

INTERNET BASED SURVEY ON ENERGY USE AND EVALUATION, INCLUDING HOUSEHOLD MACHINERY AND CLIMATE IMPACTS

Andrea Farkas

National University of Public Service, Budapest, Hungary
E-mail: andrea.farkas@klimaklub.hu

Janos Mika

Eszterhazy Karoly University, Eger, Hungary
E-mail: mika.janos@uni-eszterhazy.hu

Three sets of questions selected from an internet-based survey are presented, related to energy utilisation. The 831 responses, obtained in May-September 2016, answered to over one hundred questions. Altogether 34 questions are analysed. Representativity of the survey is enhanced by stratified sampling, considering the number of inhabitants in the settlement. Four strata are established: small settlements (below 5,000 inhabitants), medium settlements (5,000 – 50,000), cities in Hungary (50,000 – 1 million) and Budapest (over 1 million inhabitants). The stratified sampling means that the averages of the given strata are multiplied by the frequency of the same strata over the country as established by the Central Statistical Office of the country. As concerns the household equipments, number of cellular phones television, other kitchen equipments, lap-top PC-s and vacuum-cleaners are over 1 piece / family. Number of gas-cookers is by 50% more than that of electric cookers. From among the energy sources, the renewable ones are assessed the highest, with 4.77 from the maximum possible 5.00. Energy use and CO₂ emission by the living houses are also assessed over 4.0. Nuclear and fossil energy sources are negatively assessed (3.05 and 2.82. in average). The most feared consequences of climate change in Hungary are connected with water management. E.g. the nation-wide water management strategy should be re-considered (4.22), or many plants can be produced with irrigation, only (4.17). Direct impact on more energy for cooling (4.07) and less energy for heating (3.11) appear rather asymmetrically. In addition to the above results, energy related aspects of the UN SDG are considered in the first part of the paper.

Keywords: renewable energy, climate change, public survey, stratified sampling, SDG (2016-2030)

1. Introduction

Environmental safety is one of our basic rights which can be achieved by protecting the environment and smart utilisation of our resources. The changing climate and extremes of weather often warn us on timeliness and hardness of the problem. The recent UN Sustainable Development Goals (2016-2030) collected 17 Goals and 169 targets serving materials for wide considerations. In the present paper we provide some thoughts on energy consumption and renewable energy in Section 2.

The key elements of the paper are, however, the questions and answers which were obtained based on 831 responses for an Internet-based questionnaire containing 107 questions. This methodology and the results are presented in Section 3. Possible utilisation of these results are briefly outlined by Section 4.

2. The SDG (2016-2030) on energy

2.1 The UN document

The United Nations accepted the 2030 Agenda for Sustainable Development including 17 Sustainable Development Goals (SDG, 2015) including 169 more detailed targets. These goals spread over all environmental, social and economical aspects of sustainability, all over the world. In September 2015 the United Nations (UN) accepted the 2030 Agenda for Sustainable Development (SDG) for 2016-2030, including 17 Goals including 169 detailed Targets. This latter document is in the focus of the present Section.

The aim of the paper is to provide information on the targets related to renewable energy sources, chosen as a possible example to serve as a field where the related targets can be exposed. Many other foci could have been selected, but this topic, the renewable energy sources are characterised by three features that make this aspect appealing: renewable energies are (i) fast developing, (ii) future oriented by saving the environment and (iii) they represent relatively new pieces of knowledge, so contemporary information should not fight with older learning.

The 17 established Goals are not ordered into any logical structure. Even the colouring of the logo-s does not help in establishing any intention to classify the Goals, though it would be rather useful in memorizing and understanding the goals. Hence, a trial is made to classify the goals keeping their original numbering in Table 1.

Table 1: Grouping of the 17 Goals (2016-2030). All original texts are denoted by (“.”):

Group of Goals	Numbered Goals
<i>Basic human needs</i>	<p>“2. End hunger, achieve food security and improved nutrition and promote sustainable agriculture.”</p> <p>“3. Ensure healthy lives and promote well-being for all at all ages.”</p> <p>“6. Ensure availability and sustainable management of water and sanitation for all.”</p> <p>“7. Ensure access to affordable, reliable, sustainable and modern energy for all.”</p>
<i>Equality and justice</i>	<p>“1. End poverty in all its forms everywhere. “</p> <p>“4. Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.”</p> <p>“5. Achieve gender equality and empower all women and girls in their social role.”</p> <p>“10. Reduce inequality within and among countries.”</p>
<i>Efficient, sustainable economy</i>	<p>“8. Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.”</p> <p>“9. Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation.”</p> <p>“12. Ensure sustainable consumption and production patterns.”</p> <p>“13.* Take urgent action to combat climate change and its impacts.*”</p>
<i>Protecting</i>	<p>„11. Make cities and human settlements inclusive, safe, resilient and sustainable.</p>

<i>vulnerable environments</i>	<p>“14. Conserve and sustainably use the oceans, seas and marine resources for sustainable development.</p> <p>“15. Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.”</p>
<i>Cooperation towards common goals</i>	<p>“16. Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels.”</p> <p>“17. Strengthen the means of implementation and revitalize the global partnership for sustainable development.”</p>

*”Acknowledging that the United Nations Framework Convention on Climate Change is the primary international, intergovernmental forum for negotiating the global response to climate change.”

The SDG were recommended as a document reflecting the important *5P* for mankind: *people, planet, prosperity, peace, partnership* (SDG, 2015: p. 2). These concepts, however, do not really accompany the document. The first two groups of our classification, the basic needs (No. 2, 3, 6 and 7) and the equity group (No. 1, 4, 5 and 10) deal really with *people*. The next two groups, the production (No. 8, 9, 12 and 13) and the zones in danger (No. 11, 14 and 15) fit to *prosperity* and *planet*, but *peace* and *partnership* are related to the smallest group, cooperation (No. 16-17).

The majority of the Targets contain quantitative objectives, mostly related to 2030. Their number is 126. A minority of the Targets points at organisation needs as preconditions of the objective targets, encountering 43 such Targets. As a rule, the quantitative targets are marked by numbers, and the latter ones by letters.

Let us remark, that there is one Goal which is problematic to select into any of the groups. This is Goal 13. Climate action, since climate change is the only environmental problem which is tackled as a separate Goal in the SDG (2016-2030). All other problems, like reduction of biodiversity, ozone depletion, etc. are considered in other goals as their effects on the vulnerable spheres or on the human health. It could also be kept as an individual group with one single Goal. Another remark is that this Goal refers to the Paris Agreement (2015) which deals with several aspects of climate change, not mentioned by this Goal.

2.2 Synergy and conflicts of renewable energy with other targets

This sub-section describes which goals and targets are related to renewable energy sources. The first sub-section includes the two goals that support the use of renewable energy sources. In contrast, there are two goals which can conflict with this objective. Finally, the third sub-section will contain the targets indirectly related to renewable energy sources. The three subsections will only include quantitatively measurable targets.

Synergistic targets

Table 2 lists the two goals demonstrating obvious synergy with renewable energy sources, as well as their specific targets. With respect to renewable energy, the three most important goals are universal access, increasing the share of renewable energy, and doubling the global rate of improvement in energy efficiency (i.e. achieving the same result by using less energy).

Uniquely, for Goal 13, the “number.number”-type targets are also general in nature. Strengthening adaptive capacity, integrating climate change measures into national strategies, and the single target regarding improving education and institutional capacity are all prerequisites to non-defined target states.

Table 2: Goals in synergy with renewable energy sources, and the relevant targets (SDG, 2015)

7.1	“By 2030, ensure universal access to affordable, reliable, and modern energy services”
7.2	“By 2030, increase substantially the share of renewable energy in the global energy mix”
7.3	“By 2030, double the global rate of improvement in energy efficiency”
13.1	“Strengthen resilience and adaptive capacity to climate related hazards and natural disasters in all countries”
13.2	“Integrate climate change measures into national policies, strategies, and planning”
13.3	“Improve education, awareness raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction, and early warning”

Conflicting targets

Another two goals, specifically ending hunger (Goal 2) and protecting terrestrial ecosystems (Goal 15), may conflict with the renewed growth in bio-fuels. In both cases, there is a single specific target that can potentially conflict with the use of these types of fuel (Table 3). Any given plot of land, can only be used simultaneously for food and energy source production if the plant in question is edible (target 2.3). It is possible that terrestrial ecosystems do not become a source of conflict. If production does not grow faster than the natural growth rate, and if the desire for rapid growth does not stress the natural forest ecosystems, even when taking climate change into account, then this source of conflict can be avoided (target 15.2).

Table 3: Goals conflicting with renewable energy sources, and their relevant targets (SDG, 2015)

2.3	“By 2030, double the agricultural productivity and the incomes of small-scale food producers, in particular women, indigenous people, family farmers, pastoralists and fishers, including through secure and equal access to land, other productive resources and inputs, knowledge, financial services, markets, and opportunities for value addition and non-farm employment”
15.2	“By 2020, promote the implementation of sustainable management of all types of forests, halt deforestation, restore degraded forests, and increase afforestation and reforestation globally”

2.3 Education of and by sustainability

Possible educational aspects related to the SDG do not directly follow from their content, but four aspects can be recommended as possible ways of using SDG and related knowledge for teaching *of and by* sustainability. These aspects are as follows:

- (i) The SDG (2016-2030) are worth knowing for all pupils of ca. 15 years or elder as long term tasks for everyone on this Globe. One can use these goals and targets to emphasise relative development of a given country or region presenting national sustainability indicators.
- (ii) Especially in higher education it might be useful to collect the related targets to a given wider topic, e.g. as it has been done above for renewable energy sources. In this respect, renewable energy is just a possible field to specify the rather wide set of SDG. For this, motivated audience it is also worth demonstrating how the concrete “number.number” targets are mutually connected with the background and pre-condition type “number.letter” type targets.
- (iii) It is useful to apply the SDG-s also for counteracting the often experienced rather selective topical selection among the various problems by the public media. Some problems are over-emphasised by the various channels and home-pages, whereas others are not represented at all. Having consequently rising all the problems for the adult or younger audience, these problems might be adequately weighted. Furthermore, the teachers should also be active in preparation to introduce the SDG or their selected topics for the given group of pupils, since the written targets themselves are not interesting enough to attract their attention. Hence, proper illustrations of global or national character should be found by the teachers, as well.
- (iv) Finally, the SDG-related statements and examples are suitable for supporting selected topics of school-subjects. E.g. trigonometric functions in mathematics can be demonstrated by solar collectors, i.e. one kind of renewable energy sources. Steepness of the surface in geography can be illustrated by availability of water energy. Photosynthesis in biology and fermentation in chemistry are clearly connected to bio-energy. Another possibility is improvement of the key competences. Application of the above illustrations can themselves be used to improve *Mathematical Competence* and *Competences in Natural Science and Technology*. The *Digital* and the *Foreign language competences* can be developed by asking the pupils to search the appropriate targets in a given topic. Similarly, *Communication in the Mother Tongue* together with their *Learning to Learn* competences can be improved simply by understanding and memorizing the goals and targets. *Social and Civic Competences* may be developed by personal participation in some related voluntary activities concerning e.g. poverty. This is how sustainability is not only an important topic to be educated, but also a useful contributor to reach other aims of education.

3. Public survey on energy, climate and environment

3.1 Methodology

The Internet based questionnaire had been launched in May 2016 and the answers were collected until the end of September in the same year. 831 responses were received answering the 107 questions on the list. Representativity of the samples is enhanced by stratified sampling based on six different aspects (Table 4). This means that the averages calculated for each stratum are weighted by the nation-wide true proportions, published by the Central Statistical Office, as related to the year 2016. These aspects are (i) sex of the responders, (ii) location in the country, (iii) settlement size, (iv) age of the responders, (v) number of people in one household and (vi) highest education of responders.

Table 4. The applied stratifications including the name and frequency of the strata in the 831 responses

Stratification	Strata	Percentages
<i>Sex (2 strata)</i>	<i>man : woman</i>	<i>52 : 48 %</i>
<i>Location in the country (3)</i>	<i>West : Central : East</i>	<i>26 : 52: 22 %</i>
<i>Settlement size (4)</i>	<i><5,000 : 5,000 – 50,000 : 50,000 -1 million : >1 million</i>	<i>15:29:27:29%</i>
<i>Age in years (5)</i>	<i><30: 30-40: 40-50: 50-60: >60</i>	<i>7 :18:32:25:18%</i>
<i>People in one household (5)</i>	<i>1 : 2 : 3 : 4 : ≥ 5</i>	<i>13:29:23:20:14%</i>
<i>Highest education (6)</i>	<i>≤8 yrs: techn. coll.: sec. school: college: university: PhD</i>	<i>4:11:7:34:38:6%</i>

In the following sub-sections, the responses to the 107 questions are briefly presented in the following topical groups:

- Data on households and lifestyles (32 questions)
- Opinions on the environment (12 questions)
- Opinions on air pollution and energy (15 questions)
- Opinions on the reasons and the impacts of climate change (22 questions)
- Opinions on the environmental safety (26 questions)

3.2 Results on the households

Number of mobile phones was 1-2 per household. Number of TV-sets, laptop computers, vacuum cleaners and the other kitchen machines is also over 1 piece per household. Nearly one Internet availability, washing machines, kitchen robots, microwave ovens, toasters, desktop computers and other, non-kitchen devices are found in a household. Much more families are equipped with gas cooker than with electric cooker.

Main component of the family budgets is food consumption (40%). Much less (10-20%) can be spent on summer vacation, car fuels and redemption of housing debts. Nearly ten percent of the budget, or less is used for week-end and cultural programs, car debts and winter skiing vacation.

Both groups contained by Figure 1 indicate that the financial situation of the responders was not special concerning the general conditions over the country.

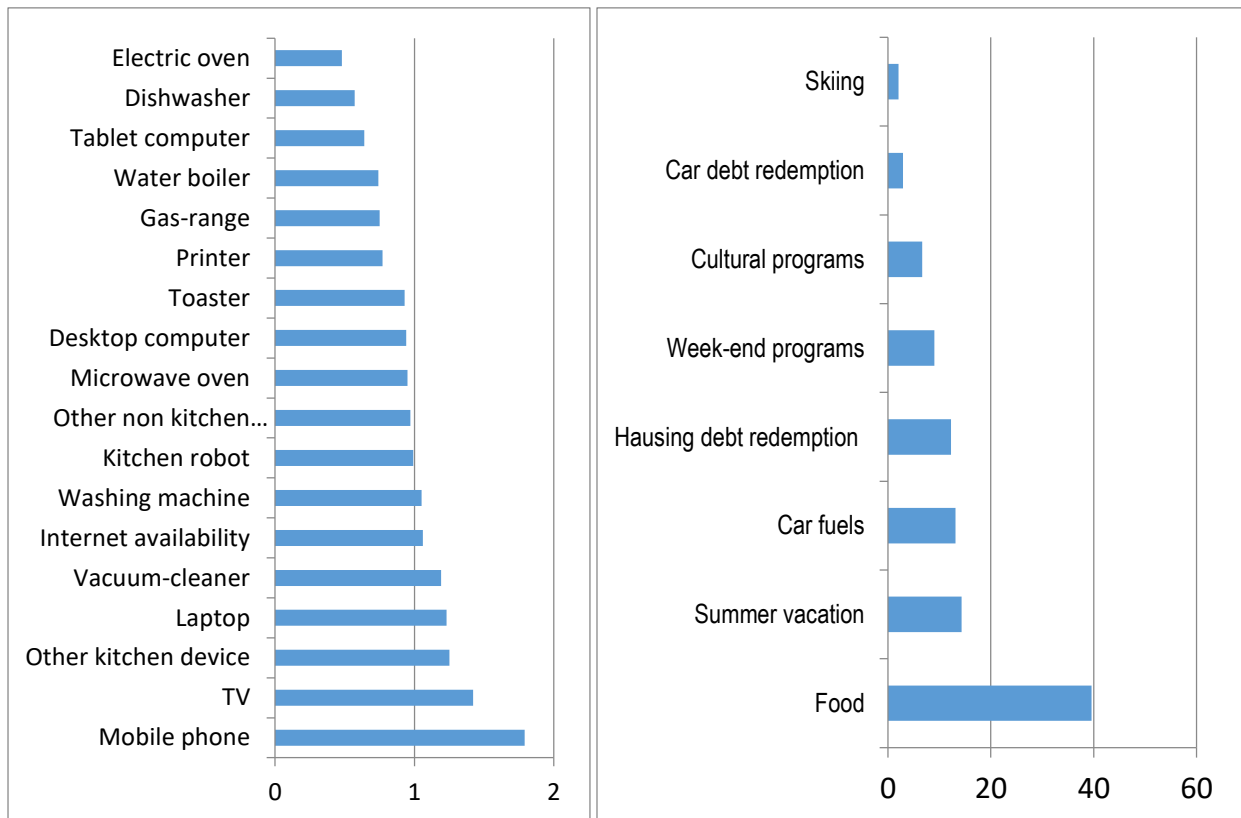


Figure 1. (left) Availability of household machines stratified according to location in the country (right) Distribution of family costs stratified according to the sex of the responders, proportioned from 67.7% to 100%.

3.3 Results on environmental problems

The responders evaluate those environmental services with the highest marks which are perceived directly. They are e.g. drinking water supply, waste collection, wastewater treatment and selective waste collection. From the dangers littering and pollution by the enterprises are felt as most unpleasant ones, but climate change and pollution of the cities remains not by much behind. Somewhat smaller marks are given for noise, ozone hole, acid rains and overpopulation of the cities.

Evaluation of these general environmental questions depend on the question put before the answer (Figure 2). Asking just about the problems in question generally, the received by 0.5-1.0 (i.e. by 10-20%) higher values than in case of the questions on the role of the same problems as factors of the responders' everyday life. The average difference is 0.68 in this respect.

Evaluation of responses to the softer question indicate that the responders are highly sensitive to the exposed environmental questions. Even the lowest evaluations are near or above 4.0.

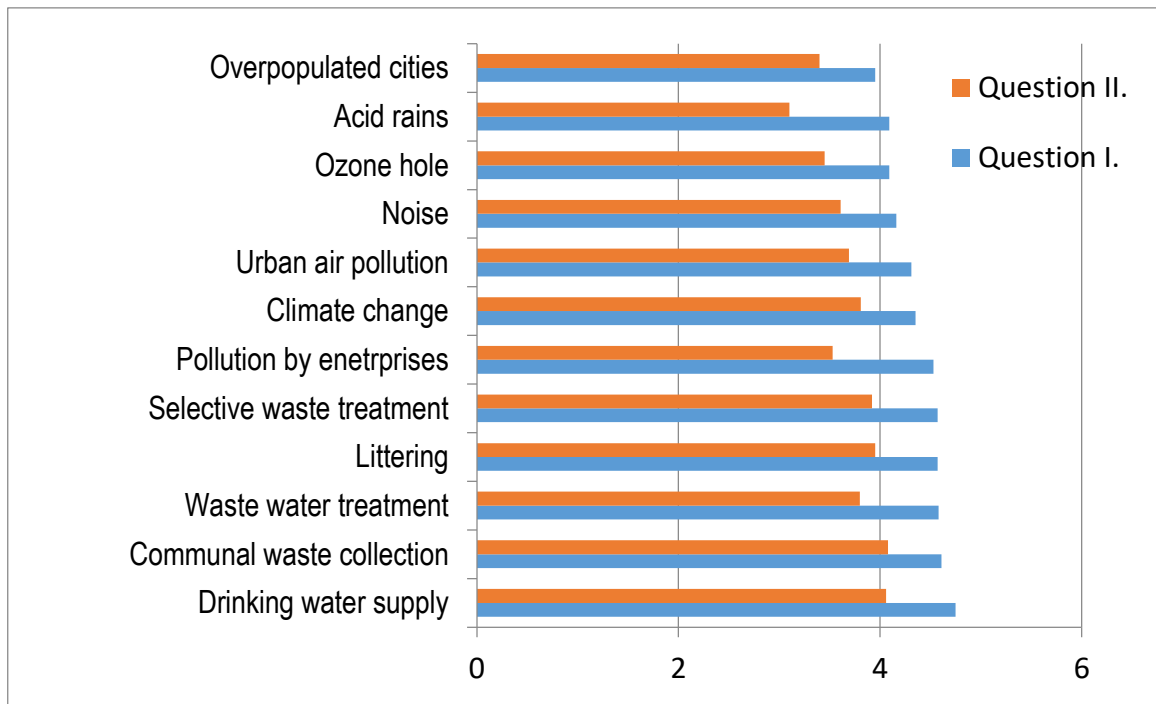


Figure 2. Importance of selected environmental problems judged in response to two different questions. Question I. How important are the following environmental problems for you? Question II. How much do the following problems affect your life? (Stratification according to the sex of responders.)

3.4 Results on air pollution and energy

Sources of air pollution are mostly seen in the polluting materials emitted by the enterprises, in or everyday CO₂ emission and the communal wastes by the responders (Figure 3). Somewhat smaller, but still around 4.0 are the importance of urban overpopulation, the climate change (which is not a reason but a consequence) and the anachronistic heating systems of flats. Much less important are the ozone hole (a consequence of the pollution, again) and the animal ordure.

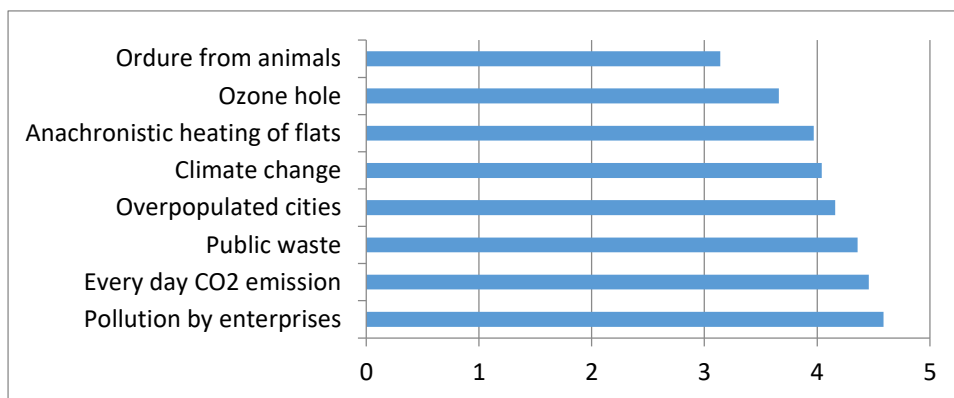


Figure 3. Evaluation of various forms of air pollution (Stratified according to education.)

The renewable energy sources received the highest (almost 5.0) evaluation among the energy sources, whereas the worst numbers (nearly 3.0) were given to nuclear and fossil energy forms (Figure 4). These evaluations are obviously driven by environmental considerations not by those motivated by reality of energy feasibility. Energy consumption and CO₂-emission of the living houses are highly evaluated (over 4.0), as well. Questions related to nuclear energy are evaluated in strange manner: high energy dependence is connected with the lack of nuclear plant, but no change in CO₂-concentration is assumed for this case, whereas misunderstood air-quality changes are reported.

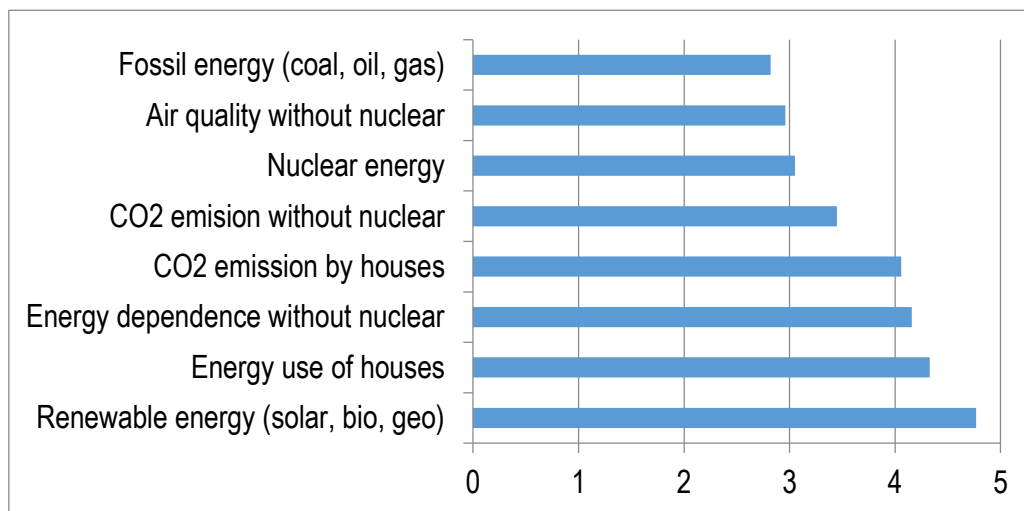


Figure 4. Evaluation of the different energy sources (Stratification according to the sex of responders.)

3.5 Results on climate change

Highly ranked are the carbon-dioxide emission among possible reasons of climate change. This evaluation is correctly much higher than those for internal processes of the Earth or solar activity. Deforestation is higher marked than its real danger, but evaluation of animal husbandry and agriculture are evaluated nearly according their real contribution. One should note that besides the scientifically correct terms for reasons of climate change, high ranks are given to less defined terms, as irresponsibility or public, as well.

Impacts of climate change related to water supply are ranked slightly higher than those related to plant production or energy demands. But, the difference between “re-considering or water management” and “less energy is needed for heating” is only slightly over 1.0. This reflects the high mental sensitivity of the responders to all potential changes of climate change.

Both above features are demonstrated below in Figure 5.

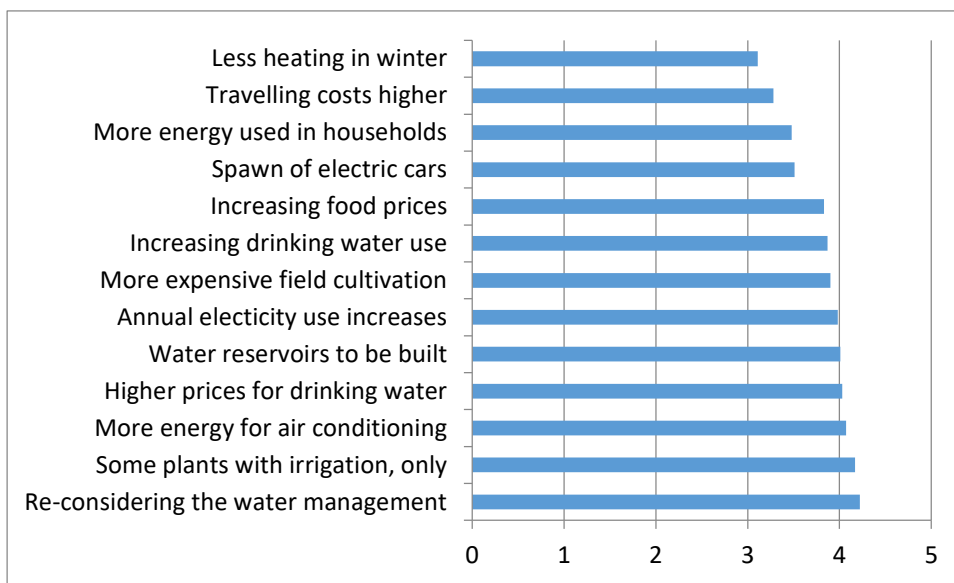
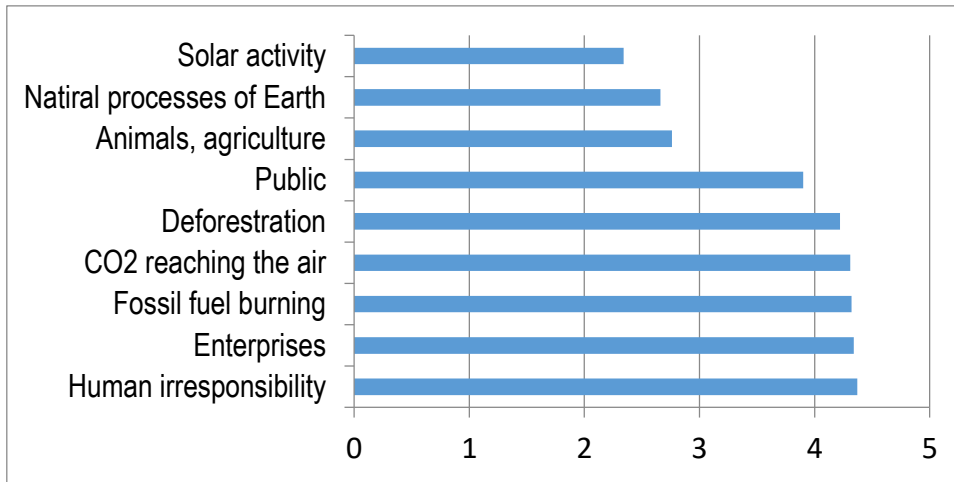


Figure 5. (upper) Evaluation on potential reasons of climate change according to highest education stratification (lower) Evaluation on various impacts of climate change according to stratification based on location within the country

3.6 Results on environmental safety

Responders consider the lack of clean water, energy and healthy food not of high risk, but air and environment pollution are evaluated over 4.0. Migration and overpopulation meant low risk in the time of the survey (Figure 6). In case of another 15 problems it is established that the evaluations depend on the compilation of the question even if they were of similar meaning after first reading.

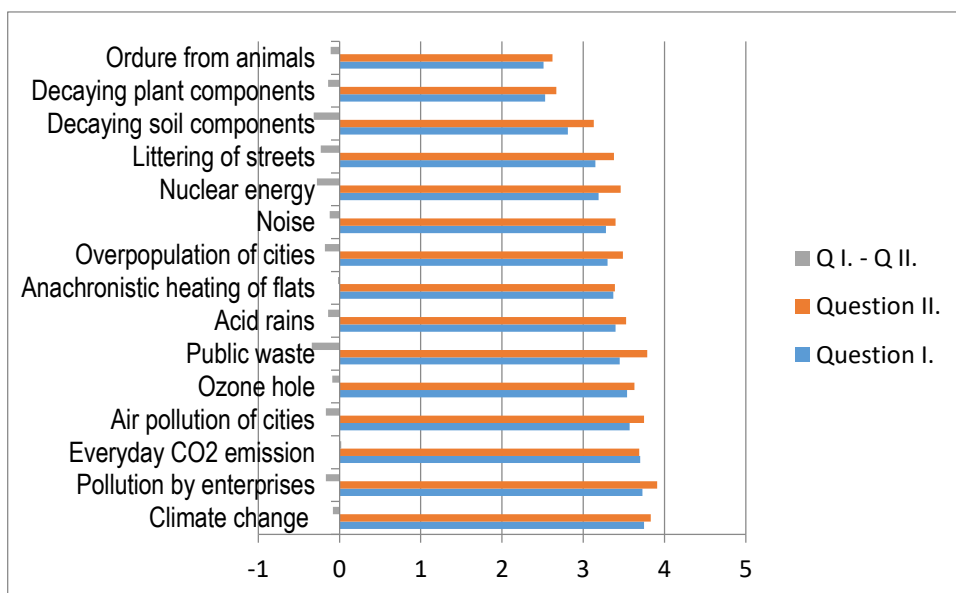
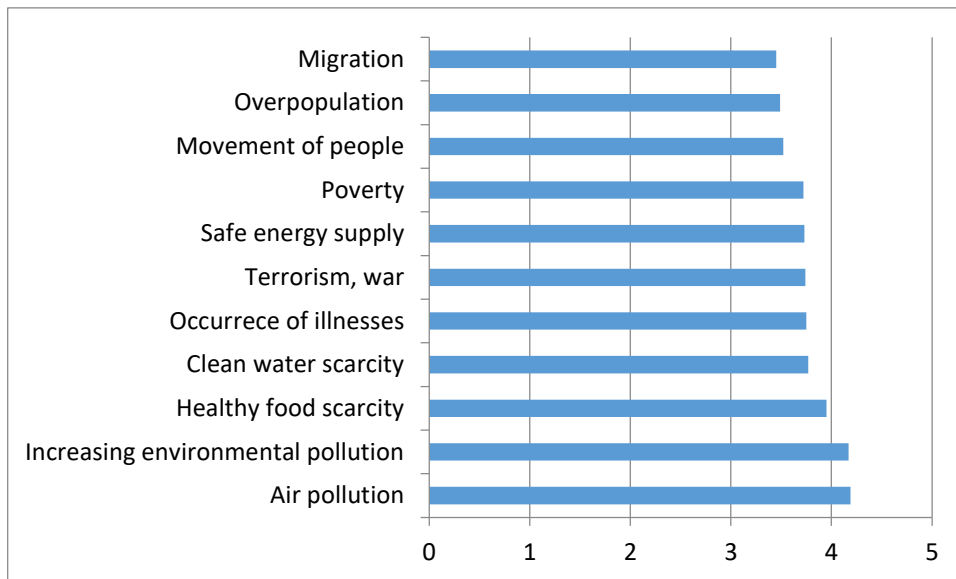


Figure 6. (upper) Evaluation of environmental safety factors, according to stratification based on the sex of the responders (lower) Evaluation of environmental safety problems in response to two different questions, Question I. „To what extent mean risk and threat the followings?“ Question II. „To what extent influence the followings your feeling being in safety?“

3.7 General and specific differences among the sample strata

Women are more sensitive concerning state of the environment in almost all particular aspects analysed. This means higher evaluation of their importance by women than by men. At the same time, responders with high education mark the risks less than those finished just technical college (Figure 7).

Besides these general differences among the strata, we could rarely establish large monotonous differences among the strata averages. One such difference is the increasing number of computer printers in the household with the increasing age of the responders. The other plausible difference is that evaluation of urban pollution gets higher with the increasing number of inhabitants. (Figure 8).

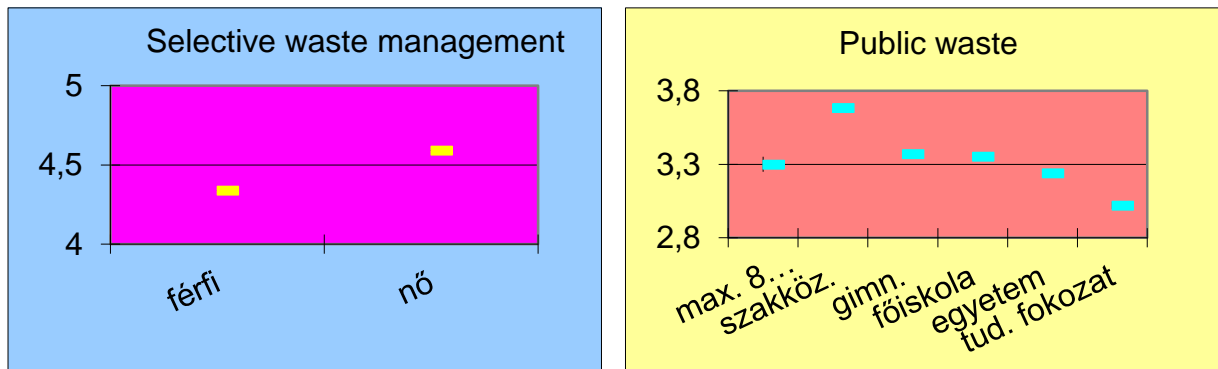


Figure 7. (left) Characteristic difference between environment sensitivity of men and women (right) Characteristic decrease in evaluation of the problems by responders with high education The categories of axis X: man („férfi”) – woman („nő”); below 8 years in school, technical college, secondary school, college, university, person with scientific degree.

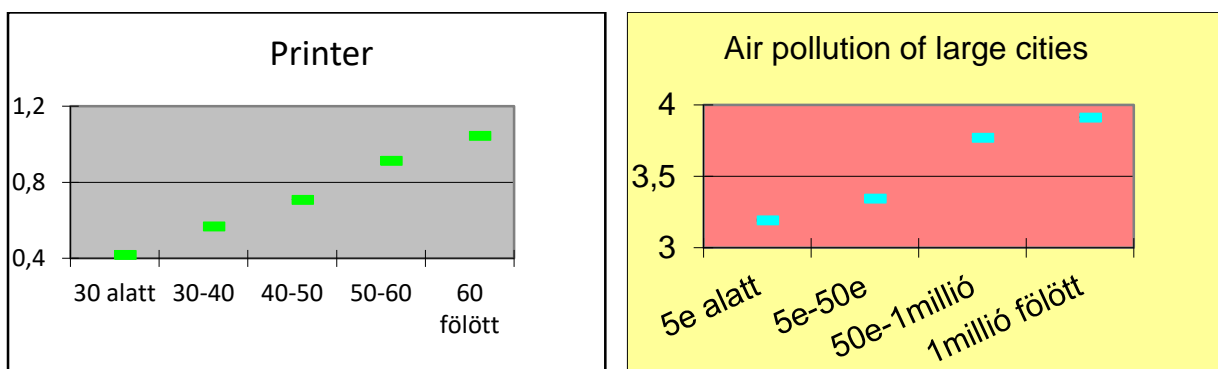


Figure 8. (left) Unique difference in frequency of printer sin the family with increase of the age of responders (right): Unique difference in evaluation of urban air pollution according to the settlement size The categories of axis X: for the ages, below („alatt”) above („fölött”); for the inhabitants below 5,000, 5,000 - 50,000, 50,000 - 1 million, above 1 million.

4. Utilisation of the results

In English we use policy and politics, where the latter is highly evaluated by the parties in a democracy. In order to convince the parties to work for policy, as well it is important to know what the potential voters think about the various policy aspects.

The results of the survey, presented just briefly based on a larger study, may serve as factual basis of such bridge between policy and politics, reflecting what people think about energy, climate, pollution, as well, as on environmental safety and sustainability.

Acknowledgement

This study was supported by the National Research, Development and Innovation Office (NKFIH), Project No. K 116595 and this support is gratefully acknowledged here.

Reference

SDG (2016-2030). United Nations Resolution A/RES/70/1 of 25 September 2015. The Goals are listed in par. 51 (http://www.un.org/ga/search/view_doc.asp?symbol=A/RES/70/1&Lang=E)