

Survey on Nuclear Energy Acceptance among Students in Technical Sciences in the Republic of Serbia

Koviljka Stanković, *ETRAN Member & Member IEEE*

Abstract— Public opinion on nuclear energy in Serbia is considered to be negative in general, even though there are no official statistics on this topic. This paper presents the results of a pilot survey on nuclear energy taken among 231 university BSc and MSc students in technical sciences. The main aim of the performed survey was to check students' knowledge on ionizing radiation in everyday life and to obtain their opinion on nuclear energy uses from the perspective of both decarbonisation and growing demands on electricity sources. Results of survey show that 84.4% of participants support nuclear energy for the electricity production and recognise nuclear energy as clean energy source (70.2%). While taking into account growing needs for electricity, participants would support the construction of nuclear power plant in Serbia in 77.1%. The leading reason why Serbia does not have a nuclear power plant is the cost of construction (43.4%) according to participants' opinion. Participants answered that the greatest impact on the public negative opinion about nuclear energy that exists in Serbia goes firstly to the lack of education on this topic (96.1%) and then to accidents from the past (78.4%). Participants think that the most important, for approaching the public positive opinion on the peaceful use of nuclear energy in the future in Serbia, would be more education available to different age groups (83.1%). The ban lifting on nuclear power in Serbia would support 72.3% of participants.

Index Terms— Nuclear energy; public opinion; survey.

I. INTRODUCTION

SERBIA agreed on the overall EU goal, introduced through the Paris Climate Convention, to reduce CO₂ emission by 85-90% compared with emission in 1990. In order to schedule green energy transition, the Republic of Serbia is currently in process of drafting two crucial documents for energy sector: the Integrated National Energy and Climate Plan (INECP) of the Republic of Serbia until 2030 with a Vision until 2050 and the Strategy of Energy Sector Development. INECP [1] should provide an overview of the current situation in the Republic of Serbia, key policies and adequate measures for the purpose of considering the five dimensions of Regulation (EU) 2018/1999 on the Governance of the Energy Union and Climate Action: Decarbonisation (GHG emissions and renewable energy); Energy efficiency; Energy safety and

security; Energy market; and Research, innovation and competitiveness.

By now, Serbia has made very little progress towards energy decarbonization, since the major source of electricity generation in the Serbian power system are coal-fired power plants (70% share in energy mix, 2021). INECP draft proposes 4 scenarios (for period after 2030): all with two options – with and without using nuclear energy.

In terms of reducing global warming, nuclear energy has no alternative among base load sources. However, before including nuclear energy as an option in energy strategy and after on considers and introduces nuclear program, as described in IAEA guide for new nuclear commers [2], Serbia should firstly take into account two main obstacles: existing ban on nuclear energy and public opinion.

Public opinion on nuclear energy in Serbia is considered to be negative in general, even though there are no official statistics on this topic. There is one survey recently taken, in 2019, but it was performed from the perspective of disasters [3]. This paper presents the results of a pilot survey on nuclear energy taken among university BSc and MSc students in technical sciences. As the author of this survey is one of few lecturers in Serbia on nuclear power engineering, the main aim of the performed survey was to check students' knowledge on ionizing radiation in everyday life and to obtain their opinion on nuclear energy uses from the perspective of both decarbonisation and growing demands on electricity sources.

II. SURVEY DATA

The survey was distributed to students at two universities: University of Belgrade – UB (School of Electrical Engineering, Faculty of Mechanical Engineering, Faculty of Technology and Metallurgy and Faculty of Civil Engineering) and University of Novi Sad – UNS (Faculty of Technical Sciences). The total number of students participated in the survey was 231. The distribution of students among faculties is shown in the Table I. Number of male participants was 164 (71%) and female participants 67 (29%). Age average was 23. Education on nuclear subjects had 35 students (15.2%). The survey was distributed to students through Google surveys in January 2021 and it stayed open for 15 days.

The survey was consisted of 20 questions. Questions were structured in the way to firstly check students' knowledge on ionizing radiation in everyday life and then to obtain their opinion on nuclear energy uses from the perspective of both

Koviljka Stanković is with the School of Electrical Engineering, University of Belgrade, 73 Bulevar kralja Aleksandra, 11020 Belgrade, Serbia (e-mail: kstankovic@etf.bg.ac.rs)

decarbonisation and growing demands on electricity sources (at global and national level).

TABLE I

THE DISTRIBUTION OF STUDENTS AMONG FACULTIES PARTICIPATED IN THE SURVEY.

Faculty	Number of students
UB School of Electrical Engineering	158
UNS Faculty of Technical Sciences	31
UB Faculty of Mechanical Engineering	30
UB Faculty of Technology and Metallurgy	10
UB Faculty of Civil Engineering	2
Total	231

III. SURVEY RESULTS AND DISCUSSION

Q1: Is there ionizing radiation in everyday life on our planet (excluding medical applications and nuclear power plants)?

YES	90.9%
NO	1.7%
I don't know	7.4%

Q2: The population on our planet receives the highest radiation dose from:

Natural radiation sources	81.4%
Medical applications	6.1%
Nuclear power plants	12.6%

Q3: Is there radioactivity in food, drink, air and building materials?

YES	81.8%
NO	9.1%
I don't know	9.1%

Q4: According to your knowledge, which are the sources of ionizing radiation among the answers given:

Nuclear power plants	73.2%
Mobile phones (5G)	22.5%
Mobile phones (1G - 4G)	17.7%
Microwave oven	35.5%
Magnetic Resonance Imaging (MRI)	52.4%
CT scanner	68.0%

Q5: Do you support the use of nuclear power for electricity generation?

YES	84.4%
NO	15.6%

Q6: Does the use of nuclear technologies for electricity production result in the emission of greenhouse gases?

YES	11.3%
NO	76.2%
I don't know	12.6%

Q7: Do you think that nuclear energy is a clean energy source?

YES	70.6%
NO	20.8%
I don't know	8.7%

Q8: In your opinion, which power plant pollutes the environment more?

Nuclear power plants	5.6%
Coal power plants	94.4%

Q9: Which of the listed contributes the most to the greenhouse gas emission in Serbia?

Coal Power Plants	54.1%
Industry	17.7%
Transport	7.8%
Home fireplaces using fossil sources	20.3%

Q10: Which type of electricity generation would you support in order to reduce the greenhouse emission gases in your environment?

RES – Renewable Energy Sources (Solar, Wind, Hydro)	36.4%
Nuclear + RES	61.0%
Coal + RES	2.6%

Q11: How familiar are you with the benefits and risks of electricity supplying from nuclear power plants?

Insufficiently	45.9%
Sufficiently	31.2%
Fairly well	22.9%

Q12: Does properly dispose radioactive waste represent a greater danger than the greenhouse gases emission and tailings generated in coal power plants?

YES	9.5%
NO	73.2%
I don't know	17.3%

Q13: Do you know any institution in Serbia that deals with the control of the ionizing radiation sources and/or the ionizing radiation monitoring in the environment?

YES	31.2%
NO	68.8%

Q14: In your opinion, what is the main reason why Serbia does not have a nuclear power plant?

Accidents from the past	21.2%
Serbia does not have nuclear workforce	18.2%
Cost of construction	43.3%
Serbia does not need a nuclear power plant	9.5%
I don't know	7.8%

Q15: What has the greatest impact on the public negative opinion about nuclear energy that exists in Serbia? (multiple answers allowed)

Television	31.2%
Social Networks	36.8%
Other media (newspapers, web, forums etc)	34.6%
Accidents from the past	78.4%
Lack of education on this topic	96.1%
The influence of parents, friends, relatives	18.6%

Q16: What would be the most important for approaching the public positive opinion on the peaceful use of nuclear energy in the future in Serbia? (multiple answers allowed)

Television	49.8%
Social Networks	45.0%
Other media (newspapers, web, forums etc)	37.2%
More education available to different age groups	83.1%

Q17: Would you support the construction of a nuclear research centre in Serbia for the needs of nuclear medicine, agriculture, research and training of personnel?

YES	92.2%
NO	3.9%
I don't know	3.9%

Q18: Would you support the ban lifting on nuclear power in Serbia?

YES	72.3%
NO	14.7%
I don't know	13.0%

Q19: Bearing in mind the growing need for electricity, the construction of which power plant in Serbia would you prefer to support?

Nuclear Power Plant	77.1%
Coal Power Plant	6.9%
I am not sure	16.0%

Q20: According to your knowledge, how many Serbia neighbouring countries have nuclear power plants?

None	16.5%
1 – 2 countries	54.5%
3 – 4 countries	27.7%
More than 4 countries	1.3%

Based on the answers in questions Q1 to Q3, participants showed their awareness on radioactivity in everyday life (in water, drink, air and building materials) as well as that the population on the planet receives the highest radiation dose from natural sources (81%-91%).

Question Q4 aimed to check whether participants

distinguish between non-ionizing and ionizing man-made radiation sources. However, an unexpectedly large percentage of students recognized sources of non-ionizing radiation (mobile phones, microwave ovens and MRI) as sources of ionizing radiation.

Questions Q5 to Q10 were related to how participants see nuclear energy from the aspect of environmental protection and decarbonization of the energy sector. Based on the opinion given in question Q5, 84.4% of participants support nuclear energy, in general, for the electricity production. Based on the answers to questions Q6 and Q7, it can be seen that participants recognise nuclear energy as clean energy (slightly over 70%). From the answers to question Q8, it is clear that participants know that thermal power plants pollute the environment more than nuclear power plants (94.4%) and that the dominant pollutant in Serbia is thermal power plants (Q9). In order of reduction GHG emission and energy sector decarbonisation (Q10) participants would, in their environment, rather support Nuclear + RES (61%) then Coal + RES (2.6%) or only RES (36.4%).

Participants answered in 45,9% that they are not familiar with benefits and risks of electricity supplying from nuclear power plants (Q11), but they are aware (73,2%) that the greenhouse gases emission and tailings generated in coal power plants represent a greater danger than properly disposed radioactive waste (Q12). High percentage of participants (68.8%) do not know any institution in Serbia that deals with the control of the ionizing radiation sources and/or the ionizing radiation monitoring in the environment.

The main reason why Serbia does not have a nuclear power plant (Q14) is the cost of construction (43,4%) according to participants' opinion. Participants answered that the greatest impact on the public negative opinion about nuclear energy that exists in Serbia (Q15) goes firstly to the lack of education on this topic (96.1%) and then to accidents from the past (78.4%). Participants think that the most important, for approaching the public positive opinion on the peaceful use of nuclear energy in the future in Serbia (Q16), would be more education available to different age groups (83.1%).

Participants support the construction of a nuclear research centre in Serbia (Q17) for the needs of nuclear medicine, agriculture, research and training of personnel (92.2%).

The ban lifting on nuclear power in Serbia would support 72.3% of participants (Q18). While taking into account growing needs for electricity, participants would support the construction of nuclear power plant in Serbia in 77.1% (Q19). In the last question, participants were asked to number Serbia's neighbouring nuclear countries, but only 27.7% gave the correct answer.

With results gained, the author of the paper tries to find modality to provide more information and education on nuclear energy to young people and has just established the Serbian Nuclear Society with the help of Serbian young nuclear professionals. Young people will be policy and decision makers of tomorrow, so it is worth investing in their knowledge. In terms of adult education, there are huge challenges in front of us, so we have to face the first challenge

- education of journalists, and then all other population groups in Serbia [4]. So, shaping the general public opinion on nuclear energy in Serbia is still a challenging issue.

IV. CONCLUSION

This paper presents the results of a pilot survey on nuclear energy taken among university BSc and MSc students in technical sciences in 2021. The total number of students participated in the survey was 231. The survey consisted of 20 questions. The main findings are as follows. In general, 84.4% of participants support nuclear energy for the electricity production and recognise nuclear energy as a clean energy source (70.2%). In order of reduction GHG emission and energy sector decarbonisation participants would, in their environment, support Nuclear + RES (61%). They are aware (73.2%) that the greenhouse gas emission and tailings generated in coal power plants represent a greater danger than properly disposed radioactive waste. While taking into account growing needs for electricity, participants would support the construction of a nuclear power plant in Serbia in 77.1%.

The leading reason why Serbia does not have a nuclear power plant is the cost of construction (43.4%) according to participants' opinion. Participants answered that the greatest impact on the public negative opinion about nuclear energy that exists in Serbia goes firstly to the lack of education on this topic (96.1%) and then to accidents from the past

(78.4%). Participants think that the most important, for approaching the public positive opinion on the peaceful use of nuclear energy in the future in Serbia, would be more education available to different age groups (83.1%). The ban lifting on nuclear power in Serbia would support 72.3% of participants.

ACKNOWLEDGMENT

This work was supported by the Ministry of Science, Technological Development and Innovation of the Republic of Serbia under contract number: 451-03-47/2023-01/200103.

REFERENCES

- [1] Ministry of mining and energy of the Republic of Serbia, Integrated National Energy and Climate Plan (INECP) of the Republic of Serbia until 2030 with a Vision until 2050, <https://www.mre.gov.rs/dokumenta/strateska-dokumenta/integrirani-nacionalni-energetski-i-klimatski-plan-republike-srbije-za-period-2021-do-2030-sa-vizijom-do-2050-godine> (visited in April 2023).
- [2] INTERNATIONAL ATOMIC ENERGY AGENCY, Milestones in the Development of a National Infrastructure for Nuclear Power, No. NG-G-3.1 (Rev. 1), VIENNA, 2015.
- [3] V. M. Cvetković et al., Nuclear Power Risk Perception in Serbia: Fear of Exposure to Radiation vs. Social Benefits, *Energies* 2021, 14(9), 2464.
- [4] K. Stanković, Start-up Approach and Proposal for Nuclear Safety Knowledge Management Strategy in the Republic of Serbia *Proc. 6th Int. Conf. Electrical, Electronic and Computing Engineering (icETAN 2019)*, Silver Lake, Serbia, June 03 – 06, 2019, (pp. 701-704) ISBN 978-86-7466-785-9.