Reasons for carbon-free resources and viewing conventional energy supply on the results of a research

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The consequences of climate change are among the greatest challenges of the 21st century. The global average temperature will rise by more than 2.5 C, which will increase the number of starving people by over 80 million. 25% of mammal species and 12% of bird species are projected to be extinct. The Earth's population is currently over 7.5 billion people, growing steadily. It also means a steady increase in the energy demand of the population. The greenhouse effect, which causes global warming, is primarily responsible for climate change. According to a NASA report, the rate of warming is faster than that of any previous modeling, so the greenhouse gas emissions must be drastically reduced to slow down the process. Each year, 6 billion tonnes of CO2 emissions come from fossil fuel emissions and 1 billion tonnes from land use. According to the University of California, CO2 emissions are distributed as follows: transport 49%, electricity generation 30%, industry 11%, population 7%, trade 3%. The aim of the study is to present the knowledge and opinion of the respondents about the classification of conventional energy sources and how long the Hungarian carbon / lignite stock may be sufficient.

Keywords: traditional, energy sources, coal, lignite, stock.

1 Literature review

The consequences of climate change are among the greatest challenges of the 21st century.

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It also means a steady increase in the energy demand of the population. The greenhouse effect, which causes global warming, is primarily responsible for climate change. According to a NASA report, the rate of warming is faster than that of any previous modeling, so the greenhouse gas emissions must be drastically reduced to slow down the process. Each year, 6 billion tonnes of CO2 emissions come from fossil fuel emissions and 1 billion tonnes from land use. As a result of global warming, natural disasters such as forest fires, floods, rising sea levels, hurricanes and hot waves are becoming more common. The heat wave of the summer of 2003 caused 35,000 death. Due to the low water level of the rivers, the power plants will not get enough cooling water, so energy shortages are expected. According to the University of California, CO2 emissions are distributed as follows: transport 49%, electricity generation 30%, industry 11%, population 7%, trade 3%. The way to reduce emissions from electricity generation is through renewable and nuclear-based carbon-free production. Without a carbon emission, a nuclear power plant can only perform the task of a basic power plant. Renewables are not able to take over the role of basic power plants, however, by integrating appropriate storage facilities into the system, decentralized scheduling and peak control capacities can be provided alongside the base-load generation nuclear power plant units [9].

Progress is being made to ensure that the needs of the present population are met so that this option can be maintained for future generations (Brundtland Commission of the United Nations, 1987). China is already the most fossil energy user society in the world today. By 2035, double as much coal will be used to generate electricity, as the OECD's most economically advanced countries in the world. China alone will use twice as much coal to generate electricity as OECD countries together in 2035 [15].

From 2030 onwards, fossil energy sources (including hydrocarbons, coal and lignite) can only be exploited with Carbon Capture and Storage (CCS) and clean coal technologies. Without this, decarbonisation plans will not be implemented. If the environmental externalities of energy production are also included in the prices, fossil fuels could be a major competitive disadvantage for nuclear and renewable energy. The share of renewable energy will still be eligible for funding. The benefits of nuclear power are low greenhouse gas (GHG) emissions, low electricity production prices, raw materials without political and economic risk. Its disadvantages are the high investment demand, which in the case of private sector investment also requires budget coverage (budget deficit increasing item) and high environmental risks of a possible malfunction. In the case of power plant gas demand, which increases many times in the long term without the use of nuclear energy, it is a disadvantage of source-vulnerability, high oil-related purchase price, and high greenhouse gas emissions compared to nuclear energy.

The advantageous features of the natural gas are that its disadvantageous properties can be improved by the emergence of non-conventional gas on the world market, the price can be reduced and CCS technology can also significantly reduce GHG emissions. The prerequisite for this scenario is, of course, the marketability of CCS technology. The scenario dominated by natural gas and / or nuclear energy is also likely to be due to the limited share of renewable energy sources (economic and technical maximum), even if the exploitation of renewable energy sources is partly competitive on a market basis. [11]. The exploitation of renewable resources is a major challenge for the millennium, and the financing side also places great emphasis on it [5][6]. The future situation of third world countries poses other problems than developed countries. The energy challenge of rapid development and related carbon emissions is the biggest challenge [1].

Nuclear energy, as the energy from the fission process, is the subject of debate in the energy sector. Nuclear power plants produce CO2 free of charge, and the provision of radioactive waste at the end of the process must be ensured. Safe operation is also a basic requirement, as a serious malfunction can cause destructive radiation to the environment. Nuclear power plants have evolved from the military industry in the middle of the twentieth century and to this day, significant progress has been made. In 2013, 11% of the world's electricity production was produced [3].

There should be professional discussions about the positive and negative effects on the environment and the experiences of the accidents that have occurred so far. An important task is the management and storage of low, medium, high grade nuclear waste. This includes geological placement, reprocessing of spent fuel pastilles, and conversion of radioactive isotopes into stable or short-lived materials. An important task is the development of fission reactors (third and fourth generation reactors) and fusion reactors [9].

The goal is to create diverse agriculture, environmental and landscape management that produces healthy and safe foods, as well as local energies and various raw materials, while preserving our soil, our drinking water resources, our wildlife, our natural values [11].

A nation state is energy safe, where energy carriers and services are available to such an extentto ensure the nation's survival, the protection of well-being, and the minimization of risks arising from care and use [7].

The installed capacity of the Hungarian electricity system is constantly decreasing due to the power plant units lost by aging. Until 2020, 3300MW will be closed and another 660MW will be closed by 2025 [12]. According to MAVIR's short-term, medium- and long-term resource side balance sheet analysis of the electricity system, by 2025 an annual peak demand of 8,000 MW should be calculated [10]. The continent's nuclear, coal and gas plants together, use 4.5 billion cubic meters of water annually. This is the annual water demand of 82 million EU citizens, roughly the same as Germany. 44 percent of the EU's total water use is attributable to the energy industry [14].

The energy carriers created by decomposition of air from plant and animal residues are fossil (fossil) energy carriers that have evolved over millions of years. They are solid, liquid or gaseous, have high energy density, have mainly carbon and hydrogen compounds. These are non-renewable energy sources. What had to be accumulated for millions of humanity deplete in a few hundred years. Essential fossil fuels are coal, oil, petroleum products and natural gas [8].

Intensive energy utilization of communal waste began to develop in the 1990s, in Western Europe. As a result of technological advances, the problem of waste management has become increasingly important. There were various alternatives to the treatment of the waste generated, the priorities of which are the waste hierarchy. Energy use is at a higher level than landfill, but less good than recycling. So it is advisable to burn non-recoverable waste in the power plants. The thermal utilization of waste is also favored by cement plants.

2 Methodological background

Quantitative research was a national survey conducted between 23 October 2018 and 02 January 2019. Before finalizing the questionnaire I made a pre-test. The questionnaire contained closed questions, according to which the respondents were able to choose the answer options in the standardized questionnaire. This method makes the assessment clearer and easier. I have tried to formulate the questions so as not to weaken the respondents' willingness to respond. I was especially concerned that the questions and possible answers did not violate the rights of the personality and the potential sensitivity of the respondents. I have been looking for answers to questions about the knowledge of energy sources that have not yet been the subject of a national survey of this kind and provide the researcher with information about the learned or experiential knowledge of the respondents. I tried to involve the population as widely as possible in the education and age distribution. I sent this questionnaire for more than 200 people. The online questionnaire was filled by 183 people. All 183 completed questionnaires were regular and evaluable. Data Processing was made by SPSS (Statistical Package for Social Sciences) 19. and Microsoft Office Excel 2007 software. The results in this study are presented using cross-table analysis.

Of the 183 respondents, 139 were male and 44 female respondents. The age distribution of respondents is shown in the table below.

Table 1: Distribution of respondents by age

Date of birth	Person
Before 1946	2
1946-1964	47
1965-1980	54
1981-1999	76
After 2000	4

Source: own research, 2019, N = 183

The table shows that the vast majority of respondents are citizens born between 1946 and 1999. The activity of the respondents born between 1981 and 1999 also stands out significantly from this set.

3 Results

With the first question in the questionnaire, I wanted to know what the respondents considered as the conventional source of energy by looked at the respondents' age. Looking at the answer options, analyzing the SPSS software with cross-table function, I got the following results.

Table 2: Carbon as a traditional energy source

Age	Before1946	1946-1964	1965-1980	1981-1999	After 2000	All
Person	1	43	51	71	3	169
Ratio of the carbon markers	0,6%	25,4%	30,2%	42,0%	1,8%	100,0%
Age distribution	50,0%	91,5%	94,4%	93,4%	75,0%	92,3%
Distribution across all respondents	0,5%	23,5%	27,9%	38,8%	1,6%	92,3%

Source: own research, 2019, N = 183

On the basis of the results obtained, it can be stated that the vast majority of respondents, more than 90% of people born between 1946 and 1999 consider coal as a traditional source of energy. The highest proportion was from 94.4% of the 1965-1980 age group.

Table 3: Lignite as a conventional energy source

Age	Before 1946	1946-1964	1965-1980	1981-1999	After 2000	All
Person	1	36	42	43	1	123
Ratio of the lignite markers	0,8%	29,3%	34,1%	35,0%	0,8%	100,0%
Age distribution	50,0%	76,6%	77,8%	56,6%	25,0%	67,2%
Distribution across all respondents	0,5%	19,7%	23,0%	23,5%	0,5%	67,2%

Source: own research, 2019, N = 183

On the basis of the results obtained, it can be seen that the respondents considered the majority of people born between 1946 and 1999 to be lignite as a conventional source of energy, but at a much lower rate than coal. In addition, it can be observed that the majority of people born between 1946 and 1980 think of lignite as a conventional source of energy between 76.6% and 77.8%, so the uncertainty of younger respondents is 56.6%.

Table 4: Natural gas as a traditional energy source

Age	Before 1946	1946-1964	1965-1980	1981-1999	After 2000	All
Person	1	38	48	55	3	145
Ratio of the natural gas markers	0,7%	26,2%	33,1%	37,9%	2,1%	100,0%
Age distribution	50,0%	80,9%	88,9%	72,4%	75,0%	79,2%
Distribution across all respondents	0,5%	20,8%	26,2%	30,1%	1,6%	79,2%

Source: own research, 2019, N = 183

Based on the results obtained, the assessment of natural gas as a traditional energy source for the most active three age groups is once again showing a strong majority with the 88.9% outstanding value of the 1965-1980 age group, however, there were some uncertainty about the responses was born in 1981.

Table 5: Wood as a traditional energy source

Age	Before 1946	1946-1964	1965-1980	1981-1999	After 2000	All
Person	0	30	40	49	3	122
Ratio of the wood markers	0,0%	24,6%	32,8%	40,2%	2,5%	100,0%
Age distribution	0,0%	63,8%	74,1%	64,5%	75,0%	66,7%
Distribution across all respondents	0,0%	16,4%	21,9%	26,8%	1,6%	66,7%

Source: own research, 2019, N = 183

The perception of wood as a traditional energy source also enjoys a majority, but to a lesser extent than the previous three energy sources. In this case, respondents born between 1965 and 1980 proved to be more determined by 74.1% compared to other age groups.

Table 6: Straw as a traditional energy source

Age	Before 1946	1946-1964	1965-1980	1981-1999	After 2000	All
Person	0	18	14	14	0	46
Ratio of the straw markers	0,0%	39,1%	30,4%	30,4%	0,0%	100,0%
Age distribution	0,0%	38,3%	25,9%	18,4%	0,0%	25,1%
Distribution across all respondents	0,0%	9,8%	7,7%	7,7%	0,0%	25,1%

Source: own research, 2019, N = 183

The classification of straw as a conventional energy source has a strong uncertainty for all ages. In the highest proportion, 38.3%, the generation born between 1946 and 1964 thinks straw is a traditional fuel, but most do not accept it.

Table 7: Waste as a traditional energy source

Age	Before 1946	1946-1964	1965-1980	1981-1999	After 2000	All
Person	1	13	13	7	0	34
Ratio of the waste markers	2,9%	38,2%	38,2%	20,6%	0,0%	100,0%
Age distribution	50,0%	27,7%	24,1%	9,2%	0,0%	18,6%
Distribution across all respondents	0,5%	7,1%	7,1%	3,8%	0,0%	18,6%

Source: own research, 2019, N = 183

Waste is considered the least conventional source of energy by the respondents. According to the survey, 9.2% of respondents born between 1981 and 1999 said waste was a traditional energy source. The highest votes was 27.7% of the generation between 1946 and 1964.

With the second question in the questionnaire, I wanted to know that, according to the respondents, choosing from the given answer options, how long can the Hungarian carbon / lignite stock be enough, tested by age of respondents?

Table 8: Sufficient carbon / lignite stock for 0-50 years according to respondents

Age	Before 1946	1946-1964	1965-1980	1981-1999	After 2000	All
Person	1	18	23	44	1	87
Ratio of the 0-50 years markers	1,1%	20,7%	26,4%	50,6%	1,1%	100,0%
Age distribution	50,0%	38,3%	42,6%	57,9%	25,0%	47,5%
Distribution across all respondents	0,5%	9,8%	12,6%	24,0%	0,5%	47,5%

Source: own research, 2019, N = 183

Of the total of 183 respondents, 87, 47.5% of respondents thought that the carbon stock would run out in 50 years. In this 50.6% response, those born between 1981 and 1999 proved to be the most determined. This is a 24.0% ratio between all respondents (183 people).

Table 9: Carbon / lignite stock for 50-100 years according to respondents

Age	Before 1946	1946-1964	1965-1980	1981-1999	After 2000	All
Person	0	19	24	27	3	73
Ratio of the 50-100 years markers	0,0%	26,0%	32,9%	37,0%	4,1%	100,0%
Age distribution	0,0%	40,4%	44,4%	35,5%	75,0%	39,9%
Distribution across all respondents	0,0%	10,4%	13,1%	14,8%	1,6%	39,9%

Source: own research, 2019, N = 183

A total of 73, 39.9% of the respondents said that we still have enough carbon for up to 100 years or at least 50 years. In this issue, the majority of the respondents were born between 1981 and 1999, with a ratio of 37.0%. This is a 14.8% ratio between all respondents (183 people).

Table 10: Sufficient carbon / lignite stock for over 100 years according to respondents

Age	Before 1946	1946-1964	1965-1980	1981-1999	After 2000	All
Person	1	10	7	5	0	23
Ratio of the more than 100 years markers	4,3%	43,5%	30,4%	21,7%	0,0%	100,0%
Age distribution	50,0%	21,3%	13,0%	6,6%	0,0%	12,6%
Distribution across all respondents	0,5%	5,5%	3,8%	2,7%	0,0%	12,6%

Source: own research, 2019, N = 183

Only 23 out of 12.6% of all respondents said we still had at least 100 years of carbon stock in Hungary. In this group, respondents born between 1946 and 1964 proved to be the most optimistic with 5.5% of all respondents (183).

4 Conclusion

It can be seen from the above that the highest number of questionnaires sent by respondents born between 1981 to 1999 sent answers. However, when evaluating the responses, it can be stated that while all three age groups that could be considered were strong in the judgment of coal as a traditional energy carrier, there was different understanding of the other options. It is worth noting that lignite is less known as a conventional energy source than coal. In contrast, wood has been classified by many as 122 traditional fuel, although it is the most widely used renewable energy source. Some literature also identifies nuclear energy as a conventional energy source. The energy industry also has different opinions, so I did not make it difficult for the respondents to choose uranium. The overwhelming majority of respondents, 160 people think in the assessment of the Hungarian carbon stock is enough up to 100 years. The majority, 87 people believe that we cannot think over the availability of hungarian coal for more than 50 years.

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