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Press Release

Czech public opinion on small modular reactors – June 2020

- Only slightly under one-fifth of citizens have ever heard of the technology of so-called small modular reactors.
- Among the advantages of small modular reactors, people most often stated ensuring stable energy supply, lower risk of severe accidents compared to large reactors, more easily regulated output compared to large reactors, and possibly making the energy system independent of large, central sources of power.
- The most frequently mentioned disadvantages included the fact that small modular reactors generate radioactive waste and represent a new technology that has not been field-tested yet.
- A considerable majority of the public would find it acceptable to install small modular reactors on the premises of existing nuclear power plants. However, only slightly over one-fourth of the respondents find it acceptable to install a small modular reactor within 10 km of their place of residence, while over one-half find it unacceptable.
- More than two in three respondents think that the Czech Republic should support research and development in the field of small nuclear reactors.

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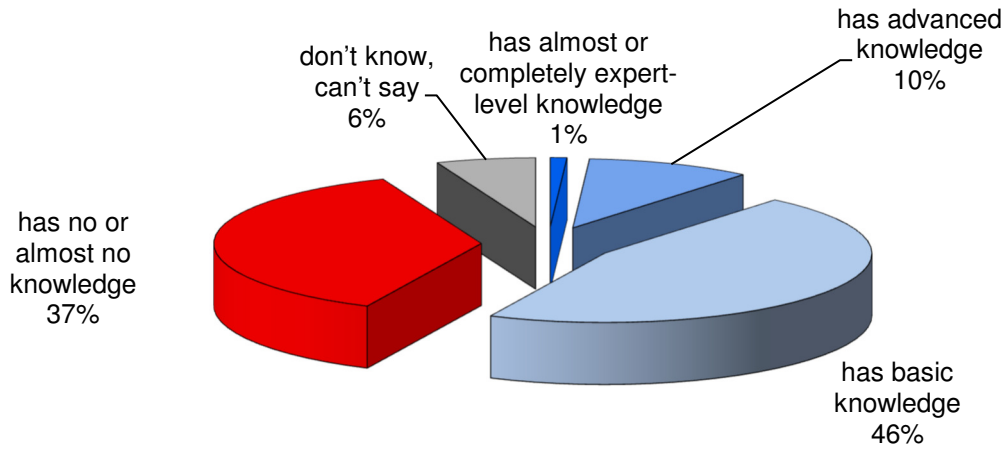
In its June 2020 survey, the Our Society series included a battery of questions on issues of energy. Within that battery, we focused on a new avenue of development of nuclear energy in the world, namely the so-called small modular reactors. More specifically, the survey inquired to what extent the respondents felt acquainted with the physical and technological principles of the operation of nuclear power plants, whether they had ever heard of the technology of so-called small nuclear or modular reactors, how they perceived the advantages or disadvantages of small nuclear reactors, under what conditions they would find such installations acceptable, and whether the Czech Republic should support research, development and education in the area of nuclear energy as well as in the area of such small nuclear reactors. The battery's final question focused on people's perceptions of the environmental impacts of different energy technologies.

As indicated by the results shown in Graph 1, a clear absolute majority, almost three in five respondents (57%) believe they have at least basic knowledge of the physical and technological principles of the operation of a nuclear power plant, with the largest part (just under one-half) referring to their knowledge as basic, 10% as advanced, and 1% stating to have expert-level knowledge in this regard. More than one in three respondents (37%) declare having no or almost no knowledge in this regard, while the remaining 6% stated they did not know or could not say what level of knowledge they had in this regard.

Detailed analysis revealed that higher levels of knowledge of the physical and technological principles of the operation of a nuclear power plant were declared by men (only 26% claimed to have no or almost no knowledge, compared to 48% of women), people aged 30–44 years (31% "no" and 53% "basic" knowledge) and college graduates (19% "no", 58% "basic" and 19% "advanced" knowledge). In contrast, lower levels of knowledge were declared by women, people above the age of 60 (45% "no" knowledge) and those without a general certificate of secondary education (*maturita*). There were interesting differences by attitudes to nuclear energy. Those in favour of increasing the proportion of nuclear energy in electricity production were more likely to declare "basic" knowledge (58%) and also considerably less likely to have no or almost no knowledge, whereas the opponents of nuclear energy, who were against increasing

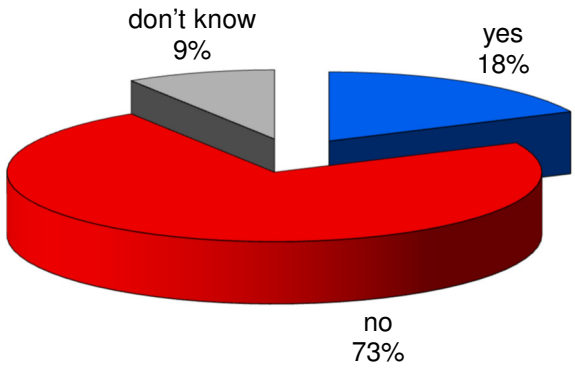
its proportion in electricity production, turned out more likely to declare advanced or even expert-level knowledge (19%).

Graph 1: Declared knowledge of the physical and technological principles of the operation of a nuclear power plant (%)[1]



Source: Public Opinion Research Centre, Institute of Sociology CAS (*CVVM SOÚ AV ČR*), Czech Society (*Naše společnost*), June 20 – July 2, 2020, 1013 respondents aged 15 and over, face-to-face interviews.

Graph 2: Ever heard of the technology of small nuclear or modular reactors? (%)[2]

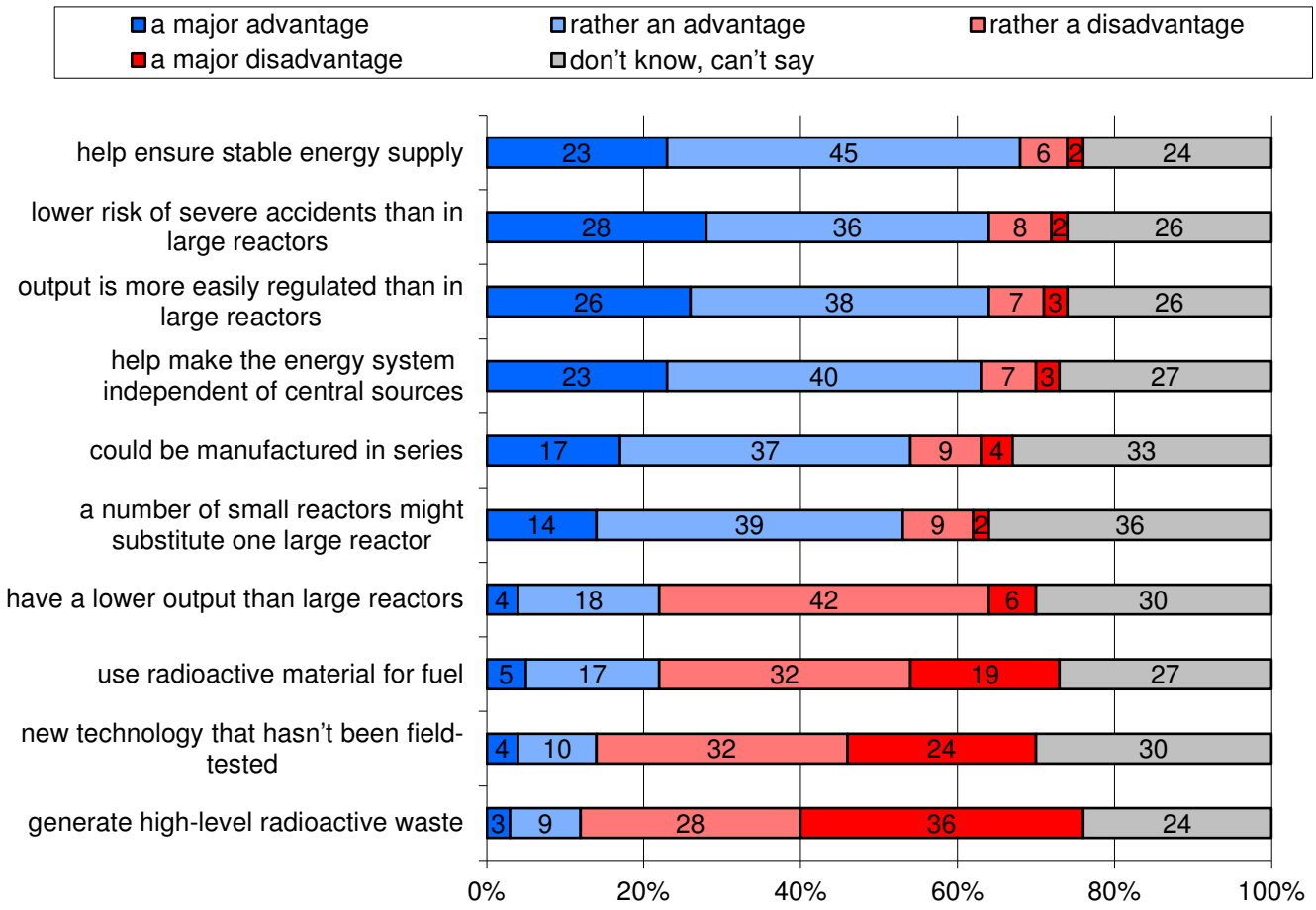


Source: Public Opinion Research Centre, Institute of Sociology CAS (*CVVM SOÚ AV ČR*), Czech Society (*Naše společnost*), June 20 – July 2, 2020, 1013 respondents aged 15 and over, face-to-face interviews.

[1] Question wording: "By your own estimation, please try to tell me your level of knowledge of the physical and technological principles of the operation of a nuclear power plant. Would you say that you have no or almost no knowledge of the operating principles of a nuclear power plant, you have basic knowledge, you have advanced knowledge, you have almost or completely expert-level knowledge?"
[2] Question wording: "Research is currently being done into ways of using the technology of so-called small nuclear or modular reactors in nuclear energy production. Have you ever heard of the technology of small nuclear or modular reactors? Yes, no."

When asked whether they had ever heard of the technology of small nuclear or modular reactors, 18% of the respondents answered in the affirmative and 73% in the negative (see Graph 2). More likely to have heard of small modular reactors were men (24%, compared to 13% of women), college graduates (32%), residents of major cities with a population of 80 thousand or more (30%), Prague (32%) or the Pilsen Region (38%), respondents with high living standards (25%), those rating the current economic situation positively (28%), proponents of increasing the proportion of nuclear energy in electricity production (25%) and especially those declaring at least basic (25%) or advanced to higher (40%) knowledge of the operating principles of nuclear power plants.

Graph 3: Advantages and disadvantages of small modular reactors (%)[3]



Source: Public Opinion Research Centre, Institute of Sociology CAS (*CVVM SOÚ AV ČR.*), Czech Society (*Naše společnost*), June 20 – July 2, 2020, 1013 respondents aged 15 and over, face-to-face interviews.

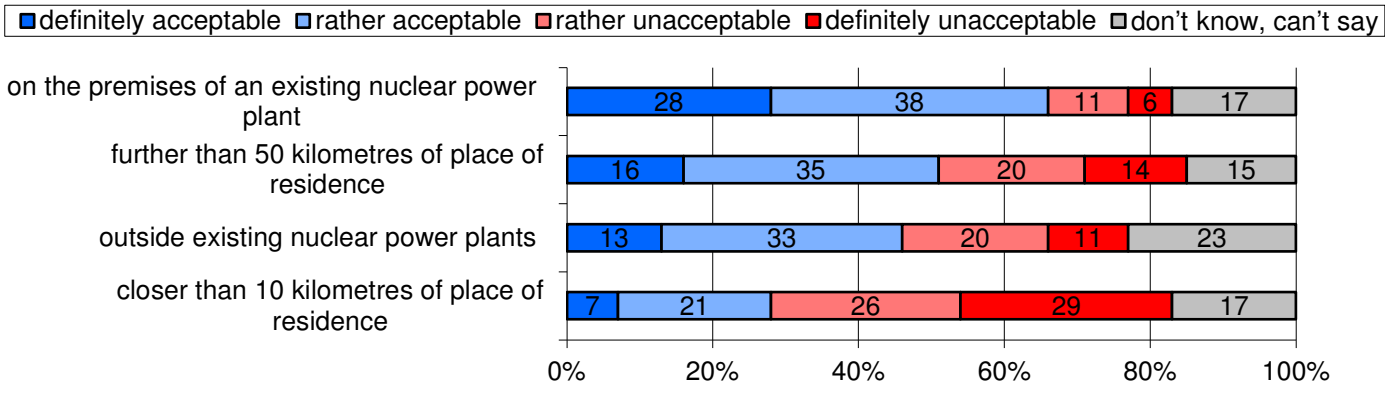
As indicated by the results shown in Graph 3, the most frequently stated advantages of small modular reactors included ensuring stable energy supply (68%), lower risk of severe accidents compared to large reactors (64%), more easily regulated output compared to large reactors (64%), and the possibility of making the energy system independent of large, central sources of power (63%). An absolute majority also stated as an advantage the fact that small modular reactors could be manufactured in series (54%) and that a number of small reactors might substitute the output of one large reactor (53%). In contrast, the most frequently mentioned disadvantages of small modular

[3] Question: "Small nuclear reactors generate energy from heat that comes from nuclear fission. Their development seeks to minimise the weaknesses of existing large reactors. When considering small nuclear reactors as a possible way of generating energy in future, do you find the following facts to be their advantages or disadvantages? (a) They have a lower output than large reactors. (b) They use radioactive material for fuel. (c) They help ensure stable energy supply. (d) They help make the energy system independent of large, central sources of power. (e) They generate certain amounts of high-level radioactive waste. (f) Their output is more easily regulated than the output of large reactors. (g) Their risk of severe accidents is lower than in large reactors. (h) As opposed to large reactors, they could be manufactured in series in future. (i) It's a new technology that hasn't been field-tested. (j) A number of small reactors might substitute the output of one large reactor."

reactors included generation of high-level radioactive waste (64% found this a disadvantage, including 36% “a major disadvantage”), followed by the facts of being a new technology that has not been field-tested (56%), of using radioactive material for fuel (51%), and of having a lower output than large reactors (48%) – although conversely, more than one in five respondents found the latter two facts to be an advantage of small modular reactors.

Some rather interesting differences were revealed by detailed analysis when ignoring undecided answers, which accounted for a large part of the socio-demographic differences and obscured more fine-grained variations in the respondents’ attitudes. People who considered themselves advanced or even experts on the physical and technological principles of the operation of nuclear power plants were more likely to state among the advantages of small modular reactors their lower output, their using radioactive material for fuel, and even their generating certain amounts of high-level radioactive waste (whereas the question remains how exactly the respondents interpreted the question, whether they worked with the implicit assumption that those “certain amounts of high-level radioactive waste” would be lower than in the case of large reactors), and also their being a new technology that has not been tested yet. In contrast, these people are more likely to consider as a disadvantage the energy system’s possible independence of central sources, easier regulation of output, and lower risk of accidents, albeit these attitudes should probably be interpreted as disagreement with the theses (quite certainly so in the latter case), rather than perceived “disadvantages” of small modular reactors. Conversely, people who declare no or only minimal knowledge of the operation of nuclear power plants, when ignoring undecided answers, are relatively more likely to view as “rather a disadvantage” the possibility of serial manufacturing of small reactors, their possible substituting a large reactor, and their ensuring stable energy supply. In contrast, these respondents are more likely to view as “a major disadvantage” the fact that small reactors use radioactive material, generate high-level radioactive waste, and are a new, hitherto untested technology (here, the group was probably more responsive to the modifier “field-tested”, while others more often reflected the modifier “new”). This group was also more likely to consider the lower output of small reactors as a disadvantage. Quite predictably, then, the attitudes to the declared (dis)advantages of small modular reactors are differentiated by general attitudes to nuclear energy and how its proportion should evolve in future: those in favour of increasing the proportion of nuclear energy are less worried, in terms of “disadvantage”, by these reactors’ using nuclear fuel and generating radioactive waste (they are more likely to consider the latter as “rather a disadvantage” and much less likely as “a major disadvantage”), and they are more likely to view as “a major advantage” the possibility of serial manufacturing, ensuring stable energy supply, more easily regulating output, independence of central sources, and possible substitution of a large reactor by a number of small ones. Those in favour of increasing the proportion of nuclear energy were somewhat more likely to view the lower output of small modular reactors as “a major disadvantage”.

Graph 4: Acceptability or unacceptability of building small nuclear reactors (%)[4]



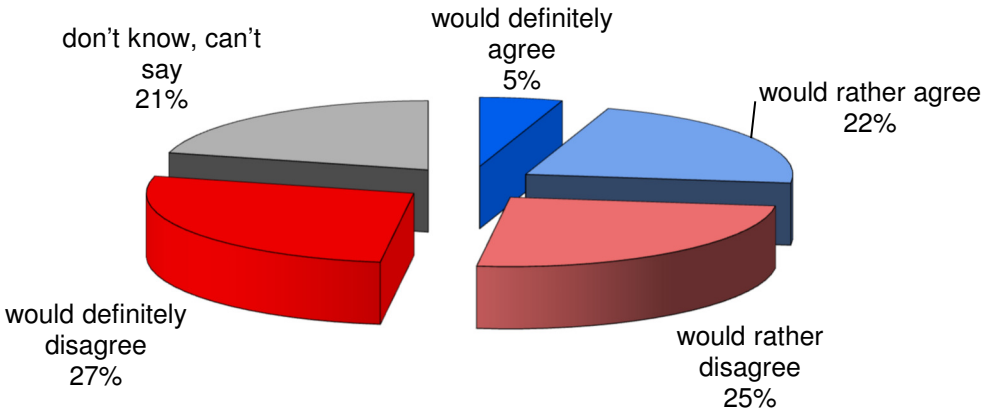
Source: Public Opinion Research Centre, Institute of Sociology CAS (*CVVM SOÚ AV ČR*), Czech Society (*Naše společnost*), June 20 – July 2, 2020, 1013 respondents aged 15 and over, face-to-face interviews.

[4] Question: “How acceptable, or unacceptable, would you find the construction of a small nuclear reactor? Please tell me what you think of the following options: (a) a small nuclear reactor would be constructed closer than 10 kilometres of your place of residence, (b) a small nuclear reactor would be constructed further than 50 kilometres of your place of residence, (c) a small nuclear reactor would be constructed on the premises of an existing nuclear power plant in the Czech Republic, (d) a small nuclear reactor would be constructed outside existing nuclear power plants in the Czech Republic.”

Another question focused on the acceptability or unacceptability of building small nuclear reactors depending on their distance from the respondent's place of residence (see Graph 4). The results indicate a relatively clear NIMBY effect among the Czech general public, despite its rather favourable attitudes to nuclear energy. Only slightly more than one in four respondents (28%) would find it acceptable to construct a small nuclear reactor within 10 km of their place of residence, while an absolute majority (55%) would find it unacceptable, including 29% who would find it "definitely unacceptable". Other options are not faced with majority resistance, whereas the respondents are clearly the most accepting of building and installing small nuclear reactors on the premises of existing nuclear power plants in the Czech Republic (66% acceptable, 17% unacceptable). The public is clearly less enthusiastic and more uncertain about building outside those premises (46% acceptable, 31% unacceptable, 23% undecided), albeit acceptability somewhat increases when it is specified that one would build at a distance of more than 50 km from the place of residence (51% acceptable, 34% unacceptable, 15% undecided).[5]

Understandably, the acceptance of building small reactors given their distance from one's place of residence is closely associated with general attitudes to nuclear energy and concerns about its uses. Those in favour of increasing the proportion of nuclear energy would predominantly not have a problem with building a small nuclear reactor within 10 km of their place of residence (45% would find it acceptable, 37% unacceptable), and the same applies to those who definitely would not relocate should a nuclear power plant be built in the vicinity of their place of residence (47% acceptable, 38% unacceptable) or those who are not at all concerned about using nuclear energy (46% acceptable, 32% unacceptable), yet these groups, too, have considerable shares of those who would find the building or installation of a small nuclear reactor in their community unacceptable. Those who declare advanced or expert knowledge of the operation of nuclear power plants are, too, more accepting of building small reactors close to their place of residence.

Graph 5: Building a small nuclear reactor in town, with potential use as a heating plant (%)[6]



Source: Public Opinion Research Centre, Institute of Sociology CAS (*CVVM SOÚ AV ČR*), Czech Society (*Naše společnost*), June 20 – July 2, 2020, 1013 respondents aged 15 and over, face-to-face interviews.

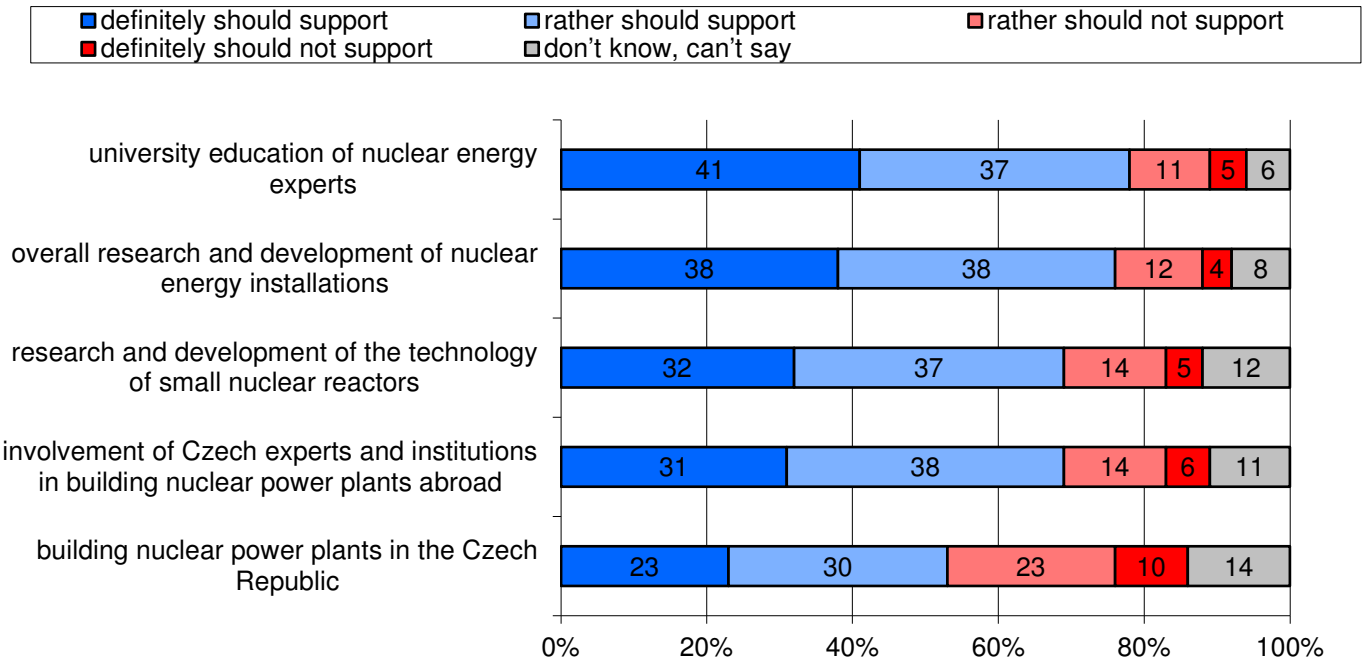
Similar results as for the possible building of a small nuclear reactor within 10 km of one's place of residence were found for the next question, which inquired about people's attitudes to the idea of installing small nuclear reactors directly in towns and using them not only for electricity generation but also as heating plants, to supply heat –

[5] The term NIMBY ("not in my backyard") refers to people's negative attitudes to projects implemented in their neighbourhood.
[6] Question wording: "As opposed to large nuclear reactors, which are constructed outside cities, one is currently considering the option of building a small nuclear reactor directly in town and using it at the same time as a heating plant to supply heat. Would you agree or disagree with building a small nuclear reactor directly in town to serve as a heating plant? Would you definitely disagree, rather disagree, rather agree, definitely disagree, or you don't know, can't say?"

something that cannot be implemented when the reactor is installed further away because high losses effectively prevent the transportation of heat at large distances. As shown by the results in Graph 5, only slightly more than one in four respondents (27%) would agree with something to that effect, while just over one-half (52%) would oppose it.

Detailed analysis revealed that both of the above questions are strongly correlated (with a Spearman rank-order correlation coefficient of 0.618) and both exhibit similar sociodemographic differences, which are typically based on general attitudes to nuclear energy and level of concerns about the uses of nuclear energy. For that reason, men, for instance, are more likely to agree with the question (33%) than women (20%) as well as more accepting of building a small nuclear reactor within 10 km of their place of residence (34%) compared to women (21%). In general, those in favour of increasing the share of nuclear energy and those not concerned about its uses are more likely to agree. Also more agreeable are respondents who declare advanced or expert-level knowledge of the physical and technological principles of the operation of a nuclear power plant.

Graph 6: Whether the Czech Republic should or should not support research, development and education in selected areas (%)[7]



Source: Public Opinion Research Centre, Institute of Sociology CAS (*CVVM SOÚ AV ČR*), Czech Society (*Naše společnost*), June 20 – July 2, 2020, 1013 respondents aged 15 and over, face-to-face interviews.

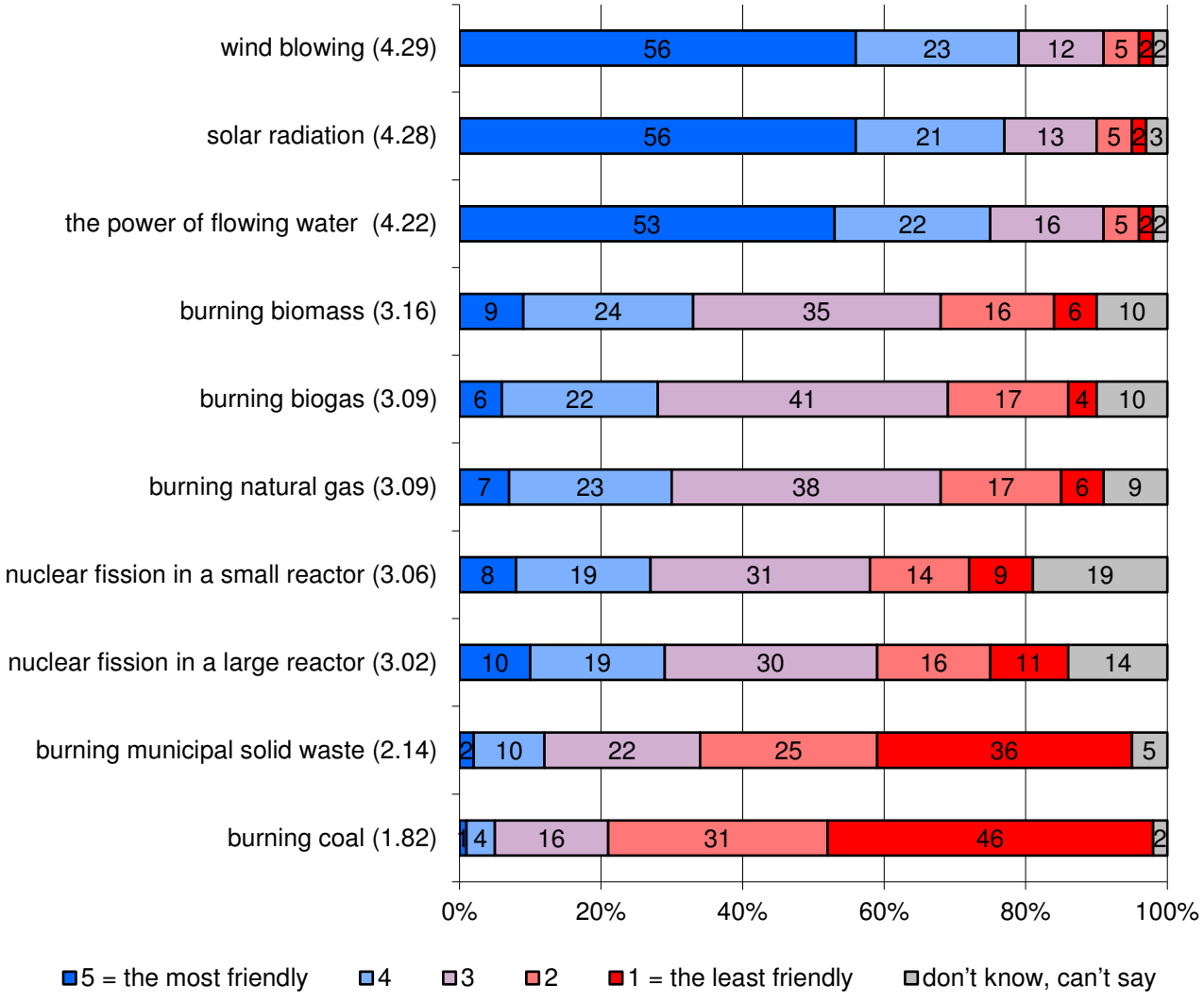
Another question of the battery dealt with whether or not the Czech Republic should support research, development and education in selected areas of nuclear energy. The results shown in Graph 6 indicate a general inclination of the Czech public to supporting development in the field. The clearest support is voiced for university education of nuclear energy experts, with more than three in four respondents (78%) in favour and 16% against. Similar observations have been made for the area of overall research and development of nuclear energy installations, where 76% of the respondents are in favour and again only 16% are against the support. Only slightly lower support, with practically identical results, is voiced for research and development of the technology of small nuclear reactors and involvement of Czech experts and institutions in building nuclear power plants abroad, with equally 69% in favour and around one in five respondents (19% and 20%, respectively) against the support. Building nuclear power plants in the Czech

[7] Question: "Do you think the Czech Republic should or should not support research, development and education in the following areas? (a) University education of nuclear energy experts, (b) overall research and development of nuclear energy installations, (c) research and development of the technology of small nuclear reactors, (d) building nuclear power plants in the Czech Republic, (e) involvement of Czech experts and institutions in building nuclear power plants abroad."

Republic is relatively most contested, with only slightly above one-half (53%) in favour and one-third (33%) against the support.

As for gender, men are significantly more likely to support building nuclear power plants in the Czech Republic. In all areas of interest, stronger support is voiced by people who are in favour of increasing the share of nuclear energy in electricity production and those not concerned about its use.

Graph 7: Evaluations of the environmental friendliness of different power sources[8]



Note: Items in the graph are ranked by average score on the scale between 1 (the least friendly) and 5 (the most friendly).

Source: Public Opinion Research Centre, Institute of Sociology CAS (*CVVM SOÚ AV ČR*), Czech Society (*Naše společnost*), June 20 – July 2, 2020, 1013 respondents aged 15 and over, face-to-face interviews.

[8] Question: "I am now going to read out different sources of power that are used in generating electricity and heat." For each source, please tell me how environmentally friendly or unfriendly it is to use. Use a scale from 1 to 5 where 1 means the least environmentally friendly and, conversely, 5 means the most friendly. (a) Burning natural gas, (b) solar radiation, (c) wind blowing, (d) burning coal, (e) burning biogas, (f) nuclear fission in a large reactor, (g) nuclear fission in a small reactor, (e) the power of flowing water, (i) burning biomass, (j) burning municipal solid waste."

The battery's last question inquired about how environmentally friendly people found it to use different sources power, including nuclear fission in a small reactor. As shown by the results in Graph 7, the power sources of interest fell into three highly distant groups. The first group consists of sources generally viewed as the most environmentally friendly (energy from the wind, solar radiation, and flowing water), the second of sources considered, conversely, as environmentally unfriendly (primarily coal, to which the respondents also added burning municipal solid waste), and the third group of "central" items with little differences from one another. Those include nuclear fission in small or large reactors, burning biomass, burning biogas, and burning natural gas. Nuclear fission in small or large reactors was rated similarly, with a somewhat higher share of undecided answers in the case of small reactors. This is characteristic of the entire central category, in which the shares of undecided answers oscillate around or above one in ten, as opposed to both remaining groups, where few respondents were undecided.

Detailed analysis revealed an extremely strong association between views on the environmental friendliness of nuclear fission in small and large reactors, respectively (with a Spearman rank-order correlation coefficient of 0.837). Both are primarily shaped by or linked to general attitudes to nuclear energy. In addition, men are more likely to consider fission energy from small nuclear reactors as environmentally friendly. Also interestingly, there is a relatively clear positive correlation between views of the environmental friendliness of nuclear fission in small reactors and those of burning natural gas, biogas, biomass and municipal solid waste; a very weak correlation on the verge of statistical significance was also observed with using the power of flowing water. The attitudes to environmental friendliness of nuclear fission energy from small reactors are not correlated to wind, solar, or coal energy.

Technical parameters of the survey

Survey:	*Czech Society, v20-06*
Survey by:	*Public Opinion Research Centre, Institute of Sociology, Czech Academy of Sciences*
Project:	*Czech Society – Continuous Public Opinion Research Project of the Public Opinion Research Centre, Institute of Sociology, Czech Academy of Sciences*
Survey dates:	*June 20 – July 2, 2020*
Sampling method:	*Quota sampling*
Quotas:	*Region (NUTS 3 Regions), size of place of residence, sex, age, education*
Data weighting:	*Education × NUTS 2, age × NUTS 2, sex × region, age × education, age × size of place of residence*
Data source for quota sampling and weighting:	*Czech Statistical Office*
Representativeness:	*Population of the Czech Republic aged 15+*
Number of respondents:	*1013*
Number of interviewers:	*163*
Data collection method:	*Face-to-face interviews conducted by interviewers with respondents – mixed CAPI and PAPI methods*
Research instrument:	*Standardised questionnaire*
Questions:	*MR.1, MR.2, MR.3, MR.4, MR.5, MR.6, MR.7*
Press release no.:	*oe201203en*
Published on:	*3 December 2020*
Prepared by:	*Jan Červenka, Martin Ďurďovič*

Glossary of terms:

A quota sample replicates the structure of the basic population of the study (in this case the population of the Czech Republic aged 15+) by setting quotas for different parameters. In other words, a quota sample is based on the same proportion of persons with the selected characteristics. We used data from the Czech Statistical Office to create the quotas. In our surveys, quotas are set for sex, age, education, region, and community size. The sample is thus selected so that the percentage of men and women in the sample, for instance, corresponds to the share of men and women in each region of the CR. Similarly, the sample reflects the corresponding shares of the population in individual regions in the CR, citizens in different age groups, people with different levels of educational attainment, and people in different sizes of communities.

A representative sample is a sample of the total population whose characteristics can be validly inferred to apply as the characteristics of the population overall. In our case, this means that respondents were selected with a view to generalising the collected data as applicable to the population of the Czech Republic aged 15 and over.

Data weighting – a method of increasing representativeness in terms of selected population characteristics by assigning a weight to each respondent. Calculated by the method of iterative proportional weighing, the weights range between 0.333 and 3.

The Public Opinion Research Centre (CVVM) is a research department of the Institute of Sociology, Czech Academy of Sciences. It dates back to 1946, when the Czechoslovak Institute for Public Opinion Research began operating as part of the Ministry of Information. The current CVVM emerged in 2001 when its predecessor (IVVM) was transferred from the Czech Statistical Office to the Institute of Sociology. Its incorporation within an academic institution provides a guarantee of high professional standards and quality, and as part of an academic environment, the CVVM is required to fulfil criteria that ensure it meets the highest professional standards. The CVVM's work is centred on the Czech Society research project, under which it examines public opinion by conducting ten surveys annually on a representative sample of the population over the age of 15, with approximately 1000 respondents participating in each survey. The questionnaire's omnibus format makes it possible to cover a wide array of topics. Political, economic, and other general social topics are regularly covered by the survey. The surveys include both repeat questions, whereby it is possible to observe phenomena over time, and new topics that reflect current events. The long-term and continuous nature of this public opinion survey project is unique in the Czech Republic.

This work has been supported by the AV21 Strategy of the Academy of Sciences under the 'Systems for Nuclear Energy' research programme and the 'Social Aspects of Nuclear Energy' research topic.