Article

Public Acceptance of Renewable Energy Sources: a Case Study from the Czech Republic

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Abstract: The substitution of traditional energy production with renewable energy sources (RES) in the European Union (EU) represents a multidimensional issue with its pros and cons viewed differently by governments, technology companies, markets, as well as the general public. There are significant public doubts in expediency of investments in renewables in place. Our paper studies the factors related to the public opinion on renewables using a reasonable and representative sample of respondents (N = 1026) from one of the EU Member States, the Czech Republic, via a set of ordinal regression analyses with spline correction for ordinal predictors. Our results suggest that the population of the Czech Republic is split in half in its trust in renewables as a substitute to traditional energy sources. In addition, our results show that the opinions on renewables in the Czech Republic are significantly related to personal concerns on environmental protection and worries about use of nuclear energy. Moreover, we find that traditional mass media is not statistically significant, even though internet news channels and social media were statistically related to the opinions (negatively and positively, respectively). The comparison of the responses with respect to the frequency of following social media support the hypothesis of the media bubble. The empirical results indicate that public opinions on renewables are likely to be built on the information sources vulnerable to hoaxes, bubbles, and misinformation. We conclude that more media presentation on RES is needed and make some practical suggestions for the stakeholders, journalists, and relevant policymakers.

Keywords: renewable energy sources; public opinion; mass media; European Union; Czech Republic; energy policy; social networks

1. Introduction

Renewable energy sources (RES) are becoming an increasingly important part of the energy basket in the European Union (EU) [1,2]. Their presence in the overall energy mix of European countries has been constantly rising over the last thirty years [3]. While in 1990 the share of renewables in energy production in EU countries constituted only 4.39%, in 2017 (the most recent available data) it raised to 13.73%, as reported by the Organization for Economic Co-operation and Development (OECD) [4]. The Czech Republic, an EU Member State since 2004, also experienced increasing emphasis on renewables—their share in this country increased from 0.29% (in 1989) to 10.31% (in 2018) [4]. Even larger shares of renewables in energy production were recorder in Austria (29.39% in 2018), Finland (33.76%, 2018), and Sweden (37.79%, 2018), and the highest in Norway (47.11%), as well as Island (88.68%, 2018) [4]. Although the high shares of renewables in Nordic countries are partially determined

by natural conditions, there appears to be some room for the increase also in countries like the Czech Republic as well as other European Union member countries. The overall target for all EU Member States is to reach a 20% RES share in EU energy consumption by 2020 [5].

The use of renewables as electricity resources (RES-E) has its pros and cons. On the pros side, RES-E are supposed to be environmentally neutral and not exhaustible, they reduce the dependence of the countries on imports of fossil fuels from abroad, they form an alternative to risky nuclear energy, and the operational costs of RES-E are low or virtually equal to zero (in case of sun and wind energy), although the capital costs are high [6,7]. On the cons side, the largest disadvantages of RES-E are the extremely and unexpectedly volatile energy production caused by dependence on weather conditions (wind, sunlight, sufficient water flow) as well as the overall cost of energy, which is still relatively high [8,9].

While the cost of RES-E electricity in the future is expected to be reduced or partly covered by the state [10], the inherent volatility of production depending on weather and other nature conditions, pose a more important problem for the energy market. The technical limitations on electricity storage make the successful operation of the RES-E electricity market contingent upon timely balancing of supply and demand. Highly inelastic electricity consumption on the consumption side, the balance is to be achieved mostly on supply side [11].

The smart grid (SG) technology presents a break-through in electricity distribution as it considers consumers to be an integral part of the system and enables the modification of purchasing patterns and behavior of buyers according to the obtained information, incentives, and disincentives [12]. It increases the demand elasticity and helps to balance the system also on the consumption side [13,14]. Hence, it might eventually solve the distributional issues related to RES-E. Currently, because of these and the other technical difficulties, RES-E energy is viewed more as a supplement to traditional energy producing technologies than as a viable replacement as it is reflected in low shares in energy production in many European countries. The exceptions are the countries where natural conditions allow for relatively stable and predictable RES energy production, and which were able to overcome the technical difficulties and replace significant parts of electricity production with RES (e.g., Norway or Iceland).

Most studies evaluating the overall effect of benefits and costs suggest that in most cases the net effect for the society is positive, and RES should be supported [15–18]. While the governmental support on the EU level as a whole and in the EU countries, in particular, has manifested itself via various governmental policies (for the overview and projection see del Río et al. [8]), public support still remains unclear.

Apart from the technological, distributional, and economic issues, which are not usually visible to the general public, other cons related to the direct public experience can influence their opinion. In the case of wind turbines, people complain on typical noise created by the turbines [19,20], visual factors deteriorating the scenery [21,22], the collusion of wind turbines with birds [23,24] leading to the change in their habitat, and resulting environmental imbalance [25,26]. The largest problems of solar energy visible to the lay person is high cost of photovoltaic panels, dependency on the sunlight, and intense land requirements, the latter especially in northern countries and in countries with high density of population and therefore high energy consumption. Some models indicate that if EU-27 countries are to cover 100% of electricity from solar energy, this will require around 50% of their available territory [27,28]. All the reasons presented above create doubts in viability of the RES-E to be a substitute for the conventional sources of energy, and reduce public support for RES-E.

Psychologically, public acceptance of energy resource mix is contingent upon three factors: (i) motives and goals; (ii) perceived context (trust and fairness issues); and (iii) knowledge and experience (see e.g., Huijts et al. [29]). Motives and goals that influence attitudes are in turn divided into benefits, costs, and risks [30–32]. Arguably, one of the biggest benefits of RES-E is the possibility to replace traditional, exhaustible, and environmentally dangerous resources with inexhaustible, clean, and potentially cheap energy. In addition, given the overall worry of nuclear energy use caused by

the Fukushima and Chernobyl accidents that were widely presented in mass media, RES-E offers safe radioactivity-free technology without any possible global accidents [33].

Arguably, the perceived context, knowledge, and experience (Huijts et al. [29]) can be divided into external (the external information and experiences) and internal (the ways one treats the information and experiences one receives). Obviously, the external side is affected by the various information and educational platforms, which may substantially differ in context discourses and contents presented (see e.g., van Dijk [34]). Here, similarly to public opinion research, the sources of information include exposition to mass media and interpersonal communication [35], social media, and internet sources [36], as well as education.

On the internal side, the overall life satisfaction and subjective living standard are well-studied factors. In accord with the studies by Truelove [37], Keller et al. [38], or Peters and Slovic [39] who focused on the influence of emotional states happiness included on the acceptance of various energy resources, in this paper we also study the effect of overall life satisfaction. Being associated with low anxiety [40,41], overall life satisfaction can reduce the fear of the new and increase support for new technologies given the information provided. Higher living standards may increase the acceptance of the cost side of new energy resource, which in the first stages might increase the overall cost of the energy mix.

The aim of this paper is to study the factors related to public opinions on renewables on a reasonable and representative sample of the Czech population ($N = 1026$, aged 15–95 years, $M \pm SD$: 47.64 ± 17.44 ; 48.80% women, 18.50% with higher education). Namely, we are interested in public opinions on whether it is possible to replace traditional electricity production with RES-E and their evaluation of use of renewable energy sources in the Czech Republic. Overall, ten hypotheses ($H_{i,j}$) listed below are tested (see Table 1 that follows).

Table 1. Hypotheses tested.

Indicator on Opinion on RES-E	Hypothesis	Factor
1 Public opinion on whether it is possible to replace traditional electricity production with RES-E ($H_{1,i}$) and	$H_{1,1}$	the exposure to sources of information (mass media, social networks, Internet and non-internet discussions)
	$H_{2,1}$	
	$H_{1,2}$	to sensitivity to environment protection
	$H_{2,2}$	
2 Public evaluation of current situation concerning use of renewable energy sources in the Czech Republic (good/bad $H_{2,i}$) are related to	$H_{1,3}$	the worries concerning nuclear energy
	$H_{2,3}$	
	$H_{1,4}$	subjective living standard
	$H_{2,4}$	
	$H_{1,5}$	subjective life satisfaction
	$H_{2,5}$	

RES-E, renewables as electricity resources; **Source:** Own results

2. Materials and Methods

2.1. Participants and the Survey

The data used for the empirical analysis presented in this paper were collected in May 2019 in a survey conducted by the Institute of Sociology, Czech Academy of Sciences. A total of 1026 respondents from the Czech Republic (aged 15–95 years, $M \pm SD$: 47.64 ± 17.44 ; 48.80% women, 18.50% with higher education) completed the questionnaire voluntarily and anonymously under the supervision of 217 experienced interviewers. The sampling relied on a representative sampling with quotas (geographical location, age, gender, and education). According to the correspondence of the samples with the total population in quotas, the data sample appears to be representative for the Czech Republic. The data were kindly provided by the Czech Social Science Data Archive [42]. The data are deposited on <http://nesstar.soc.cas.cz/webview/> and are available for free use for academic and research purposes.

2.1.1. Measures of Opinions on Renewable Energy Sources

As far as replacing the conventional energy production with the renewables constitutes the main rationale for the energy policy concerning renewables in Europe, the indicators concern the opinion of the respondents on whether it is possible to replace the classical energy production with energy production from renewables and whether the situation concerning the use of renewables in the Czech Republic is good or bad. The exact wording of the questions is presented below. The distributions of the respondents are presented in Table 2 below.

- “Do you think it is possible to replace electricity generation from the conventional sources (such as coal-fired or gas-fired power plants, nuclear power plants or large hydroelectric power plants) by generating electricity from wind, solar radiation, and biomass combustion?” (1—it is definitely possible to replace it, 2—it is rather possible to replace it, 3—it is rather not possible to replace it, 4—it is definitely not possible to replace it)
- “What do you think is the situation in our country concerning the use of renewable energy sources?” (1—very good, 2—rather good, 3—rather bad, 4—very bad) (Sociologický ústav, Akademie věd ČR, 2019 [42]).

Table 2. Indicators of attitude to renewable energy sources, distribution of the respondents, %.

	1, %	2, %	3, %	4, %	No Opinion, %
Use of renewable energy resources in the Czech Republic, 1—very good, 4—very bad	1.8	29.2	39.6	12.5	16.8
It is possible to replace electricity from conventional sources with renewables, 1—yes, 4—no	11.2	33.8	29.8	11.3	13.8

Source: Own results

The answers of the respondents were not uniform on whether it was possible to replace electricity produced by the conventional energy sources with renewables. Actually, the respondents were split into two approximately equal groups with 45% of the respondents who believed that it was, or rather was possible, while similar 41% believed that it was not possible.

Interestingly, the respondents were more inclined to evaluate the use of renewable sources of energy in the Czech Republic as unsatisfactory. More than a half of the respondents (52%) believed that the situation in the Czech Republic was rather bad or very bad. Only one-third of the respondents (31%), evaluated the situation positively or rather positively. Approximately 17 % of the respondents did not reveal their opinion at all.

2.1.2. Measures for the Exposition to Sources of Information on a Country Level Social Life

Arguably, mass media, internet, social groups, and discussion platforms are the most frequently used sources of information on social life and social discussion. However, discussion on socially relevant issues is not the only reason why people follow the particular medium. Other possible reasons include, e.g., background music, movies and entertainment, sources of excitement and emotions, diversions from their everyday life routines, following and presenting individual daily lives and activities, etc. In this study, we need to differentiate these sources and to collect the frequencies of following these sources for the information about the country's level social life. Therefore, the phasing on following country's level of social life is included in the questionnaire.

Exposition to sources of information and social discussions was measured by the answers to the following question:

“How often do you follow country's level social life via ... ” TV, printed newspapers and magazines, radio, news web pages on internet, internet discussions and blogs, social networks (for example Facebook, Twitter or Instagram), and discussions outside the internet. The answers and the distributions of the respondents are presented in Table 3 below.

Table 3. Indicators of exposition to mass media and social discussion platforms as for following country's level of social life. Distribution of the respondents, %.

How Often Do You Follow Country Level Social Life Via	at Least Once a Day, %	Several Times a Week, %	Once a Week, %	Less Than Once a Week, %	Never, %
TV	47.4	32.7	7.4	7.7	4.8
Printed newspapers and magazines	8.6	23.9	22.1	22.2	22.9
Radio	21.9	32.1	12.7	16.0	17.2
News web pages on internet	17.2	29.5	15.1	11.0	24.5
Internet discussions and blogs	6.2	13.7	13.6	16.2	49.5
Social networks (for example Facebook, Twitter or Instagram)	10.0	16.2	10.3	13.4	49.7
Discussions outside of internet	5.8	18.2	21.2	24.8	29.3

Source: Own results

As expected, TV and radio were the most frequently followed sources of information. Almost 50% of the respondents watch TV on a daily basis or listen to the radio at least several times per week. Printed newspapers and magazines are read by approximately 50% of the population at least once per week. Similar numbers (46%) participate in discussions outside the internet at least once per week. Social networks, internet discussions, and blogs are the least frequently used sources of information about country level of social life—49% of the respondents never use them at all (see Table 3).

2.1.3. Measures of Opinions on Environment

Three aspects are included: (i) the country level environmental protection (does the Czech Republic care enough about environmental protection); (ii) the individual level environmental protection (do respondents save energy and water for environmental reasons); and (iii) the self-reported level of information about the state of the environment in the Czech Republic. The exact wording of the questions is presented below. The distribution of the respondents across the indicators is presented in Table 4:

- “In your opinion, how much does the Czech Republic care of environmental protection?” 1—too much, 2—adequately, 3—too little
- “In your household, do you save energy and water for environmental reasons?” 1—always, 4—never, 4-point scale
- “Do you have enough information on the state of the environment in the Czech Republic?”, 1—sufficient information, 4—insufficient information, 4-point scale.

Table 4. Indicators of concern for the environment, nuclear energy use, and life satisfaction, distribution of respondents, %.

Indicators of Concern for the Environment	1, %	2, %	3, %	4, %	No Opinion, %
The Czech Republic cares about the environment, 1—too much, 2—adequately, 3—too little	1.9	48.3	44.9		4.8
Sufficiency of information about environment R, 1—sufficient information, 4—insufficient information	2.3	35.7	45.3	10.2	6.3
Saves energy and water due to environment, 1—always, 4—never	19.2	42.7	24.5	12.2	0.8

Source: Own results

From Table 4 it follows that the opinion of the respondent on whether the Czech Republic cares about environmental protection is skewed to the side of too little care (45%). The other 48% of the respondents believe that it cares adequately. In addition, respondents feel rather uninformed about the state of environment in the Czech Republic: 55% of the respondents believe that they do not have or rather do not have enough information about the state of the environment. Despite that, the respondents tend to care about the environment themselves: 62% of the respondents save the energy and water to protect the environment always or frequently and only 12% never do that.

2.1.4. Measure of Worry about the Use of Nuclear Energy

Apart from the environmental issues, the risks attached to nuclear energy are one of rationales for increasing the share of renewables in energy production. Here, we consider the level of worry about the use of nuclear energy in the Czech Republic. The exact wording of the question is presented below. The distribution of the respondents is presented in Table 4.

“Do you yourself feel worried about the use of nuclear energy in our country?” 1—very worried 4—not at all worried, on a 4-point scale.

From Table 4 it follows that Czechs are not worried about the use of nuclear energy—63% of the respondents stated that they are rather not worried or not worried at all.

2.1.5. Measures of Opinion on Living Standard and Life Satisfaction

Given that renewables are costly and present a relatively new technology, standard of living and life satisfaction of the respondents are the other two factors to consider. Both of them are related to the level of anxiety and fear of new things, which may substantially influence the acceptance of novel technologies. In addition, the standard of living proxies for the willingness to pay for the renewables as they are costly. The exact wording of the question is presented below. The distribution of the respondents is presented in Table 5.

- “Do you consider the standard of living of your household: 1—very good, 2—rather good, 3—neither good nor bad, 4—rather bad, 5—very bad”
- “How satisfied are you with your life?” 1—very satisfied, 5—very unsatisfied, 5-point scale

Table 5. Indicators of concern for the environment, nuclear energy use, and life satisfaction, distribution of the respondents, %.

	1, %	2, %	3, %	4, %	5, %	No Opinion, %
Concern for the nuclear energy use						
If worried of nuclear energy, 1—very worried 4—not at all worried	6.9	25.4	37.9	24.8		5.0
Life satisfaction and household living standard						
Life satisfaction, 1—very satisfied, 5—very unsatisfied	15.8	50.8	23.6	8.4	1.3	0.1
Household Living Standard, 1—very good, 5—very bad	9.4	45.6	34.0	9.5	1.3	0.3

Source: Own results

From Table 5 it follows that more than half of the respondents in the Czech Republic consider their household living standard to be rather good, and in general, are rather satisfied with their lives—55% of the whole sample stated that their household living standard is rather good or very good and 66% of the respondents stated that they are satisfied or rather satisfied.

2.1.6. Social and Demographic Factors

Social and demographic characteristics of the respondents can be summarized as follows: age (15–95 years, $M \pm SD$: 47.64 ± 17.44), gender (48.80% women), education (18.50% with higher education),

political orientation (22.8% left, 29.5% center, 36.9% right). We do not include income of the respondent as it is highly correlated with the household living standard.

2.2. Methods

We computed a set of ordinal multinomial regression analyses with spline corrections for ordinal predictors to study the factors associated with the attitude to renewable energy sources in the Czech Republic. The main model is presented below (see (1)). This model was computed four times for different indicators of attitude to renewables presented in the section of indicators above, and existence of opinion on the attitude towards renewables:

$$RE = \text{logit}(a_0 + a_{1-7}Info + a_{8-10}Env + a_{11}Nu + a_{12}LS + a_{13}Sat + a_{14}Age + a_{15}Sex + a_{16}Edu + a_{17}Pol + \xi) \quad (1)$$

where *RE* stands for the attitude towards renewable energy sources.

We employ four indicators: (1) It is possible to replace electricity from the conventional sources with renewables (1—yes, 4—no, 4-point scale, Table 1), (2) Use of renewable energy sources in the Czech Republic, 1—very good, 4—very bad (Table 2). In addition, we ran two similar regressions (formula 1) for the dummy variables on whether the respondent has an opinion on question (1) and (2) where:

- *Info*—stands for the exposition to a country's level social life in the mass media and other sources of information (see Table 3);
- *Env*—stands for the environmental concerns (Table 4).
- *Nu*—stands for the level of fear of nuclear energy (Table 5)
- *LS* and *Sat*—stands for living standard and overall subjective life satisfaction (Table 5)
- *Age*, *Sex*, *Edu*, *Pol*—stand for age, sex, education, and political orientation (right-left wing, 11-point scale) of the respondents respectively. The education variable was split into dummies for the elementary, secondary without state exam, secondary with state exam, and higher education. Higher education dummy was used as a reference variable.

2.3. Data Transformation—Inclusion of Ordinal Predictors to Regression Analysis

The academic opinion on whether it is appropriate to include ordinal predictors into the regression analysis is not always uniform. The researchers arguing against the inclusion stress the different distances between the categories, which may eventually lead to incorrect results [43,44] and suggest splitting the variable into a set of dummies. The opposing side counters with the idea that splitting the predictors into sets of binary variables would lead to the loss of ordinality and does not allow to include the ordinal predictor as an interaction term and testing of the mediating effects (see Helwig [45]).

In this paper, we chose not to split the ordinal predictors (except education and political orientation) but rather to transform the predictors via smoothing spline (ordinal spline transformation, knots 2, order 2), which offers a flexible approach for incorporating ordered predictors in regression models, and is proven to be invariant to any monotonic transformation of the predictor scores. The Pearson correlations of original and transformed variables are presented in Table 6. We did not compute spline transformation for education and political orientation, as the effect of education might not be linear and the political orientation was measured on a 11-point scale, which itself is close to the linear approximation.

3. Results

The results of the ordinal regression analyses predicting public opinion and existence of this opinion on possibility to replace electricity produced by the conventional technologies with the renewables and on the use of the renewable energy resources in the Czech Republic are presented in Table 6 that follows.

Table 6. Results of the ordinal regression analyses predicting support for renewable sources of energy and subjective evaluation of the renewable energy sources usage in the Czech Republic.

	It is Possible to Replace Electricity from the Conventional Resources with the Renewables		Use of Renewable Energy Resources in CR		It is Possible to Replace the Electricity from the Conventional Resources, No Opinion		Situation in our Case of Renewable Energy Resources. No Opinion		Corr.
	Estimate	Sig.	Estimate	Sig.	Estimate	Sig.	Estimate	Sig.	
Threshold = 1	−1.882	0.000	−4.328	0.000	3.023	0.000	3.275	0.000	
Threshold = 2	0.330	0.287	−0.714	0.029					
Threshold = 3	2.291	0.000	1.788	0.000					
Sources of information									
TV	0.042	0.617	0.068	0.446	0.220	0.120	0.229	0.073	0.987***
Printed newspapers and magazines	−0.046	0.570	0.123	0.146	−0.084	0.558	0.107	0.424	0.989***
Radio	0.094	0.225	−0.046	0.563	−0.096	0.478	0.155	0.227	0.975***
News web pages on Internet	−0.214*	0.020	0.157	0.106	0.187	0.209	−0.205	0.137	0.851***
Internet discussions and blogs	0.073	0.451	−0.163	0.114	0.003	0.986	−0.025	0.871	0.874***
Social networks	0.220*	0.020	0.040	0.688	0.017	0.922	0.127	0.415	0.936***
Discussions outside of internet	−0.027	0.718	−0.043	0.573	0.012	0.925	0.202	0.092	0.969***
Environmental concerns									
The Czech Republic cares about the environment	−0.167*	0.016	0.572***	0.000	0.013	0.914	−0.067	0.555	0.967***
Saves energy and water due to environmental	0.306**	0.003	−0.066	0.479	0.154	0.178	−0.085	0.560	0.694***
Self-claimed knowledge of environment	0.224**	0.001	0.101	0.157	0.702*	0.013	0.409	0.066	0.648***
Concerns for nuclear energy									
If afraid of nuclear energy	0.377***	0.000	−0.204**	0.006	0.050	0.668	0.083	0.447	0.974***
Socio-demographics and other									
Household Living Standard	0.292**	0.001	−0.022	0.808	−0.048	0.737	−0.052	0.698	0.932**
Satisfaction with life	−0.048	0.570	0.164	0.060	0.210	0.147	0.246	0.072	0.966**
Age	0.008	0.122	0.000	0.993	0.006	0.490	0.021*	0.010	
Political orientation	−0.011***	0.000	0.005	0.069	0.002	0.674	0.002	0.544	
Gender (men)	0.152	0.276	−0.048	0.741	−0.222	0.353	−0.553*	0.015	
Education elementary	0.220	0.403	−0.586*	0.032	1.008*	0.022	1.041**	0.009	
Education secondary w/o state exam	−0.187	0.338	−0.379	0.066	0.488	0.219	0.619	0.073	
Education secondary with state exam	−0.149	0.428	−0.085	0.666	0.453	0.244	0.072	0.838	
Cox and Snell Pseudo R-Square	0.127		0.127		0.042		0.061		
Nagelkerke Pseudo R-Square	0.138		0.143		0.086		0.116		
McFadden Pseudo R-Square	0.054		0.063		0.064		0.085		
N	772		754		860		859		
Sig.	0.000		0.000		0.009		0.000		

Note: ordinal regression, link function logit. *** Significant at the 0.001 level (2-tailed). ** Significant at the 0.01 level (2-tailed). * Significant at the 0.05 level (2-tailed). Reference variables: women, higher education. Ordinal predictors except education (4-point scale, dummies) and political orientation (11-point scale) were transformed via ordinal spline transformation (knots 2, order 2). a Corr.: Pearson correlation of the ordinal variable and its ordinal spline transformation. **Source:** Own results.

3.1. Sources of Information

Surprisingly, most of the sources of information (both formal and informal) were not statistically related to the opinions of the respondents. Out of the two statistically associated, news web pages

(negatively) and social networks (positively) were related to the opinion on possibility to replace electricity from conventional resources with renewables. The more often the respondents follow internet news, and the less frequently they follow country's level of social life on social networks (Twitter, Facebook, Instagram), the less they believe that the replacement is possible.

Two possible conclusions arise from the results above. First, the conventional media (one of the most frequently followed sources of country level information, see Table 3) seem to do a poor job in informing the public about the benefits of the renewable energy resources with respect to the conventional ones. Three reasons are possible: (1) not enough information presented, (2) presentation of the information is conducted mostly from the technological point of view, in sections devoted to science and technology, in a way not understandable or not interesting for the general public, (3) presentation of conflicting ideas that prevent the general public from making an opinion. However, from the last two regressions in Table 5 it follows that the existence of the opinion also did not seem to be related to mass media. We suggest that most possible reasons are (1) or (2). Especially, more work needs to be done to present perceived benefits and costs from the point of view of laymen as far as perceived benefits have the most significant impacts on the acceptance of all energy resources [46].

The other conclusion concerns the different impact of social networks (positive) and internet news (negative). Given that most of traditional media are also present on the internet, however, the relation of opinions and traditional media was statistically insignificant, we might suppose that alternative media form the negative opinion on renewables in their function to replace traditional sources. Traditionally, alternative news media are viewed and positioned as correctives of the mainstream news media (Holt et al. [47]), thus their interpretation is likely to be more critical. More research needs to be done on media framing of the renewables in alternative media.

In addition, more research needs to be done on the presentation of renewables on social networks (Instagram, Facebook, Twitter, etc.), even though 49.7% of the respondents never use these resources. From Figure 1 and Table 7 one can see a significant difference between the respondents following this resource more than several times per week (more positive ideas on RES-E), and less than once per week (more doubts about RES-E).

Figure 1. Confidence intervals for means showing two distinct groups on frequency of following country level social life on social networks (Facebook, Instagram) in their opinion about possibility to replace conventional electricity production with renewables. Note: x times per week denotes more than once per week. **Source:** Own results.

Table 7. Analysis of variance (ANOVA) results with Post Hoc tests (LSD) showing two distinct groups on frequency of following country level social life on social networks (Facebook, Instagram) in their opinion about possibility to replace conventional electricity production with renewables.

Multiple Comparisons			Sig.
ANOVA			0.000
Post Hoc Tests (LSD)			
daily	x times per week		0.577
	once per week		0.000
	< once per week		0.000
	never		0.000
x times per week	once per week		0.001
	< once per week		0.000
	never		0.000
once per week	less than once per week		0.927
	never		0.602
< once per week	never		0.490

Source: Own results.

The differences inside these groups are not statistically significant. The strict division of the respondents into these two groups support the bubble hypothesis where the frequent users of social media reinforce shared identities, and rely mainly or totally on the information shared within the bubbles as opposed to outer sources of information [48,49]. The positive effect of social networks on opinions on RES-E may arise from the phenomenon of Greta Thunberg, a Swedish environmental activist fighting against the climate change whose campaigning gained international recognition [50,51]. This phenomenon needs more research attention and might be a subject of further research.

3.2. Environmental Concerns

As expected, environmental concerns came through as significantly associated with the opinions on renewables on all three levels: (i) individual level; (ii) country level; and (iii) knowledge level. First, the more the respondents are dissatisfied with the extent the Czech Republic cares for the environment, the more they are inclined to believe that it is possible to replace the traditional electricity resources with renewables and that the overall situation concerning the use of renewables as main energy resources in the Czech Republic is bad. Here, we might hypothesize about what “bad” might imply. In general, three interpretations are possible: (i) too much use of the renewables; (ii) too little; or (iii) inappropriate use of the renewables. The idea of the relation between too much use and bad situation with renewables corresponds to the disadvantages of renewables. However, given the relationship with environmental concerns, the overall presentation of renewables and environmental advantages, and the overall energy rhetoric and policy in Europe, we are inclined to believe that the bad situation reflects insufficient use.

Second, the personal active care for environment is positively associated with the belief in RES-E: the more often the respondents save the energy and water to help the environment, the more they believe that it is possible to replace the electricity produced via conventional technologies with RES-E.

Third, self-claimed knowledge of environmental issues is positively associated with the belief in RES-E: the more people believe their knowledge of environmental issues is sufficient, the more they think that it is possible to replace traditional electricity resources with RES-E. In addition, and in accordance with our expectations, more self-reported knowledge was associated with the higher odds of opinions on RES-E as the alternative source of energy.

3.3. Concerns for Nuclear Energy

Interestingly, the worry about nuclear energy use was a significant predictor of both the belief in RES-E (it is possible to replace the electricity from conventional sources with RES-E) and the evaluation of the situation with the use of renewables as the main energy source in the Czech Republic in terms

of good or bad. The more the respondents are worried about the use of nuclear energy, the more they believe that it is possible to replace the traditional sources of electricity with RES-E and the more they think that the situation with the use of renewables in the Czech Republic is bad. The obvious explanation is that the fear of nuclear energy increases the belief in renewables.

3.4. *Standard of Living and Sociodemographic Characteristics*

As we expected, the optimistic opinion on RES-E (it is possible to replace the conventional electricity with RES-E) is associated with the higher standard of living and the right political orientation. Respondents with elementary education are more inclined to believe that the situation in the Czech Republic concerning the use of renewables is good compared to the respondents with higher education. Naturally, elementary education significantly reduces the odds of having an opinion on both RES-E and the situation in the Czech Republic concerning renewables comparing to the respondents with the higher education. Men are more likely to have an opinion on the situation with the renewables in the Czech Republic comparing to women. Older respondents are less likely to have an opinion on the renewables in the Czech Republic.

4. Discussion

According to our results described above, opinions of the Czech population on RES-E and on the renewables appear to be formed more on the basis of environmental concerns and concerns about the use on the nuclear energy. The formation of opinions via traditional mass media was not statistically significant. The internet news pages (including the alternative ones) tend to form more skeptical opinions, while social networks (such as Facebook or Instagram) create more favorable public perspectives. However, the exposition of the public to the country's level of social life on social networks is rather low (approx. 50% of the representative sample do not follow social networks), and the distribution of opinions with respect to the frequency of following social networks supports the hypothesis of the information bubble. Arguably, this bubble may be associated with the phenomenon of Greta Thunberg, a Swedish teenage environmental activist protesting against climate change, whose campaigning gained international visibility. The Facebook campaign of Miss Thunberg gained more than three million followers on Facebook in 2020 (Facebook data from 10.3.2020) with her page created just on December 7, 2018 (data from 10.3.2020). Similarly to the results reported in Qazi et al. [52] and Nisar et al. [53], we suggest that the role of social media including the media bubbles in opinion formation requires more research attention as social media constitutes a productive tool for generating public awareness on various events.

The negligible role of traditional mass media in informing the general public on laymen related to purely technological aspects of renewables and consequently to opinion formation, which may lead to insufficient support for the renewables in the Czech republic where 41% of the respondents in a representative sample believe that it is rather not or not possible to substitute traditional electricity with RES-E and that 52% of the respondents evaluate the situation with the renewables in the Czech Republic as bad or rather bad. The lack of public awareness, causing the lack of support, is a major barrier to the acceptance of renewable energy technologies [54].

We suggest a more active approach of researchers, mass media, and other alternative media as well as the governments in building the public opinion on RES. When traditional mass media does not reflect on this topic sufficiently, public opinion might be formed by alternative media sources, which are more vulnerable to various hoaxes, fake news, or misinterpretations. Similarly, in case of the lack of reliable information on renewables, more public attention might be given to various ecological and other activists who tend to create extremist opinions on the topic.

Furthermore, from the review of literature conducted in this paper, it follows that the public discussion on renewables in mass media need to present the pros and cons of renewables, which are relevant to the general public and not to focus on technical, market, financial, or political issues only. In this way, the issues on positive and negative encounter experiences with RES technologies

for the laymen such as installing solar panels on summer houses or disadvantages of wind power, gain particular importance. Similarly, it is important to create the perspective of attractiveness of the RES technologies as an investment opportunity for individual investors, who if it pays off, may partly decrease the financial burden from governmental institutions.

5. Conclusions and Implications

All in all, it becomes very clear that RES in general, and RES-E, in particular, represent a multidimensional problem in European politics, technology, businesses, market structures, and for the general public affected by both major benefits and costs. While the overall economic net benefits for the society is calculated to be positive in most cases, the levels of implementation in European countries vary significantly and the share of RES in energy basket differs from 88.68% in Norway, to 7.46% in Luxembourg. In the Czech Republic, their share increased from 0.29% (in 1989) to 10.31% (in 2018), which falls below the EU28 average (13.73%, 2008). Public support seems to be indispensable.

In the Czech Republic, public opinion on renewables and RES-E is far from uniform. In the last public opinion survey (2019), the general public revealed significant doubts on whether it is possible to replace the electricity produced by traditional methods with RES-E at all. The respondents were split into two approximately equal groups: 45% of the respondents believed that it was or rather was possible, while 41% believed that it was not possible. Similarly, most of the respondents were split about their evaluation of the use of the renewable energy sources in the Czech Republic. More than half of the respondents (52%) believed that the situation in the Czech Republic was rather bad or very bad. Only one third of the respondents (31%) evaluated the situation positively or rather positively—slightly more than half of the respondents (52%) believed that the situation in the Czech Republic was rather bad or very bad, while a third of the respondents (31%) evaluated the situation positively or rather positively.

Given the complexity of the issue and the opinion diversity in the Czech Republic, this paper studies the factors influencing the opinions of a reasonably representative sample of the Czech population ($N = 1026$, aged 15–95 years, $M \pm SD$: 47.64 ± 17.44 ; 48.80% women, 18.50% with higher education). Our results suggest that mass media and other sources of information were little related to opinions. The only related sources were internet news (negative perception of the renewables) and social networks such as Facebook, Twitter, and Instagram (positive perception). The distribution of opinions with respect to the frequency of following a country's level of social life on social networks strongly supported the hypothesis of a media bubble as we observed the exact cut line in distributions of opinions on frequency of once per week. We suggest that more media research should be done on this issue and we might hypothesize that the reason for the positive effect is the internet campaign of Swedish teenage environmental activist Greta Thunberg.

Moreover, it appears that the environmental concerns and worries about the use of nuclear energy were the factors most related to the public opinion on RES-E as well as the renewables. The more people are concerned about the environment (on the individual level, on country level, and in the aspect of self-reported level of information on environment) and the more they are worried about the use of nuclear power, the more they believe in the renewables. Therefore, we suggest, that public opinion on renewables in the Czech Republic is mainly created based on issues related to the environment and nuclear energy than on the overall presentation of pros and cons of the renewables in mass media. Nevertheless, more work needs to be done on the media analysis of presentation of the renewables to fully confirm this finding. From public opinion analysis, we can suggest that the mass media presentation is insufficient, poorly directed or missing, and that public opinion is formed on individual popularity of activists via social media bubbles, internet news where more space is given to alternative mass media, and individual preferences on environmental protection, or fears of nuclear energy technologies. However, more research needs to be carried out in order to inform the public via traditional media.

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