2003/04 PUBLIC OPINION SURVEY "NUCLEAR ENERGY-THE PRESENT AND THE FUTURE"

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ABSTRACT

During the academic years 2000/01, 2001/02 and 2002/03 the Croatian Nuclear Society Young Generation Network (CYGN) carried out public opinion surveys among student population of around 600 individuals age 18-20. The results of the surveys have shown that the participants are rather ignorant on nuclear issues but still very negative towards nuclear power plants. As a part of the active involvement of CYGN members in upgrading of the positive public opinion, especially young generations, towards nuclear issues, a brochure on radioactivity has been prepared and distributed at the beginning of the 2002/03 school year to third and fourth graders in high schools. In order to investigate the effects of the brochure, 2003/04 public opinion survey "Nuclear Energy - the Present and the Future" has been carried out. The results and the analyses of the 2003/04 public opinion survey, as well as the comparison of the results with the previous surveys are presented in this paper.

1 INTRODUCTION

The results of the public opinion surveys carried out by Croatian Young Generation Network (CYGN) in the academic years 2000/01, 2001/02 and 2002/03 have shown that the participants, student population of around 600 individuals age 18-20, are rather ignorant on nuclear issues but still very negative, especially towards nuclear power plants and radioactive waste disposal sites with emphasized **N**ot **I**n **M**y **B**ack **Y**ard (NIMBY) syndrome. General conclusion of the CYGN was that additional and more active involvement of CYGN members and other nuclear experts in education is necessary. After careful consideration high school population, primarily third and fourth graders, has been chosen as a targeted group. A brochure on radioactivity has been prepared and distributed at the beginning of the 2002/03 school year.

Hopefully a part of the 2003/04 academic year, freshman student population received a brochure during their high school education. Therefore, CYGN decided to carry out 2003/04 public opinion survey "Nuclear Energy - the Present and the Future" in order to investigate the effects of the brochure on student opinions on nuclear subjects, primarily radioactivity. The results of the survey should also provide information on the quality of the distributed materials, as well as the quality of the distribution strategy.

The survey has been carried out with the aid of the Department of Applied Physics, Faculty of Electrical Engineering and Computing, University of Zagreb among the students of four faculties of the University of Zagreb: Faculty of Electrical Engineering and Computing (FEEC), Faculty of Food Technology and Biotechnology (FFTB), Faculty of Chemical Engineering and Technology (FCET) and Faculty of Civil Engineering (FCE). The total number of the public opinion survey participants was 420 students age 18-20 (272 males and 148 females).

The questions in the survey covered several different nuclear energy issues, like:

- the present and the future energy resources,
- the acceptability of different fuel type power plants,
- the environmental protection and global warming,
- the radioactivity,
- the waste issues,
- Reliable information sources.

The results of the 2003/04 public opinion survey: "Nuclear Energy – the Present and the Future" as well as the results of comparison with the previous surveys conducted in the academic years 2000/01, 2001/02 and 2002/03 are presented in this paper.

2 RESULTS AND COMPARISON

2.1 Do you think that Croatia has enough oil, gas, coal and/or uranium?

Male and female participant's opinion on the subject is generally the same and therefore only total is given. The opinion of the participants is in an agreement with the expert's opinion that Croatia does not have enough of any of the mentioned energy resources for its projected demands. The comparison with the previous surveys shows a tendency of the "improvement" of the student opinion and their awareness of the lack of the energy resources in Croatia (Table 1.).

Table 1. Question 1 - Results of the 2003/04 survey and the comparison with the previous surveys

		2000/01	2001/02	2002/2003	2003/2004
		Total	Total	Total	Total
Oil	**Yes**	20.90%	16.82%	14.48%	12.10%
	No	79.10%	83.18%	85.52%	87.90%
Gas	**Yes**	56.23%	48.94%	45.52%	43.55%
	No	43.77%	51.06%	54.48%	56.45%
Coal	**Yes**	25.98%	28.40%	32.47%	28.23%
	No	74.02%	71.60%	67.53%	71.77%
Uranium	**Yes**	2.34%	3.88%	5.34%	1.61%
	No	97.66%	96.12%	94.66%	98.39%

2.2 In the case of NPP Krško replacement with another type of power plant, would you approve a thermal power plant on fossil fuels being built instead?

Considerable difference between the answers of male and female populations is detected in the analyses of the answers given on the second question. 50% of the male population considers replacement of the nuclear power plant with the power plant on fossil fuels unacceptable, while only 31% of the female population shares that opinion. The interesting percentage to analyses is more than 40% answers "Don't know" in the female population and 27% in male population, which suggests that participants consider nuclear and thermal power plants equally unacceptable. The comparison of the results with the previous surveys show that although a large percentage of participants (46%) consider nuclear power plants more acceptable than power plants on fossil fuels, an increasing number of students treat nuclear power plants equally negative as power plants on fossil fuels (Table 2.).

Table 2. Question 2 - Results of the 2003/04 survey and the comparison with the previous surveys

	2000/01	2001/02	2002/03	2003/04		
	Total	Total	Total	Male	Female	Total
Yes	25.48%	20.70%	19.25%	22.09%	28.57%	23.36%
No	52.24%	52.77%	52.81%	50.00%	30.95%	46.26%
Don't know	22.28%	26.53%	27.94%	27.91%	40.48%	30.38%

2.3 Which type of power plant would you accept in your neighborhood?

Female population does not support any type of thermal power plant to be built in their neighborhood, while the male population is not so strict about gas plant. Both populations are strictly against coal and nuclear power plants sited in their neighborhood. As expected the attitude toward wind and solar energy is very positive in both populations (Table 3.).

Table 3 Question 3- Results of the 2003/04 survey and the comparison with the previous surveys

		2000/01	2001/02	2002/03	2003/04		
		Total	Total	Total	Male	Female	Total
Gas power plant	**Yes**	41.22%	23.46%	18.90%	25.58%	11.90%	22.90%
	No	58.78%	76.54%	81.10%	74.42%	88.10%	77.10%
Coal power plant	**Yes**	9.15%	5.27%	6.51%	7.56%	9.52%	7.94%
	No	90.85%	94.73%	93.49%	92.44%	90.48%	92.06%
Nuclear power plant	**Yes**	14.53%	12.02%	8.87%	13.95%	7.14%	12.62%
	No	85.47%	87.98%	91.13%	86.05%	92.86%	87.38%
Wind power plant	**Yes**	-	89.44%	87.86%	88.95%	95.24%	90.19%
	No	-	10.56%	12.14%	11.05%	4.76%	9.81%
Solar power plant	**Yes**	-	-	91.89%	91.27%	95.24%	92.05%
	No	-	-	8.11%	8.73%	4.76%	7.95%

2.4 Do you have confidence in experts working in the NPP Krško?

In spite off the slight difference between the answers of the male and female population, a general conclusion can be derived that the confidence in the experts working in the NPP Krško is average. The comparison of the results with the previous surveys shows the increase of the confidence, especially towards last two surveys (Table 4.).

Table 4 Question 4- Results of the 2003/04 survey and the comparison with the previous surveys

	2000/01	2001/02	2002/03	2003/04		
	Total	Total	Total	Male	Female	Total
High	30.95%	23.94%	23.82%	27.79%	16.43%	34.50%
Average	60.34%	64.17%	62.67%	58.70%	70.05%	55.14%
Low	8.71%	11.89%	13.51%	13.51%	13.53%	10.36%

2.5 Are you concerned about natural radioactivity?

As in previous surveys, a significant difference can be observed between male and female answers. Female participants are generally more concerned with the natural radioactivity. The results are rather similar to the ones from the previous surveys (Table 5.).

Table 5 Question 5- Results of the 2003/04 survey and the comparison with the previous surveys

	2000/01	2001/02	2002/03	2003/04		
	Total	Total	Total	Male	Female	Total
Yes. very	21.18%	26.59%	26.97%	15.69%	47.62%	21.96%
Yes	47.51%	42.77%	45.06%	41.27%	35.71%	40.19%
No	27.57%	24.42%	23.62%	32.56%	11.90%	28.50%
Don't know	3.74%	6.21%	4.36%	10.48%	4.77%	9.35%

2.6 What is the future energy production technology after the exhaustion of the fossil fuels reserves?

Students are of the opinion that the energy sources of the future will primarily be solar and wind energy as well as hydro energy, 33% and 20% respectively. Nuclear fission and fusion energy is at the third place of the participant's top list (16%). A small difference of opinion can be detected between male and female population when addressing nuclear and new technology. The results are compatible with the results of the previous surveys (Table 6.).

Table 6 Question 6- Results of the 2003/04 survey and the comparison with the previous surveys

	2000/01	2001/02	2002/03	2003/04		
	Total	Total	Total	Male	Female	Total
Nuclear fission and fusion	22.15%	21.03%	17.53%	19.29%	13.40%	16.53%
Sea wave energy	12.80%	12.96%	10.19%	10.25%	10.05%	10.19%
Wind and sun energy	26.42%	28.19%	31.20%	29.66%	34.79%	33.20%
Hydro energy	18.62%	19.12%	20.15%	18.74%	23.45%	19.15%
Fuel cells	-	-	6.10%	8.16%	1.29%	6.10%
Some new technology	20.02%	18.70%	14.83%	13.89%	17.01%	14.83%

2.7 Would you be willing to renounce some of the high-tech goods in order to protect the environment (i.e. car)?

The majority of students are prepared for some kind of renouncing. The male population is less prepared to give away high-tech goods. Comparison with previous surveys reveals that approximately the same percentages of participants are declaratory prepared to take active role in environment protection (Table 7.).

Table 7 Question 7- Results of the 2003/04 survey and the comparison with the previous surveys

	2000/01	2001/02	2002/03	2003/04		
	Total	Total	Total	Male	Female	Total
Yes	58.16%	56.27%	59.20%	55.81%	73.81%	59.34%
No	25.04%	25.82%	21.24%	25.23%	11.90%	25.23%
Don't know	16.80%	17.91%	19.57%	18.96%	14.29%	15.43%

2.8 How much do thermal plants contribute to CO_2 emission?

Both populations, male and female, share the same opinion that thermal power plants contribute to CO_2 emission very much. The same result has been observed in the previous three surveys (Table 8.).

Table 8 Question 8- Results of the 2003/04 survey and the comparison with the previous surveys

	2000/01	2001/02	2002/03	2003/04
	Total	Total	Total	Total
Very much	78.48%	76.68%	80.78%	77.11%
Not much	21.52%	23.32%	19.22%	22.89%

2.9 What is the main reason for a small fraction of solar and wind energy in total energy production?

As well as in the previous three surveys, participants believe that the main reasons for a small fraction of solar and wind energy in total energy production are high specific energy costs and monopoly interests. There isn't any significant difference between male and female population opinions (Table 9.).

Table 9 Question 9- Results of the 2003/04 survey and the comparison with the previous surveys

	2000/01	2001/02	2002/03	2003/04
	Total	Total	Total	Total
Manufacturer and vendor problem	10.60%	10.05%	10.65%	12.65%
High specific energy cost	49.94%	46.50%	43.61%	46.61%
Monopoly interest	31.32%	32.24%	36.84%	39.24%
Restrictive regulations	0.25%	1.17%	1.38%	1.50%
Don't know	7.89%	10.05%	7.52%	-

2.10 What is your attitude towards nuclear power plants?

Although the general conclusion when analyzing the results of the survey is that most of the participants are negative to nuclear power (40.27%) or ignorant to the subject (45.19%), it is also evident that the male population is more acceptable to nuclear technology than the female population. It is also important to notice that the negative tendency, observed in the last three surveys, has stopped (Table 10).

When explaining the reason for the positive opinion towards nuclear energy (Table 11) participants emphasize the fact that the nuclear power plants pollute the environment less than the classic thermal power plants (more than 40%). School education and public media have also a strong influence on building a positive attitude towards nuclear power.

The reasons for the negative attitude towards nuclear power (Table 12) are numerous, but the opinion that the nuclear power plant can explode like a nuclear bomb, sticks out (19). Public media influence is also a significant reason for the negative attitude, which is interesting, taking into account the fact that it also builds the positive attitude towards the nuclear power.

When analyzing the reasons for either a positive or a negative attitude towards nuclear power, no significant difference can be observed between male and female population.

Table 10 Question 10- Results of the 2003/04 survey and the comparison with the previous surveys

	2000/01	2001/02	2002/03	2003/04		
	Total	Total	Total	Male	Female	Total
Positive	20.34%	17.55%	14.19%	17.97%	7.21%	14.54%
Negative	34.43%	35.84%	42.57%	35.50%	49.92%	40.27%
Neither	45.23%	46.61%	43.24%	46.53%	42.87%	45.19%

Table 11 Question 11- Results of the 2003/04 survey and the comparison with the previous surveys

	2000/01	2001/02	2002/03	2003/04
	Total	Total	Total	Total
School education	13.57%	17.53%	21.17%	20.67%
Public media influence	8.55%	5.75%	14.96%	15.96%
Parents and friends influence	4.72%	3.84%	5.47%	5.97%
NPPs pollute the environment less than fossil fuels power plants	51.92%	48.77%	43.07%	45.07%
Other	21.24%	24.11%	15.33%	14.33%

Table 12 Question 12- Results of the 2003/04 survey and the comparison with the previous surveys

	2000/01	2001/02	2002/03	2003/04
	Total	Total	Total	Total
School education	8.33%	9.74%	11.09%	13.27%
Public media influence	23.33%	17.05%	25.77%	25.34%
Parents and friends influence	2.04%	4.26%	2.45%	3.60%
Unfamiliarity with technology and operation of NPP	7.22%	7.00%	8.32%	8.32%
NPP can explode like an atomic bomb	28.70%	22.68%	22.35%	19.00%
Bad feeling when the word "nuclear" is mentioned	14.07%	19.79%	17.29%	17.29%
Other	16.30%	19.48%	12.72%	13.18%

2.11 What type of waste is more difficult to take care of?

Both, male and female populations share the opinion that the nuclear waste is more difficult to take care of than the waste from the thermal power plant. The same result has been observed in the previous three surveys (Table 13.).

Table 13 Question 13- Results of the 2003/04 survey and the comparison with the previous surveys

	2000/01	2001/02	2002/03	2003/04
	Total	Total	Total	Total
Waste from thermal plant	24.18%	25.85%	10.56%	10.74%
Waste from nuclear plant	75.82%	74.15%	89.44%	89.26%

2.12 Is it necessary to build a nuclear waste repository in Croatia?

The position of the participants, male and female, towards the idea of nuclear waste repository being built in Croatia is negative. The same result has been observed in the previous three surveys (Table 14.).

Table 14 Question 14- Results of the 2003/04 survey and the comparison with the previous surveys

	2000/01	2001/02	2002/03	2003/2004		
	Total	Total	Total	Male	Female	Total
Yes	26.79%	18.91%	15.97%	20.20%	19.12%	20.37%
No	51.71%	62.32%	68.07%	69.12%	52.85%	66.14%
Don't know	21.50%	18.77%	15.97%	10.68%	28.03%	13.49%

2.13 Do you think that the Croatian parliament decision not to build new thermal or nuclear power plants in Croatia prior to the year 2015 is positive?

Majority of the participants in the survey, as well as in the previous surveys, are of the opinion that the parliament decision is positive, and that the construction of classical thermal and nuclear power plants has to be banned (Table 15).

Table 15 Question 15- Results of the 2003/04 survey and the comparison with the previous surveys

	2000/01	2001/02	2002/03	2003/04
	Total	Total	Total	Total
Yes	-	58.05%	58.68%	60.23%
No	-	18.91%	14.33%	14.00%
Don't know	-	23.04%	26.98%	25.77%

2.14 Did you receive a brochure "Radioactivity" during your high school education?

As a part of the active involvement of CYGN members in upgrading of the positive public opinion, especially, young generations, towards nuclear issues, a brochure on radioactivity has been prepared and distributed at the beginning of the 2002/03 school year to third and fourth graders in high schools. Only 11% of the survey participants received the brochure. 74% were given the brochure during the visit to the NPP Krško. The visits to the nuclear power plant are organized by the Zagreb Technical Museum, which is the co-publisher of the brochure. 26% of the survey participants received the brochure in high school, mostly in northwest and east parts of Croatia, mainly Zagreb and Vukovar region.

Due to small percentage of students receiving the brochure, an influence on the student opinion concerning radioactivity (question 5) was negligible. Distribution strategy for the brochures to come has to be modified and more aggressive if positive results are expected.

3 CONCLUSION

The results of the 2003/04 public opinion survey "Nuclear Energy-the Present and the Future", as well as the comparison of the results with the results of the previous three surveys, conducted in the academic years 2000/01, 2001/02 and 2002/03, are presented in this paper. The surveys are carried out by Croatian Young Generation Network among students of the technical faculties of the University of Zagreb.

The results of the survey show that most of the participants have negative attitude towards nuclear power plants. However, comparing the previous surveys results it is obvious that the negative tendency, observed in the last three surveys, has been stopped. Generally, female population has more negative opinion towards nuclear power than the male population.

The participants that have positive attitude towards nuclear power base their opinion on the fact that NPP is a clean energy source while those who have negative attitude base it on the opinion that "NPP can explode like a nuclear bomb", "bad feeling", and "public media influences". Low percentage of participants bases their opinion on school lectures.

Students are aware of the fact that Croatia doesn't have enough of its own energy resources, but most of them see the future in solar and wind power.

As a part of the active involvement of CYGN members in upgrading of the positive public opinion, especially, young generations towards nuclear issues, a brochure on radioactivity has been prepared and distributed at the beginning of the 2002/03 school year to third and fourth graders in high schools. The survey results, especially the answers on question 5, suggest that the brochure distribution strategy failed. Distribution strategy for the brochures to come has to be modified and more aggressive if positive results are expected.

REFERENCES

[1] P. Cvekan, "Srednjoškolci su za nuklearke, ali ne u svom dvorištu", *Večernji List*, 12 (1999)

[2] I.A. Jurković, R. Ječmenica, M. Prah, R. Matanić, J. Lebegner, "Public opinion survey "Nuclear energy - the present and the future"", Proc. Int. Conf. Nuclear Option in Countries with Small and Medium Electricity Grids, Dubrovnik, Croatia, June 19-22, Croatian Nuclear Society, 2000, pp. 567-574.

[3] S. Medaković, J. Lebegner, K. Gergeta, D. Jakšić, K. Trontl, "Continued Public Survey "Nuclear Energy – the Present and the Future"", International Youth Nuclear Congress 2002, Daejeon, Korea, April, 16-20, 2002.

[4] K. Trontl, K. Gergeta, M. Prah: "2002/03 Public Opinion Survey "Nuclear Energy – the Present and the Future", Proceeding of the International Conference Nuclear Energy for New Europe, Portorož, Slovenia, September 8-11, 2003, Slovenian Nuclear Society, 2003.