mentioning positive attributes was more common in the older generations. It is worth noting that in the case of the younger generations, the ratio of negative associations was very low, and this group of people also mentioned the lowest number of irrelevant associations, meaning that this generation has the deepest knowledge of the topic. This is also supported by the fact that the ratio of associations per capita was the highest in this group (Table 2), therefore they are familiar with the concept of renewable energies. This is not surprising, since renewable energies have become an area of interest over the past 10-15 years and the subject has been more and more of a priority in education which is reflected in the results of our investigation. The emotional connection of the public with renewable energies was most clearly demonstrated by the ratio of positive and negative associations.

Figure 8 shows that the proportion of these types of associations was highest among the older generations; therefore we can conclude that older people have a tendency to approach this topic emotionally and also that all generations clearly have a positive attitude toward renewable energies.

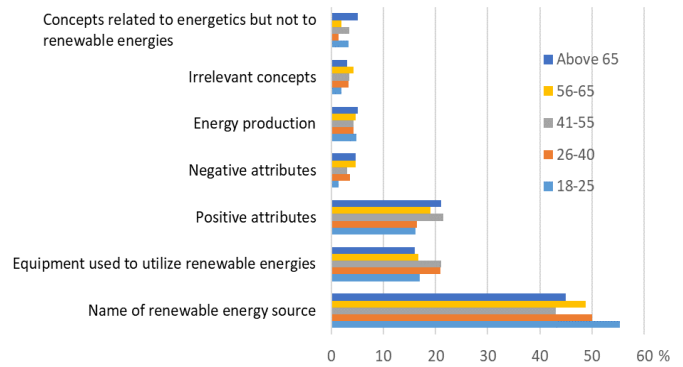


Fig. 8. Percentage distribution of associations classified among each concept group by age groups

Significant differences were also observed with the level of education. The proportion of irrelevant concepts was the highest among those with the lowest level of education, gradually decreasing with an increase in the education level (Figure 9).

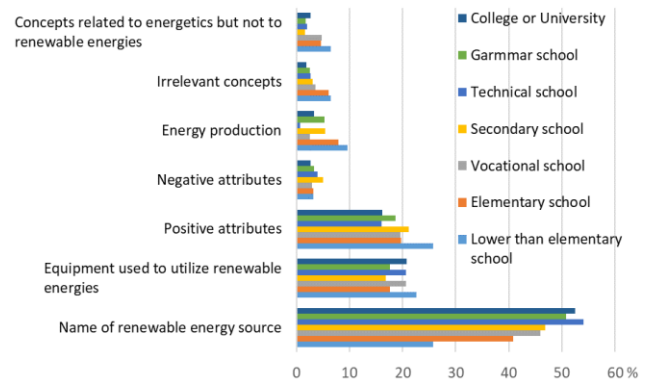


Fig. 9. Percentage Distribution of associations classified among each concept group by education levels

The ratio of associations connected with energy production but not to renewable energies was also the highest among the least educated group. During the interpretation of the results, it also worth mentioning that the proportion of people who could not name any association in connection with renewable energies was also the highest among the least educated group. These results support the claim that from the perspective of knowledge about RES the level of education is a very important factor. The proportion of the names of RES was the highest among the most educated group, indicating that they are aware of the types of energy sources belonging to this category. The ratio of positive associations, however, was the highest among the least educated group, which indicates that even though they lack information on the subject and do not really know which types of energy sources are considered renewable energies, they are generally aware that utilizing renewable energies is a good thing.

4. Conclusion

We have carried out an assessment in a total of 23 settlements of various sizes in order to investigate knowledge structure toward renewable energies. In the study, performed using the word association method, we included a total of 1066 persons, who were visited in their homes by the



surveyors. As a first step, we compiled the CN of the population with regard to renewable energies, which was created on the basis of the associations given to the calling concept “renewable energies”. Based on the above, we concluded that the most widely known RES are solar, wind and hydro energy, and we have also learned that people generally know which tools and equipment are required to utilize these energy sources. These results suggest that more attention should be paid to other renewable energy sources, especially geothermal energy and biomass, for which the conditions in Hungary are excellent and the possibilities for public utilization are also provided.

It was revealed that approximately 20% of the respondents do not know anything about RES, while there are many among the remaining 80% who have only superficial information on the subject. This is consistent with the observation that the educational system, especially in primary education there is not enough emphasis on the presentation of RES. It is an important task to pay much more attention to this topic in the new framework curricula.

The population sees the role of renewable energy sources primarily in electricity generation, which is also shown by the fact that the word “electricity” has been included in the most common associations, while the words “heat generation” and “thermal energy” have hardly appeared among the associations. Among the overhead costs the heating is the most significant item for the Hungarian population. Therefore, the role of green energies in heat production should be emphasized in awareness-raising campaigns.

The public attitude is clearly positive, indicated by the high relative frequency of associations referring to positive attributes such as environmentally-friendly, energy saving, useful and cheap. Negative associations have hardly occurred, so there are no manifestations of rejection of renewable energy sources among the population.

The public is also aware that in terms of initial costs, the utilization of renewable energy is relatively expensive; however, they also know that after setting up the system it is considered an especially cheap method of energy production. Therefore, in awareness-raising campaigns, more attention should be paid to present the payback period of renewables and cost-benefit analyses. It is also important to draw the public's attention to the most favourable credit schemes.

In terms of background variables, we have concluded that the gender of responders did not have a significant effect on the CN; consequently there are no major differences between the concept structure of men and women regarding renewable energies. However, stronger differences were observed in the age of the responders. Younger generations can typically name more associations connected to RES. It was revealed that younger generations have the most accurate information, since in these groups the proportion of irrelevant associations was minimal, and they mentioned the lowest number of negative associations as well. The number of associations gradually decreases with an increase in age, older people had the least knowledge of this subject. In the curricula of decades ago, this topic was not included at all.

Information about renewables nowadays reaches the population mainly through modern information channels which are less used by the elderly. To improve older people's knowledge of renewable energy sources, bigger emphasis should be placed on the use of traditional information channels (print media, radio, television) which they use more often. In addition, older people's skills in modern information communication tools need to be improved.

The most definitive differences were observed in terms of the level of education between the groups. The information of the least educated group regarding renewable energies is incomplete; they often cannot identify the meaning of the term and they showed the highest ratio of misconceptions, as well. With an increase in education level, the ratio of irrelevant associations gradually decreased, indicating that educated people have more precise knowledge on the subject and they are more familiar with the types of energy sources belonging to this category. This is also supported by the fact that people with a higher education level more often mentioned specific types of RES among the associations they made.

The representative evaluation including more than 1000 individuals may provide a good basis for environmental and energy policy planning. It enables strategic decision-makers to design effective and well-founded awareness-raising measures by providing an accurate picture of the population's knowledge structure about renewable energy sources. Raising the climate awareness of the population is playing an increasingly important role in the climate strategy in all countries, so the methodology presented in the study and the reported results can provide useful knowledge for all readers.

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