Roman BUCHTELE • Eva CUDLÍNOVÁ • Miloslav LAPKA • Nikola SAGAPOVA • Martina KRÁSNICKÁ • Jan VÁVRA • Zuzana DVOŘÁKOVÁ LÍŠKOVÁ

ENERGY LITERACY IN CZECHIA AND ITS INFLUENCE ON CITIZENS' PERCEPTION OF ENERGY CONSUMPTION BEHAVIOUR

Roman **Buchtele** (ORCID: 0000-0003-0851-1318)
Eva **Cudlínová** (ORCID: 0000-0002-0242-163X)
Miloslav **Lapka** (ORCID: 0000-0001-7309-0252)
Nikola **Sagapova** (ORCID: 0000-0003-1628-7758)
Martina **Krásnická** (ORCID: 0000-0003-4602-9450)
– University of South Bohemia in České Budějovice, Faculty of Economics
Jan **Vávra** (ORCID: 0000-0002-3171-6023) *– Institute of Sociology of the Czech Academy of Sciences*
Zuzana **Dvořáková Líšková** (ORCID: 0000-0003-1788-6808) *– University of South Bohemia in České Budějovice, Faculty of Economics*

Correspondence address:
Studentská Street 13, 370 05, České Budějovice, Czech Republic
e-mail: buchtr01@ef.jcu.cz

ABSTRACT: The analysis is based on a sample of 1015 citizens from Czechia. The cognitive energy literacy index (CELI), based on the knowledge of the energy mix in electricity production and the knowledge of the import/export of electricity in Czechia, is constructed in this article. The research aims to answer the following questions: What is the level of CELI within the population of Czechia? To what extent do the selected socio-demographic indicators affect the CELI? To what extent does CELI influence respondents' perceptions? The medium level of CELI is widespread across the population, while high and low levels of CELI are roughly equally shared. People with a high CELI are more likely to be older men with a university education. CELI also significantly affects the perception of behaviour on an individual, collective, and systemic level. Higher CELI is also associated with higher support for innovative solutions and renewable energy resources.

KEYWORDS: Czechia, energy literacy, energy consumption, household survey, human perception

Introduction

The utilisation of non-renewable fossil energy resources boosted economies and improved standards of living yet resulted in unsustainable growth accompanied by various problems, including pollution and climate change (Chevalier, 2009). Fossil fuels remain the primary energy sources that provide economic growth and industrialisation. However, the current global energy crisis motivates efforts to employ green technologies and alternative energy sources (Ng et al., 2021). This energy crisis arose at the beginning of 2022 after the coronavirus (Covid-19) pandemic and became more serious with the war in Ukraine. Apart from this fact, UN member states are committed to meeting the energy challenges of adopting a sustainable development paradigm defined in the late 1980s (WCED, 1987). One of the practical outputs is the 17 Sustainable Development Goals (SDGs), some of which are related to the energy sector. In Goal 7 – Affordable and Clean Energy, the community of states aims to ensure access to affordable, reliable, and modern energy for all. Energy production and consumption are also crucial from the perspective of Goal 13 – Climate Action (United Nations, 2015). Although the SDGs do not formulate specific policies to be implemented by the nations, the governments react to its agenda (Vávra et al., 2022).

To cope with the current challenges, the EU has adopted the "2030 Climate and Energy Policy Framework" with its main goals to be achieved by 2030 – at least a 40% reduction of greenhouse gas emissions, at least a 27% share of renewable energy in gross final energy demand with an indicative target of at least a 27% improvement in energy efficiency (European Council, 2014). These targets are not binding for each member state, but the governance framework should provide incentives to increase renewable energy sources (RES) deployment (Veum & Bauknecht, 2019). Although there were significant reductions in greenhouse gas emissions and improvements in the power sector, some political barriers to effective climate policy persisted as fossil fuels remain the main sources of energy, such as in Central and Eastern European countries that want to sustain coal-based energy carriers. Climate policies may be affected by increasing Euro-scepticism and climate scepticism (Oberthür, 2016). In this context, it is interesting to examine the level of energy knowledge of people using the concept of energy literacy.

Hence, energy literacy can be perceived as essential knowledge for understanding the energy nature in relation to its use and impacts on production and consumption, which encourages sustainable energy consumption habits as well as better decision-making on energy (Martins et al., 2020). Energy literacy and the awareness of households are also important for the evaluation of investment decisions in energy equipment and directly affect

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behaviour regarding energy consumption (Brounen et al., 2013). If energy literacy is such a powerful tool for behavioural change and energy savings and transition (Cotton et al., 2021), it could provide a basis for achieving the energy pledges and their acceptance by the public as the energy crisis still prevails.

Currently, there are disparities among EU countries when it comes to renewable energy resources (RES) deployment, which is not only a result of economic and financial factors but also geography and other natural factors. The highest shares of RES are evidenced in Sweden, Finland and Latvia, with the lowest shares in Luxembourg, Malta and the Netherlands. Demand for energy is increasing, but EU countries continue to set ambitious targets followed by investments (Anton & Nucu, 2020). Some of the member states, including Czechia, Slovakia, and Bulgaria, were not eager to fast-track energetical changes (Marinaş et al., 2018). Nevertheless, the EU is a global leader in the decarbonisation of the energy system (Bastida et al., 2019). Germany and France are included in the top ten energy-consuming countries (Shahbaz et al., 2018). However, Germany and France, but also Spain, Italy, Sweden, Denmark, Poland, Portugal, and the current EU exited the United Kingdom belong to the top 15 renewable energy-consuming countries (Saidi & Omri, 2020). However, many European countries are still dependent on fossil fuel sources. According to the indicator of fossil fuel energy consumption, its use is over 60% in most of them. For Czechia, the value of this indicator is approaching 80% (Martins et al., 2018). Although Czechia is Europe's 3rd largest exporter of electricity (Liu & Wu, 2021), 16% of Czech households are affected by energy poverty, and there is a probability that household expenditures on energy in Czechia are increasing. Such households cannot afford to heat or cool their houses adequately in the different seasons (Karásek & Pojar, 2018). Energy literacy and adequate knowledge can enable a just energy transition, build resilient power systems, improve household energy use practices, and therefore reduce energy use and the risk of energy poverty (Chodkowska-Miszczuk et al., 2021). The threat of energy poverty is also increasing due to the general increase in energy prices, especially electricity and gas (Eurostat, 2022).

As part of the National Energy and Climate Plan of the Czech Republic, it is planned to increase awareness and enlighten and educate consumers. E.g. the so-called EFEKT Program was introduced as a political measure aimed at increasing energy efficiency and supporting energy savings. As part of this program, actions focused on the active dissemination of information and education in the field of energy savings are planned (MPO, 2019).

This paper contributes to the discourse on energy literacy at the level of a Member State of the European Union, especially in the context of Central Europe at a time when the energy mix is moving towards renewables and

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more environmentally friendly forms. At the same time, however, nuclear energy remains of great importance. This paper's approach of linking energy literacy to perceptions of individual behaviour, collective behaviour and system level can be considered novel and innovative. The research will show what the level of cognitive energy literacy within the Czech population is, but also how the Cognitive Energy Literacy Index (CELI) is affected by socio-demographic variables. Of particular interest may be the observed effect of education level across the population.

The paper is structured as follows. The literature review section briefly presents the concept of energy literacy. The methods and survey design sections consist of the description of Czechia, the research questions and hypotheses, and the survey. The results section starts with the description of the specifics and construction of CELI, followed by the results within the perception of individual behaviour, collective behaviour and system perspective, and the interference of the individual behaviour and the system. In the discussion and conclusion parts, the results are discussed in comparison to other research with respect to the topic.

An overview of the literature

Within this paper, we proceed mainly from the definition by DeWaters and Powers (2008), DeWaters et al. (2013), and DeWaters and Powers (2013). The authors divided energy literacy into three domains – cognitive (knowledge, skills), affective (attitude, values, personal responsibility) and behavioural (intention to preserve energy, energy-saving habits). Understanding the basic energy concepts falls within the cognitive domain. The energy-literate person in the affective domain is characterised by trying to reduce their consumption and environmental impact. Such a person understands the steps that can prevent a negative environmental impact and understands energy consumption in the context of economic responsibility for the transformation towards renewables. The energy-literate person in the domain of behaviour has such patterns of behaviour that are manifested in the fact that, as the authors describe, there is an "intention to preserve" (DeWaters & Powers, 2008). DeWaters and Powers (2013) established measurement criteria for energy literacy questionnaires concerning and covering all three dimensions.

Energy literacy defined in this way was later the subject of a paper from Martins et al. (2020), and the authors proposed a partial modification. The originally defined cognitive domain contained energy knowledge. However, it has been newly designed to include energy and financial knowledge. This extension to financial knowledge is also supported by the other concepts of

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energy literacy mentioned above (e.g., Brounen et al., 2013; Blasch et al., 2021).

Within our paper, we use primarily the definition of DeWaters and Powers (2008), DeWaters et al. (2013), DeWaters and Powers (2013), Martins et al. (2020) with a cognitive domain of energy literacy. From our point of view, the cognitive domain can be understood as indirect energy literacy and the other domains as direct energy literacy. For this reason, we call our key variable the cognitive energy literacy index (CELI). The index construction will be described in more detail in the section on material and methods.

Brounen et al. (2013) consider energy literacy as the ability of households to find a compromise between savings from energy efficiency investments and the upfront investments which are necessary to achieve improvements in energy efficiency in the long term. Blasch et al. (2021) work with a different concept and call it energy-related financial literacy. The essence is a combination of energy cost-specific knowledge and the skills needed to process this information. Energy literacy is often the subject of empirical research. Authors like Öykün and Abbasoğlu (2017), Yeh et al. (2017) conducted research among high school students. Other research measures energy literacy at universities (Cotton et al., 2021), but there is also research with a more complex sample that covers multiple levels of the education system (Dwyer, 2011). Cotton et al. (2021) pointed out relatively high energy literacy among students, but cultural differences were found. Students from the United Kingdom, as representatives of Europeans, had a more positive attitude towards energy savings. While students from China had a better knowledge of the facts about the energy sector and also had more confidence in the state and businesses in terms of energy regulations. The results among European students can also be supported by research from Öykün and Abbasoğlu (2017). In this case, most students also support energy efficiency, although energy knowledge about the facts is not so high. Misconceptions about energy and why students hold these have been the subject of research by Yeh et al. (2017).

Another group of researchers is those that focus on households in the context of energy literacy. These authors (e.g. van den Broek, 2019; Martins et al., 2020) deal with the energy literacy of households in general. The output is a description of the structure of this literacy and a useful tip on how to look at this issue and how to improve the research results. Martins et al. (2020) propose implementing the financial dimension together with knowledge, affective and behaviour to gain a more comprehensive assessment of energy literacy. Van den Broek (2019) recognises four types of household energy literacy states as device energy literacy, action energy literacy, financial energy literacy and multifaceted energy literacy, and calls for more com-

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mon principles and measures for direct comparisons within the household energy literacy research.

Brounen et al. (2013), in research across households in the Netherlands, found that "energy literacy" and awareness among respondents and households is low in the context of monthly energy fees. The relationship between limited knowledge in the field of energy and the non-utilization of potential savings was the subject of research across three European countries (Italy, Netherlands, Switzerland) by Blasch et al. (2021). Boogen et al. (2021) confirm that the residential sector in these three European countries could save approximately 20% of its total electricity consumption on average. Sovacool and Blyth (2015) described energy users from Denmark as organic users. However, their results did not support the claim that Danish households would prioritise low energy prices and affordability as key energy concerns and that they are knowledgeable about energy and environmental issues. Gołębiowska (2020) mapped the energy literacy of households in the context of Central and Eastern Europe. Relatively low energy literacy was found among Poles. Energy literacy was, in this case, defined as knowledge of energy prices, environmental effects of consumption, and knowledge about climate change. It also confirmed the relationship between energy literacy and norms associated with the use of energy.

It is also necessary to mention the impact of the energy literacy of households on consumer behaviour. An example is the purchase of electrical appliances, Blasch et al. (2019) confirm that individuals with a higher level of energy literacy are more likely to perform an optimisation rather than relying on a decision-making heuristic. These consumers are more likely to identify the most cost-effective product due to their energy literacy.

Together with Denmark, Bulgaria and Germany, Czechia is one of the European countries with the highest rate of motivation to save electricity for financial reasons (Mills & Schleich, 2012). However, among European countries, Czechia has the lowest financial energy literacy (van den Broek, 2019). The sharp increase in energy prices since January 2022 has worsened the situation of Czech households affecting housing affordability and the risk of poverty (Čermáková & Hromada, 2022).

Research methods

Research questions; a hypothesis

Within the research, based on the definition of the cognitive domain of energy literacy, the CELI was constructed, which is further operated within the data analysis. The research aims to answer these questions: What is the

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level of CELI within the population of Czechia? To what extent do some selected socio-demographic indicators affect the CELI? To what extent does CELI influence respondents' perceptions?

As regards the leading variables, we take into consideration the following sociodemographic characteristics: gender, age and education. Our construction of energy literacy (high, medium and low energy literacy) is used as an explanatory variable too.

Czechia

Czechia is located in Central Europe, bordered by Poland to the north, Germany to the west, Austria to the south and Slovakia to the east. Its capital and largest city, with 1.3 million inhabitants, is Prague. The aggregate number of inhabitants is over 10 million (Czech Statistical Office, 2022). Most of the country is located between 200 and 500 meters (600 and 1,600 feet) above sea level and has a fairly homogeneous climate (Czech Statistical Office, 2021). Czechia has a temperate climate, situated in the transition zone between the oceanic and continental climate types, with warm summers and cold, cloudy and snowy winters.

The survey, questionnaire and data analysis

The article is based on data obtained in a questionnaire survey developed by the authors, which was entitled Bioeconomy, Environment and Energy. The distribution of the questionnaire and data collection was carried out by the professional market research agency FOCUS – Center for social and marketing analysis in December 2020. It included 1015 respondents using the online (CAWI) method on a representative adult population (18+ years) selected via quotas of gender, age, education, municipality size and region.

Our methodology is based on an empirical operationalisation of energy literacy – the CELI. The questionnaire included questions focused on the various topics of energy, bioeconomy, waste management, forestry and standard socio-demographic questions. The specific set of questions dealing with energy issues is analysed in this paper. These include:

- In your opinion, what is the structure of electricity production in Czechia at present? How do you think electricity should be produced in Czechia in 2040? Please indicate in percentages the total is 100% (Question #1)?
- If we add up the imports and exports of electricity, in your opinion, does Czechia import or export electricity? (Question #2)?
- Are you considering your own energy production in your household (solar panels, water turbines, geothermal energy, biogas plant, etc.)? (Question #3)?

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- Would you support your municipality/district / city to have its own joint production of renewable energy (biogas plants, solar panels, wind, etc.)? (Question #4)
- Can alternative energy sources (biomass, wind, sun) exist without subsidies? (Question #5)?
- What effect do you think consumer behaviour has on overall energy consumption? (Question #6)?

A relatively high N and representativeness of the sample above allowed a statistical comparison using IBM SPSS software. This included descriptive statistics, chi-square and ordinal regression. Chi-square is used in the analysis of all questions, while ordinal regression is used in the case of CELI and sociodemographic relationships. If not stated otherwise, the statistical significance level is $p = 0.05$.

Results of the research

CELI index

The construction of the CELI is based on two questions: the knowledge of the energy mix in electricity production and the knowledge of electricity balance. We selected these two questions because they are the most knowledge-based in the part of a survey concerning energy. The other comparative questions are normative, oriented to the future, about the motivation and attitudes about the individual energy plans, and attitudes towards municipal and regional policies. The rest is made up of questions concerning attitudes towards energy.

The first part of the CELI index is knowledge of the structure of energy production (Question #1). Figure 1 compares the average respondents' energy mix estimates with reality (International Energy Agency, 2022). It is clear that respondents tend to overestimate renewable sources. On the other hand, they are not fully aware of the extent of coal and nuclear energy as energy sources.

Due to the great deviations (several times more) in the estimation of small share energy sources in our energy mix, such as wind, water, biogas, solar, and geothermal, we integrated the categories in the following way: renewable energy sources (RES), coal, nuclear energy, and other (mostly natural gas).

Indirect indicators of energy literacy are based on a contingency table looking for homogenous characteristics; for electricity production, the deviation of the estimation from reality (International Energy Agency, 2022) was calculated for each of the three types of electricity sources (renewables

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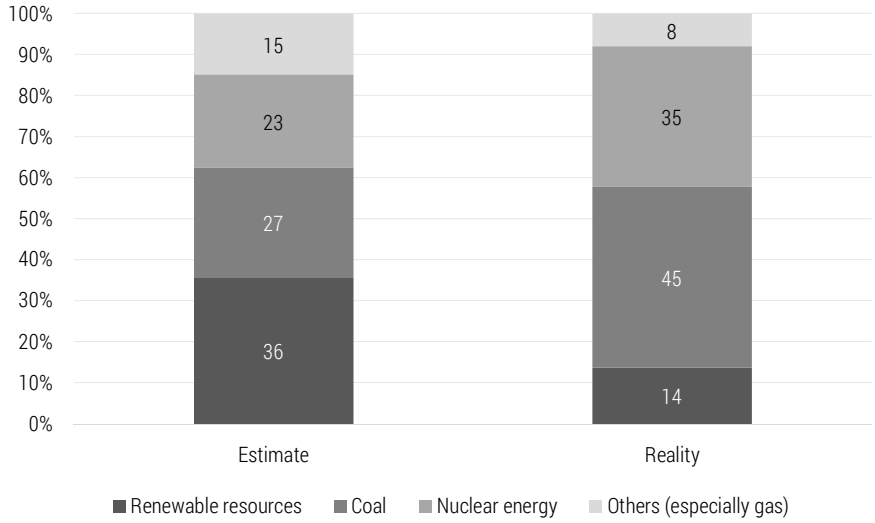

Figure 1. Electricity generation estimate and reality [%, rounded]
Source: authors' work based on International Energy Agency (2022).

together, coal, nuclear) and transformed into its absolute value. Then, the mean of the three absolute values of deviations was created. The sample of respondents was then categorised into the terciles according to their mean deviation of the assessment of electricity production from reality. First tercile with a mean deviation <16%, second 16-25%, third >25%. A total of 34% of respondents had the lowest deviation, less than 16%. Furthermore, a total of 33.3% of respondents had the middle category, a deviation between 16% and 25%, and 32.7% of respondents had the highest deviation, i.e., greater than 25% (see Table 1).

The second part of the CELI index is knowledge of the export/import of electricity (Question #2). It was categorised as "more export/more import/roughly the same/don't know", with the correct answer being "more export" and the incorrect ones being "more import" and "roughly the same". Czechia exported more electricity than it imported in 2019. Exports amounted to 24.1 TWh, and imports to 11 TWh (Energy Regulatory Office, 2019). Thus, net exports amounted to 13.1 TWh. A total number of 49% of respondents correctly answered that Czechia exports more electricity, while 22% believe that it imports more than it exports. Even 13% of respondents who believe that imports and exports are the same did not answer correctly. The remaining 16% of respondents chose the answer "I don't know, I don't think about it".

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Answers to these two questions were combined to create the CELI, as shown in Table 1. Based on this distribution, three categories of CELI were prepared. First, respondents with a high CELI answered the export/import question correctly and were in the first tercile of deviation (23.6% of respondents, light grey in Table 1). Second, those with a medium CELI who either answered export/import incorrectly or didn't know and were in the first or second tercile of deviation, plus those in the second and third tercile but with the correct answer to the export/import question (53.3%, grey in Table 1). Third, respondents with a low CELI were in the third deviation decile as well as replying incorrectly or didn't know the answer to the export/import question (23.1%, dark grey in Table 1).

Table 1. Energy Literacy Index distribution among respondents

		Export/import knowledge			Total
		Correct answer	Incorrect answer	Don't know	
Deviation of electricity production estimation	<16%	23.6%	7.9%	2.5%	34%
	16-25%	15.4%	12.5%	5.4%	33.3%
	>25%	9.7%	14.4 %	8.7 %	32.7%
Total		48.7%	34.8	16.6%	100%

Note: Percent of all respondents; light grey = high CELI, grey = medium CELI, dark grey = low CELI

Chi-square was used to test the relationship between the surveyed factors (p = 0.05). The abbreviation "ar" below indicates adjusted residuals (absolute value ≥ 1.96 as threshold of significance). We started with the relationship of CELI and sociodemographics. For this purpose, the age was categorised into 6 groups (see Annex for details). The chi-square tests revealed a significant relationship between CELI and all three characteristics: gender ($\chi^2 = 109.901$; df = 2; p < .001), age ($\chi^2 = 87.465$; df = 10; p < .001) and education ($\chi^2 = 130.994$; df = 6; p < .001). A total number of 23.6% of our respondents have high energy literacy measured by the energy literacy index (CELI) introduced above. These respondents are more often men (ar +8.3), in the age categories 55–64 and 65+ (ar +2.8, ar +4.6) and respondents with a university degree (ar +6.0). Women (ar -8.3), younger respondents in the age categories 18–24, 25–34 and 45–54 (ar -3, ar -3.4, ar -2.7) and respondents with basic and apprenticeship education[1] are less likely to have high a CELI (ar -2.2, ar -5.4).

[1] Apprenticeship education indicates a lower, more practical form of high school (vocational).

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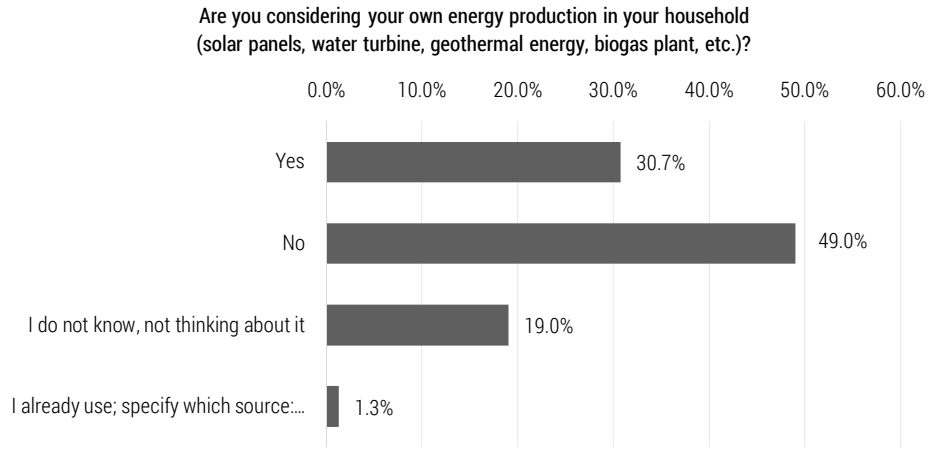
A total number of 53.3% of respondents reach the medium level of CELI. These are more often respondents with a high school education (ar +2.5). On the other hand, respondents with an apprenticeship education reach the middle level of CELI less often (ar -3.5).

A total number of 23.1% of respondents have low energy literacy, as measured by CELI. These are more often women (ar +8.6), respondents in the age categories 25–34 and 35–44 (ar +5.1, ar +2.8) and respondents with an apprenticeship certificate (ar +9.6). On the other hand, these respondents are less often men (ar -8.6), older respondents in the age categories 55–64 and 65+ (ar -3.2, ar -5.8) and respondents with high school and university education (ar -4.8, ar -6.4).

Ordinal regression with CELI as a dependent variable and gender, age groups and education as independent variables confirms that even when the effect of other sociodemographic characteristics is controlled, each of them significantly influences CELI in line as Chi-square shows (in both cases of main effect only as well as an interaction; Nagelkerke Pseudo R^2 = 0.282, respectively 0.296).

In further research, we focused on whether the energy literacy of our respondents measured by CELI has an impact on their attitudes, behaviour, and relationship to the energy policy of the state. The following four questions from the questionnaire were used for this analysis.



Own energy production in households (solar panels, water turbine, geothermal energy, biogas plant, etc.) (Question #3)

Figure 2. Own energy production in the households

Note: Percent of all respondents.

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The largest group is 49% of respondents who do not consider producing their own future energy. Further responses are detailed in Figure 2. The relation between CELI and own energy production is statistically significant (χ^2 =38.101; df = 6; p < .001). Respondents with a high CELI are more often among those who have already produced energy in their own household (ar +2.6), those who think about it (ar +2.4). On the contrary, this answer was more often chosen by respondents with the low CELI (ar +5).

Support of the municipalities/ district / city to have its own joint production of renewable energy (biogas plants, solar panels, wind, etc.) (Question #4)

A total of 64.8% of respondents, almost two thirds, support the production of joint energy in their place of residence. Further responses are detailed in Figure 3. Overall significance of chi-square is relatively lower than in case of other questions (χ^2 = 10.908; df = 6; p = .091), yet there are some significant adjusted residuals: respondents with a low CELI more often chose the answer I don't know/I don't think about it (ar + 3.1) and less often the support of joint energy production (ar -2.6).

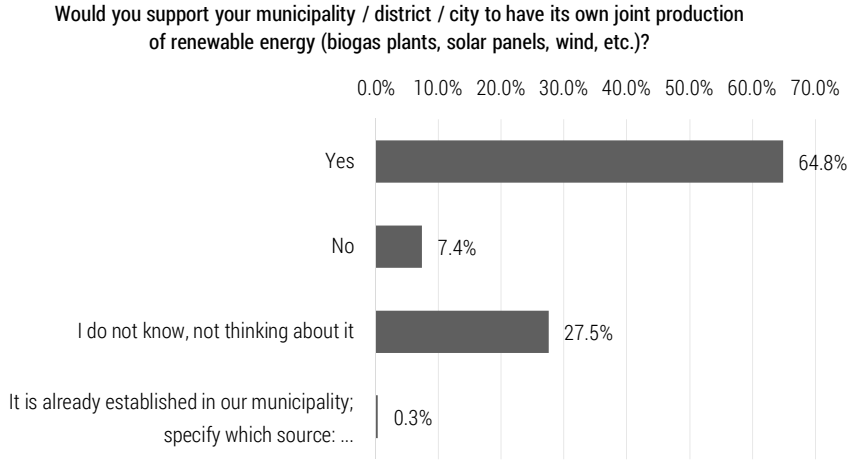

Figure 3. Support of the municipalities/ district/ city to have its own joint production of renewable energy

Note: Percent of all respondents.

Existence of alternative energy sources (biomass, wind, sun) without subsidies (Question #5)

The 45% of respondents answered that RES cannot exist without subsidies (see Figure 4 bellow). Unlike the previous question, the relation of CELI

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and RES was highly significant (χ^2 = 57.064; df = 4; p < .001). Respondents with a high CELI more often answered that RES can exist without subsidies (ar +3.9), and respondents with a low CELI do not know or do not consider it (ar +6.4). On the other hand, the last-mentioned answer was less often given by respondents with a high CELI (ar -5.1). Respondents with a low CELI less often chose the answer that RES can exist without subsidies (ar -2.8), but also the answer that RES cannot exist without subsidies (ar -3).

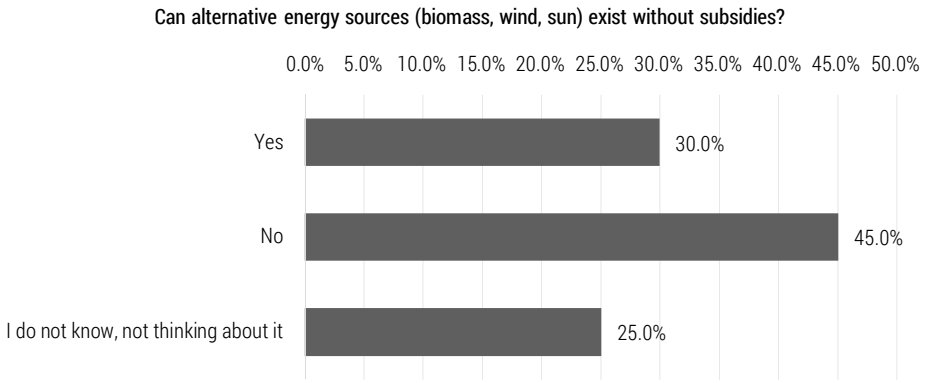

Figure 4. Existence of alternative energy sources without subsidies

Note: Percent of all respondents.

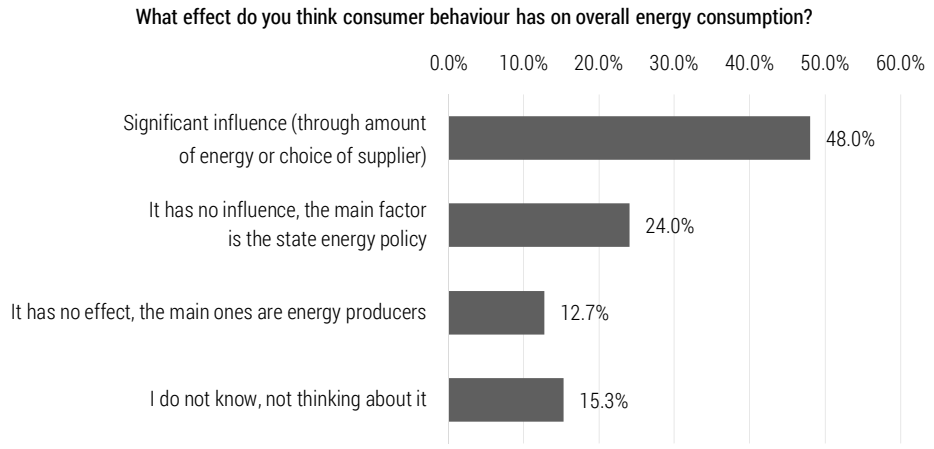

Figure 5. Influence of consumer behaviour on overall energy consumption

Note: Percent of all respondents.

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Influence of consumer behaviour on overall energy consumption (Question #6)

A total of 48% of respondents think that consumer behaviour has an impact (through the amount of energy or the choice of supplier) on overall energy consumption. Further responses are detailed in Figure 5. CELI is, again, variable with significant effect on the answers to the question ($\chi^2 = 74.789$; df = 6; $p < .001$). Respondents with a medium CELI more often answered that the main role is played by the state energy policy, not consumers (ar +2.2), and this answer was less often chosen by respondents with a low CELI (ar -4.4). The answer I don't know/I don't think about it was chosen less often by respondents with a high or medium CELI (ar -3.8, ar -3.6), and conversely, respondents with a low CELI chose it more often (ar +8.1).

Discusion and conclusions

This research article answered the researcher's several questions. The CELI within the Czech population can be divided into three groups, where the largest is the part of the population with a medium CELI score. People with a higher CELI or lower CELI represent approximately one-quarter of the population. However, this is affected by our construction of the three categories according to the CELI score. Socio-demographic indicators significantly influence the CELI score across populations. An interesting finding is that older men with a university degree achieve the highest score. The CELI also significantly affects the perception of behavior on an individual, collective, and systemic level. In general, people with a higher CELI score are more pro-environmentally minded, in our case it is the promotion of renewable energy sources and innovative solutions in terms of their own energy situation or the situation in their place of residence (region).

Instead of the energy literacy mentioned in the literature review, we cannot use this direct literacy, i.e., a comparison with literacy and the real-world behavior of individual respondents. So, instead we used a modification, indirect literacy, which is based on the knowledge of the energy mix in electricity production and the energy balance in the production of electricity in Czechia – and the reality of the mix and balance. Energy literacy is more about the respondents' perception of behaviour to energy production than about their own behavior. Knowing this fact, we avoid statements about behavior-based greening of Czech society and similar interpretations. It is more about general expectations and a picture of the mind in terms of energy production.

Many authors (e.g., Öykün & Abbasoğlu, 2017; Yeh et al., 2017; Cotton et al., 2021; Dwyer, 2011) focus on energy literacy in the context of students. We also have this population group in our research, and due to the CELI, it can be

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stated that younger respondents with basic and apprenticeship education are less likely to have a high CELI. However, it must be emphasized that people with a university degree, on the other hand, achieve a high CELI score.

Young people at age 18-24 are commonly seen as a sensitive group in the context of environmental expectations. This can be confirmed, for example, by the results where young EU citizens aged between 15-29 believe that climate change has an impact on everyday life (European Investment Bank, 2021).

The construction of the CELI was based on two knowledge questions. There are great differences in the estimation and reality in the case of knowledge of the energy mix in electricity production (not so much in the energy balance). Even looking at a normative question about the horizon 2040 and energy mix, optimistic expectations in the sense of increasing renewable energy resources exceed all expert's government concepts up to 2038. The main Czech energy company ČEZ group confirms our results in terms of the great overestimating of RES with its own experience with visitors in ČEZ visitors' centers (Votruba, 2021). The question is about the causes of these expectations.

The first, easy explanation shows weak interest in the energy mix and then weak estimations of reality. Undoubtably, this is the case. On the other hand, in a case like this, we can also expect the opposite estimation in terms of a higher estimation of coal in the energy mix. However, it does not occur.

One possible explanation is related to the fact of the relatively widespread discussion about RES, both positive and negative, in Czech mass media during the last ten years. It is connected with global climate change and social problems, the problematic subsidy scheme of solar energy (Vávra, 2014), CO_2 emissions, and the EU and its low carbon strategy. The impact of this discussion on Czech citizens inflates the share of RES in mass media rather than show the correct picture and real share of RES in the energy mix. Citizens also tend to underestimate the contribution of nuclear and coal power. In this case, slightly less than half of the respondents correctly state that electricity exports are greater than imports within Czechia.

Another part of the data analysis focused on whether the energy literacy of our respondents measured by the CELI has an impact on their perception of behavior, and its relationship to the energy policy of the state. At the level of perception of individual behaviour, it can be confirmed that overall, a smaller part of the population considers their own energy production in their households, but it is the part of the population with a higher CELI. The perception of collective behaviour was related to the support of the municipalities/district/city to have its own joint production/renewable energy. In this case, a larger proportion of the population expressed agreement, but the effect of the CELI was not statistically significant. The system level repre-

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sented the possibility of alternative energy sources (biomass, wind, solar) without subsidies. It was found that the part of the population with a higher CELI is aware of the possibility of RES without a noticeable influence of subsidies. The effect of the CELI on the consumption behaviour on total energy consumption was also found. In this case, as the CELI score decreases, the belief in consumer influence also decreases. These questions completed the picture of the Czech population and their energy literacy. The results thus contribute to already published European research (e.g., Brounen et al., 2013; Blasch et al., 2021; Boogen et al., 2021; Sovacool & Blyth, 2015) especially in the context of central Europe (e.g. Gołębiowska, 2020).

The CELI has revealed a gap between the thinking of energy experts, politicians and economists and the rest of the population in Czechia. We are witnessing a missing framework for the idea of an energy mix in the general population. Nevertheless, political and economic decisions are being made, as well as long-term strategies in the name of modernising the economy. From the point of view of the social situation, this mostly missing information is not an objective attitude comparable to that of experts. There is a lack of interest in the composition of the energy mix in the majority of the population. However, there is no lack of an interpretive framework for the attitude, which is significantly pro-environmental. We are witnessing two interpretive frameworks: energetically "real" held by experts and politicians and economists, and energetically "green" with a clear inclination towards RES for the majority of the population of Czechia. We believe that these frameworks cannot be simply explained as knowledge versus ignorance or expert versus non-expert. On the part of the majority population is the impact of the pro-environmental narrative, as presented in the media, on energy savings, CO_2 reduction, carbon switching, renewable energy, waste minimisation, modern energy-saving biotechnology, the circular economy and bioeconomy. This narrative is, in essence, a defence of energy restructuring and the high costs of this modernisation. On the other hand, it raises high expectations of a highly ecological energy mix that does not correspond to government strategies at all and far exceeds them. The question is to what extent these expectations will be reflected in the strategies in the future through the appropriate political representation holding the views of this segment of voters. This is one of the reasons why we believe that these two frameworks cannot be set in isolation but must be considered in a complementary way.

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Question	Answers	Frequency of answers	Gender		Age					Education					Cognitive energy literacy index		
			Man	Woman	18-24	25-34	35-44	45-54	55-64	65 +	Elementary School	Secondary vocational school	High School	University	High	Medium	Low
Knowledge of the structure of energy production (deviation).	<= 15	34%	8.2	-8.2		-3.2	-2.8		2.2	3.0		-6.8		6.6	24.7	-10.5	-12.5
	16-25	33%								3.1		-3.1	3.4		-12.5	21.1	-12.3
	26+	33%	-8.1	8.1	2.0	5.0	2.9		-3.4	-6.1	2.0	10.0	-5.3	-7.2	-12.4	-10.6	25
If we add up the imports and exports of electricity, in your opinion, does Czechia import or export electricity?	More imports	22.%	-4.3	4.3	4.6	5.3			-2.3	-5.1					-9.4		8.5
	More exports	48.7%	8.4	-8.4	-3.2	-4.7	-2.3		4.2	5.3		-4.5	2.3	3.8	18.2		-17
	Imports and exports are the same	12.7%							-2.9						-6.8	2.5	3.9
	I do not know, not thinking about it	16.6%	-6.8	6.8								4.3		-3.7	-7.9		9.9
Cognitive energy literacy index	High	23.6%	8.3	-8.3	-3	-3.4	-2.7		2.8	4.6	-2.2	-5.4		6			
	Medium	53.3%										-3.5	2.5				
	Low	23.1%	-8.6	8.6		5.1	2.8		-3.2	-5.8		9.6	-4.8	-6.4			
Are you considering your own energy production in your household (solar panels, water turbine, geothermal energy, biogas plant, etc.)?	Yes	30.7%	2.5	-2.5	3.6	2.9				-4.8		-2.7		2.7	2.4		
	No	49.0%											1.9				
	I do not know, not thinking about it	19.0%	-3.0	3.0			3.4			-3.3		3.9		-3.4	-3.5		5
	I already use; specify which source:...	1.3%											-2.7	5.3	2.6		
Would you support your municipality / district / city to have its own joint production of renewable energy (biogas plants, solar panels, wind, etc.)?	Yes	64.8%								-3.6							-2.6
	No	7.4%	2.2	-2.2	2.0						2.0						
	I do not know, not thinking about it	27.5%			-2.3	-2.9				4.5			2.1	-2.4			3.1
	It is already established in our municipality; specify which source: ...	0.3%				2.4											

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Question	Answers	Frequency of answers	Gender		Age						Education				Cognitive energy literacy index		
			Man	Woman	18-24	25-34	35-44	45-54	55-64	65 +	Elementary School	Secondary vocational school	High School	University	High	Medium	Low
Can alternative energy sources (biomass, wind, sun) exist without subsidies?	Yes	30.0%	4.7	-4.7	2.4										3.9		-2.8
	No	45.0%						-2.1									-3
	I do not know, not thinking about it	25.0%	-5.1	5.1								3.4		-3.2	-5.1		6.4
What effect do you think consumer behavior has on overall energy consumption?	Significant influence (through amount of energy or choice of supplier)	48.0%										-2.8		2,9			
	It has no influence, the main factor is the state energy policy	24.0%														2.2	-4.4
	It has no effect, the main ones are energy producers	12.7%															
	I do not know, not thinking about it	15.3%	-3.1	3.1			2.0	2.2		-2.0		4.4		-4.8	-3.8	-3.6	8.1

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The contribution of the authors

Roman Buchtele: conception – 30%, literature review – 45%, acquisition of data – 30%, analysis and interpretation of data – 35%.

Eva Cudlínová: conception – 25%, literature review – 5%, acquisition of data – 10%, analysis and interpretation of data – 20%.

Miloslav Lapka: conception – 20%, literature review – 10%, acquisition of data – 10%, analysis and interpretation of data – 15%.

Nikola Sagapova: conception – 5%, literature review – 10%, acquisition of data – 10%, analysis and interpretation of data – 5%.

Martina Krásnická: conception – 5%, literature review – 10%, acquisition of data – 10%, analysis and interpretation of data – 5%.

Jan Vávra: conception – 10%, literature review – 5%, acquisition of data – 20%, analysis and interpretation of data – 15%.

Zuzana Dvořáková Líšková: conception – 5%, literature review – 10%, acquisition of data – 10%, analysis and interpretation of data – 5%.

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