

## Social Attitudes towards Wind Farms and other Renewable Energy Sources in Poland

### Postawy Polaków wobec farm wiatrowych w aspekcie zrównoważonego rozwoju generacji energii elektrycznej

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#### ABSTRACT

**Introduction.** The development of the wind power industry brings benefits for humans and the natural environment through the reduction of pollution emitted into the atmosphere, the creation of new jobs, and the improvement of the energy security of the country. At the same time, however, it causes people's anxiety about adverse effects of wind farms on the environment and human health. The purpose of the study was to analyze the social attitudes of Poles toward wind power and other renewable energy sources. **Material and methods.** The research was carried out using the street survey method throughout the whole of Poland. It involved 1,169 respondents, including 680 (58.2%) from urban and 489 (41.8%) from rural areas; 354 (17.2%) respondents lived at a distance of more than 3 km from wind farms. **Results.** The majority of those surveyed support the development of the renewable energy source and wind industry, and can see the sense of investments in this sector. Every fifth respondent is prepared to pay more for renewable energy, bearing in mind that it reduces the emission of CO<sub>2</sub> into the atmosphere. The use of wind power contributes to: the protection of human health, the purity of the natural environment, the creation of new jobs, technological progress of Poland, the reduction of the air pollution, the improvement of energy security of the country, the prosperity of the region and its dwellers. **Conclusions.** Poles who do not live near renewable energy investments support the development of this sector. Nevertheless, the NIMBY syndrome cannot be excluded. Therefore, it is necessary to conduct research on two groups – a group of people living near renewable energy

investments and residents of places where such investments are not planned. Polish people also support for pro-ecological actions and demonstrate positive attitudes toward wind power and other renewable energy sources. They can see benefits for humans and the environment resulting from the development of wind energy and other renewables, and declare pro-ecological actions.

**Keywords:** renewable energy sources, social attitudes, wind farms, pro-ecological actions

#### STRESZCZENIE

**Wstęp.** Rozwój energetyki wiatrowej jest strategią zrównoważonego rozwoju, przynosi wymierne korzyści dla człowieka i środowiska naturalnego, między innymi poprzez zmniejszenie emisji zanieczyszczeń do atmosfery, w tym redukcji emisji CO<sub>2</sub>, tworzenie nowych miejsc pracy, oraz wzrost bezpieczeństwa energetycznego kraju. Ale prowadzi również do niepokoju wśród mieszkańców miejscowości, w których inwestycje są planowane, związanego z obawami o niekorzystny wpływ farm wiatrowych na zdrowie człowieka i środowisko. Celem pracy było określenie postaw Polaków wobec zrównoważonego rozwoju generacji energii elektrycznej, w tym wobec energetyki wiatrowej. **Materiał i metody.** Badania przeprowadzono na obszarze całej Polski, wśród 1169 osób, w tym 680 (58,2%) mieszkańców miast i 489 (41,8%) mieszkańców wsi. **Wyniki.** Rozwój odnawialnych źródeł energii, w tym energetyki wiatrowej jest popierany przez większość respondentów, co piąty badany jest skłonny zapłacić

więcej za energię odnawialną mając świadomość redukcji emisji CO<sub>2</sub> do atmosfery. Zdaniem badanych odnawialne źródła energii wpływają na: ochronę zdrowia mieszkańców, czystość środowiska naturalnego, tworzenie nowych miejsc pracy, postęp technologiczny Polski, zmniejszenie zanieczyszczenia powietrza, zwiększenie bezpieczeństwa energetycznego kraju, wzrost zamożności gminy. **Wnioski.** Polacy nie mieszkający w pobliżu inwestycji w energię odnawialną wspierają rozwój tego sektora, jednakże nie

można wykluczyć występowania syndromu NIMBY. Koniecznym jest przeprowadzenie badań w dwóch grupach – w grupie osób mieszkających w strefie inwestycji w odnawialne źródła energii oraz wśród mieszkańców miejscowości, w których takie inwestycje nie są planowane.

**Słowa kluczowe:** zrównoważony rozwój generacji energii elektrycznej, postawy społeczne, farmy wiatrowe, zachowania proekologiczne

## INTRODUCTION

The development of industry based on wind power and other renewable sources of energy is at present regarded as the top priority for environmental protection against climate changes. It brings notable benefits for humans and the natural environment, through the reduction of pollution emitted into the atmosphere, the creation of new jobs, and the improvement of energy security of the country. Moreover, it fosters the growth of underdeveloped regions rich in renewable energy [1–6]. Poland has introduced legal regulations concerning the commitments to use and promote renewable energy, which are the adaptation of the European Union directives to the Polish legislation [7, 8]. International literature claims that there is no correlation between social approval of wind energy and its acceptance on the local level. Some reports describe the NIMBY (*Not In My Back Yard*) effect which refers to the situation when social survey results suggest that there is public support for wind energy, but it is not certain that local communities living in the regions of investments will demonstrate similar level of acceptance [2, 4, 9–13]. Many authors claim that wind power projects are accompanied by an increasing resistance from local communities, mainly resulting from people's anxiety for their health and the consequences for the environment and the landscape, including visual effects disturbing the harmony of the countryside, and irritating light effects [14–19]. On the other hand the residents negotiated with investors for economic benefits for their community. Also Pedersen and Person Waye [20, 21] noted the relationship between economic benefits and the level of wind farm acceptance.

The analysis of advantages and disadvantages, which is performed in relation to the investment planned in one's place of residence, can be explained by Lazarus's cognitive appraisal theory of emotions. The construction of wind farms breeds

a feeling of insecurity and tension, which is perceived as overstraining or exceeding the coping abilities of an individual, and posing a threat to his/her interests [22]. The assessment of the situation in terms of "profits and losses" has an influence on the person's behavior and the level of acceptance (approval or disapproval), as well as public attitudes toward the investment recognized as an environmental stressor [22–24]. However, as pointed out by Ajzen (1986), carrying out such research before introducing a change to the environment makes it hard to predict people's behaviors, because of a divergence between declarations and real experiences associated with planning and completion of the project [24]. Human attitudes and actions are affected by internal and external factors, which should be taken into consideration in the analysis of public attitudes toward wind energy and other renewable energy sources [22, 23]. It was assumed in this study that positive attitudes toward wind and other renewables are manifested as approval of renewable energy, stronger support for the wind industry than for other renewable sources (both in the closest neighborhood and in the whole country), and searching for information about the influence of wind turbines on human health [25–27]. A special feature of social acceptance, according to Wolsink (2007), is a time dimension [4]. This author points to the relationship between the level of acceptance and the stage of the investment: planning, constructing, and completion of the works- the lowest level of social acceptance being observed at the stage of planning [4]. The opinion about wind energy and other renewables, on the other hand, is the collection of views on wind energy, wind turbines, and other renewable energy sources, which are held by a considerable part of the society and which have become the subject of a social debate [28].

The purpose of this study was to analyze social attitudes of Poles toward wind power and other re-

newable energy sources. At present, all wind energy projects in Poland and other countries encounter the opposition of local communities [29]. Despite an increasing number of scientific reports on attitudes toward wind farms, the number of such reports from Poland is limited [30].

## MATERIAL AND METHODS

A two-stage proportional stratified random sampling was used to select the area for the study and the number of respondents from particular regions of Poland. During the first stage of stratification, the population was divided into regions and the number of respondents from particular regions was determined; during the second stage of stratification, the population was divided into residents of urban and rural areas.

This survey-based study was conducted using a questionnaire asking about: the knowledge of sustainable development, opinions about wind energy and other renewable energy sources, and socio-demographic data necessary to describe the analyzed population. Most questions were assessed on a five-point Likert scale ranging from “*I fully agree*” to “*I don't agree at all*”. In the questionnaire the authors used questions proposed by Jones and

Eiser (2009) in their research on public attitudes toward the development of wind industry in Great Britain [3].

The statistical analysis was performed using the t-Student test for dependent and independent samples, the non-parametric U-Mann-Whitney test, and the Kruskal-Wallis test for more than two groups. The accepted level of statistical significance was  $\alpha = 0.05$ . The statistical analysis was done with Statistica 7.1. The project was approved by the Bioethical Commission of the Pomeranian Medical University in Szczecin, Poland [KB-0012/83/10].

## RESULTS

The study group consisted of 1169 subjects (table I), including 626 (53.6%) women, and 543 (46.4%) men. There was no statistical difference ( $p = 0.716$ ) between the mean age of women and men ( $35.92 \pm 15.07$ ). The majority of the respondents in the study group had secondary education (52%) and higher education (30.86%). Most respondents were employed (56.8%). Nearly every third respondent lived in the vicinity of wind turbines (30.28%; 354). There were no statistically significant differences between the age of the respondents from urban and rural areas ( $p > 0.05$ ).

Table I. Group structure according to socio-demographic data of respondents

Tabela I. Charakterystyka grupy badanej

Socio-demographic data		N = 1169				t-Student p
		X±Sd	Min-Max	n	%	
Gender	W			624	53.37	p<0.05
	M			545	46.62	
Age	All	35.95±15.03	18–84			p>0.05
	Women	35.8±15.06				
	Men	36.12±15.03				
Education/ Level ISCED 2011*	Primary/Level 1			73	6.24	p<0.05
	Vocational/Level 3			129	11.03	
	Secondary/Level 3			604	51.66	
	University/Level 6.7			363	31.05	
Place of residence	Urban			680	58.17	p<0.05
	Rural			489	41.83	
Employment	Employed			664	56.80	p<0.05
	Disability pension/ Retirement pension			111	9.49	
	Unemployed			69	5.90	
	Student			325	27.80	

\* International Standard Classification of Education (ISCED) 2011 – Draft (*Międzynarodowa standardowa klasyfikacja edukacji 2011 – projekt*)  
[http://www.regjeringen.no/pages/13530193/International\\_Standard\\_Classification\\_Education\\_2011\\_draft.pdf](http://www.regjeringen.no/pages/13530193/International_Standard_Classification_Education_2011_draft.pdf)

This section presents the results concerning social attitudes toward wind farms and other renewable sources of energy depending on the selected variables. Section 3.1 concerns the protection of the environment, Section 3.2 – the development of wind energy and other renewable energy sources, and Section 3.3 – the opinions about benefits of wind power development.

#### Attitudes toward environmental protection

A vast majority of the respondents claimed that human actions contribute to climate changes; 39.7% (464) of the surveyed said that the contribution is very big, and 42.34% (495) – big (the mean was  $4.22 \pm 0.83$ ). Some 17.96% (210) of the respondents said that human actions have no influence on climate changes. Personal concern for the environment mainly manifested itself as saving electrical energy (70.14%; 820), the separating of wastes (69.8%; 816), and not burning wastes in domestic stoves (59.96%; 701). Saving electrical energy correlated most strongly with the level of acceptance in the context of the concern for the environment (mean:  $4.26 \pm 1.06$ ). The surveyed Poles saved electrical energy through the installation of energy-efficient lighting (60.56%; 708) and minimizing unnecessary consumption of energy by home appliances. Some 8.89% of the surveyed entered into a contract with a power plant for energy supplies in different prices at different times of the day. Bearing in mind that this is how they could reduce the emission of CO<sub>2</sub> and other harmful gases into the atmosphere, 31.73% (371) of the respondents declared that they were ready to pay approximately 10% more for so called “green energy”; 24.12% (282) – up to 10% more, and 7.61% (89) – over 10% more than at that moment. Regardless of the place of residence, the vast majority of the respondents (68.26%; 798) did not want to pay more for electrical energy, even though they were aware that doing so would decrease the emission of CO<sub>2</sub> and other greenhouse gases. The majority of the respondents declared their support for wind power and other renewables (mean results  $4.18 \pm 1.21$  vs.  $4.28 \pm 0.98$ , respectively); the level of support depended on gender and education ( $p < 0.05$ ). The approval of renewable energy development was reflected by efforts to get information about new energy technologies. Most respondents claimed that reliable information about advantages and disadvantages of particular technologies would help them to decide whether they should be for or against the erection of wind turbines near their place of residence. The majority of the respondents did not participate in social consultations (13.34%), but 71.25% discerned

the need for such consultations. Out of 354 (100%) respondents, who knew about the plans of wind farm construction in their area, 44.06% (156) took part in information meetings. Some 29% of the surveyed were interested in wind energy issues (table II).

Table II. Attitudes toward the wind power industry  
Tabela II. Postawy wobec energetyki wiatrowej

Attitudes toward wind power industry	Yes	Neither yes nor no	No	No response
Can you see changes in the energy sector in Poland associated with spreading information on wind power?	37.21% (435)	22.92% (268)	39.26% (459)	0.59% (7)
Can you see the need for public consultations about wind power investment?	71.25% (833)	14.88% (174)	13.17% (154)	0.68% (8)
Do you take part in information meetings in your area?	13.34% (156)	8.46% (99)	77.33% (904)	0.85% (10)
Are you interested in wind energy?	29.09% (340)	23.35% (273)	45.85% (536)	1.71% (20)
Would reliable information about advantages and flaws of a particular technology facilitate your decision concerning acceptance for wind farms in the vicinity of your place of residence?	84% (983)	8.98% (105)	5.98% (70)	0.94% (11)

#### Attitudes toward the development of wind energy and other renewable energy sources

According to the majority of the surveyed Poles (62.8%; 734) the harness of wind energy prevents global warming. This group consisted mainly of people with higher and secondary education, women (66.98%) and residents of rural areas (65.03%). Every fifth respondent (20%; 222) had no opinion about these issues. The respondents mainly referred to wind (85.46%; 999) and solar power (85.29%; 997) as renewable energy sources; they less often mentioned other renewables such as: hydro power (71.43%; 835) as well as geothermal (43.20%; 505) and biomass energy (38.75%; 453). Some respondents associated renewable energy sources with nuclear power (19.33%; 226), and conventional energy (0.94%; 11) (table III). Education was a factor which had a statistically significant influence on the knowl-

edge of renewables. Wind was identified as a renewable energy source mostly by the respondents with higher and secondary education ( $p < 0.05$ ). Whether there was a relationship between the respondents' support for renewable energy development and their ability to differentiate between renewable and conventional energy sources was also analysed. A difference between the approval demonstrated by those who recognized renewable energy and those who did not was statistically significant ( $p < 0.05$ ). Poles support both wind power projects and, to a lesser

degree, the use of other renewables: hydro, solar, biomass, and geothermal energy. The respondents' education proved to have a significant influence on the acceptance of wind energy development ( $p < 0.05$ ). Similar support for conventional and nuclear energy ( $p > 0.05$ ) was not observed. According to the surveyed, the power of wind and other renewables is safer for humans and the environment than energy generated by conventional and nuclear power stations (the difference was a statistically significant: 0.909,  $p < 0.001$ ) (table IV).

Table III. Identification of and support for renewable energy sources (RSE)

Tabela III. Wspieranie rozwoju odnawialnych źródeł energii OZE

Renewable energy sources	Indicating to renewables			Support for renewable energy investment			
	N	%	p	X	Sd	t	p
Wind energy	999	85.46	.001 <sup>a</sup>	4.30	1.06	2.11	.036
Solar energy	997	85.29		4.05	0.97	3.23	.001
Hydro energy	835	71.43		4.05	0.94	5.11	.000
Geothermal energy	505	43.20		4.43	0.98	-4.78	.000
Biomass energy	453	38.75		4.36	0.97	-2.36	.018
Nuclear energy	226	19.33		4.39	0.98	-1.92	.055
Conventional energy	11	0.94		-	-	1.54	1.24

<sup>a</sup> chi-square test significance level with reference to education (*poziom istotności dla testu Chi-kwadrat z uwzględnieniem wykształcenia*)

t – Student's-t test statistic for dependent samples (*test t-Studenta dla prób zależnych*)

p – chi-square test significance level (*poziom istotności dla testu Chi-kwadrat*)

Table IV. Safety of renewable energy sources for human health and the environment

Tabela IV. Ocena bezpieczeństwa OZE dla zdrowia człowieka i środowiska naturalnego

Energy sources	X	Sd	Safety of energy sources			
			Conventional power plants		Nuclear power plants	
Wind energy	4.26	0.99	t	15.61	t	23.93
			p	.001	p	.001
			R	0.909	R	1.331
Solar energy	4.43	0.89	t	5.861	t	33.26
			p	.001	p	.001
			R	0.895	R	1.711
Hydro energy	4.23	0.97	t	15.53	t	24.21
			p	.001	p	.001
			R	0.887	R	1.312
Geothermal energy	3.58	1.24	t	1.54	t	4.38
			p	.124	p	.001
			R	0.216	R	0.718
Biomass energy	3.56	1.11	t	3.84	t	10.55
			p	.001	p	.001
			R	0.227	R	0.631
Nuclear energy	2.93	1.35	-	-	-	-
Conventional energy	3.35	1.34	-	-	-	-

t – Student's-t test statistic for dependent samples (*test t-Studenta dla prób zależnych*)

p – significance level (*poziom istotności*)

R – difference of the means (*różnica średnich*)

### Opinions about benefits of wind power

Polish people regarded the reduction of air pollution (90.93%) and the purity of the natural environment (90.6%) as the biggest advantages of harnessing wind power as a renewable source of energy; there were statistically significant differences depending on income *per capita* in the family ( $p < 0.05$ ). Favorable effects of wind power on human health were noticed by 83.23% of Poles. The differences in opinions about the influence of wind turbines on health were statistically significant and dependent on gender, education, income *per capita*, and a distance between a house and a wind farm (in all cases  $p < 0.05$ ). The respondents also mentioned higher energy security of the country (71.85%), independence of Poland from natural gas supplies (63%), and material benefits for the region (54.1%) and its inhabitants (36.3%) (table V). The authors analyzed the respondents' answers concerning advantages of the wind industry development with regard to the accepted variables. The respondents living in the vicinity of wind farms (over 3 km) significantly more often chose wind power stations and investments in the construction of wind farms ( $p < 0.05$ ). They were also statistically significantly more often inclined to believe in the favorable effects of wind power on human health and the purity of the natural environment ( $p < 0.05$ ) due to generating electrical energy without emissions of pollution. The comparison of answers provided by the surveyed residents of urban and rural areas, excluding those living near wind farms, revealed

Table V. Opinions about benefits of wind energy  
Tabela V. Opinie na temat energetyki wiatrowej

Opinions about benefits of wind energy	N	%	Presence of wind turbines		Education		Gender		Place of residence		Profession: Farmer		Income	
			H (4,N)	p	H (4,N)	p	Z*/t	p	Z*/t	p	Z*/t	p	Z*/t	p
I prefer wind power stations	-	-	11.07	.01	27.97	.001	2.11	.03	1.13*	.26	-0.74	.46	0.04	.19
I support wind power investments	-	-	13.12	.001	19.49	.001	2.97*	.003	1.23*	.21	-0.53	.59	0.04	.02
health protection	973	83.23	6.33	.04	14.22	.01	2.70	.007	1.16*	.24	1.38	.16	0.06	.04
purity of the environment	1060	90.60	7.68	.02	24.78	.001	1.33	.18	0.70	.48	2.14*	.03	0.07	.02
technological progress of Poland	956	81.80	1.18	.55	26.03	.001	2.97	.003	1.90	.06	-0.41	.68	0.05	.08
creation of new jobs	628	53.27	1.72	.42	1.63	.80	2.68	.007	1.98	.04	0.71	.48	0.001	.97
improvement of energetic security	840	71.85	1.12	.57	20.84	.001	4.06*	.001	1.43	.15	.071	.47	0.02	.49
independence of Poland from natural gas supplies	737	63.00	1.03	.60	8.86	.06	3.49*	.001	1.13	.25	0.80	.42	0.009	.76
reduction of air pollution	1063	90.93	0.72	.70	23.33	.001	3.29*	.001	0.54	.58	1.48	.14	0.12	.001
faster development of the region	633	54.10	1.49	.47	8.42	.07	1.00	.31	0.97	.32	0.02	.98	0.04	.19
prosperity of residents	424	36.30	0.53	.76	16.67	.002	3.11*	.001	-0.10	.91	0.33	.74	0.04	.17
lower energy prices	387	33.00	0.50	.78	-	-	-2.72	.01	-0.50	.61	-2.74	.006	-0.02	.48

R – Spearman's rank correlation coefficient (korelacja rang Spearmana)

H – the Kruskal-Wallis test statistic (sprawdzian testu Kruskala-Wallisa)

t – Student's-t test statistic for dependent samples (test t-Studenta dla prób zależnych)

Z – the Mann-Whitney U test statistic for large sample sizes (sprawdzian testu U Manna-Whitneya dla dużych grup)

p – test significance level (poziom istotności dla testów)

that the place of residence has no influence on the perception of benefits resulting from investments in the wind power industry with one exception – the creation of new jobs. Residents of rural areas held the opinion that investments in this sector generate new jobs, while residents of urban areas regarded wind farms as a source of revenues for the region; a statistically significant difference ( $p < 0.05$ ). Expected benefits of wind power development were the prospects for lower prices of electrical energy. Some 33% of the respondents thought that the development of this energy sector should result in a decrease in the costs of electrical energy consumption. Farmers significantly more often than representatives of other professions claimed that wind energy is tantamount to lower energy prices and the cleaner natural environment ( $p < 0.05$ ). Moreover, farmers significantly more often expressed an opinion that the development of wind power industry contributes to an increase in land prices in the vicinity of wind farms ( $p = 0.039$ ). Factors which have the strongest influence on the opinions about profits of wind power projects are education and gender of the surveyed Poles ( $p < 0.05$ ).

**Opinions about negative effects of wind turbines**

The respondents were asked to confirm or deny common opinions about harmful effects of wind farms on human health and the natural environment (table VI). The Polish people taking part in the study did not repeat opinions about detrimental effects of wind turbines on human health (mean  $1.89 \pm 1.09$ ). However, there was a statistically significant influence of gender, age, education, income *per capita* on the opinions about harmful effects of working wind turbines on human health and the noise emission. The elderly, men, respondents with lower education level, and those with low income more often mentioned detrimental effects of wind turbines and the noise which they produce (in all cases  $p > 0.05$ ). Respondents living near wind farms, on the other hand, more often mentioned negative influence of wind farms on land prices, the landscape and animals ( $p > 0.05$ ). According to 39.34% (460) of the respondents wind turbines negatively affect tourism (mean  $3.08 \pm 1.31$ ); there were statistically significant differences depending on the place of residence ( $p = 0.003$ ), age ( $p = 0.003$ ) and the level of education ( $p = 0.014$ ). There was a statistically sig-

Table VI. Opinions about negative effects of wind turbines  
Tabela VI. Opinie na temat negatywnego wpływu turbin wiatrowych

Adverse effects of wind turbines	X±Sd	Place of residence		Gender		Farmer		Age		Education		Income		Presence of wind turbines	
		T	p	T	p	Z / t*	p	R	p	H (4,N)	p	R	p	H (4,N)	p
Higher land prices	3.04±1.26	1.66	.09	1.95	.05	-2.05	.04	0.003	.91	3.45	.484	-0.02	.33	3.45	.48
Too much noise	2.68±1.23	0.39	.69	2.14	.03	1.15	.25 0	.06	.02	13.96	.007	-0.07	.02	13.96	.007
Negative effects on the landscape	2.81±1.38	1.22	.22	-0.58	.56	1.04	.30	-0.02	.37	13.39	.009	-0.11	.00	13.39	.009
Detrimental effects on human health	1.89±1.09	0.26	.79	1.97	.05	-1.30	.19	0.118	.001	13.30	.001	-0.07	.02	13.30	.001
Lower attractiveness of the region	2.49±1.30	-0.52	.60	0.15	.88	3.08	.001	-0.01	.62	11.75	.02	-0.10	.00	11.75	.02
Harmful effects to animals	2.29±1.24	-1.06	.29	-0.38	.70	-0.09	.93	0.03	.28	4.18	.382	-0.009	.76	4.18	.38
Effects on tourism	3.08±1.31	-2.95	.003	1.82	.07	1.02	.30	-0.08	.001	12.46	.014	-0.066	.03	12.46	.01
Higher energy prices	2.90±1.27	1.32	.18	0.84	.40	3.35*	.001	0.003	.91	4.29	.36	-0.029	.33	1.94	.38

t – Student's-t test statistic (test t-Studenta)  
 Z – the Mann-Whitney U test statistic for large sample sizes (sprawdzian testu U Manna-Whitneya dla dużych grup)  
 R – Spearman's rank correlation coefficient (korelacja rang Spearmana)  
 H – the Kruskal-Wallis ANOVA by ranks test statistic (sprawdzian testu ANOVA rang Kruskala-Wallisa)

nificant correlation between income *per capita* and opinions that wind farms have negative effects on the landscape ( $p=0.0001$ ) and make the region less attractive for tourists ( $p=0.0001$ ). The lower income the respondents had, the more often they mentioned negative effects. There was a significant correlation between the age and opinions about a negative impact of wind turbines on tourism ( $p=0.003$ ).

## DISCUSSION

The study presented here is innovative in Poland, since it has a nationwide character, raises socially important issues, such as energetic security of the country and the approval of renewable energy sources, and employs the attitude theory to explain the problem of acceptance of electricity generated by wind power stations [30]. The research shows that analyses of social opinions are important for the development of new energy technologies [29]. Results obtained by other authors suggest that general social disapproval of the wind power industry is a serious obstacle to its growth [2, 11, 12]. Wind power stations and other generators of renewable energy are the future of energetic security for many countries. At the same time, however, they are a serious social problem causing dissatisfaction and riots in the countries where they are erected [2]. In Poland, protests break out especially in the areas of the planned investments, often resulting in the suspension of the venture [29, 30]. They are usually associated with the concern for the standard of living, and more specifically: the influence of wind turbines on human health, consequences for the environment and the landscape, land prices and tourist development of the region [3, 26]. There are differences in social acceptance between residents of areas where renewable energy investments are not planned and places where such investments are intended or under construction. Hall et al., 2013, however, tend rather to seek the causes of this disparity in varied levels of social maturity and responsibility for the environment [31]. One-third of Poles involved in this study declared their readiness to pay more for “green energy” coming from renewable sources. These answers show that even though respondents affirm pro-ecological attitudes, they are still not prepared to incur the financial burden of environmental protection.

It was assumed in this study that attitudes of Polish people are dependent on socio-demographic factors, the knowledge of renewables, and the presence

of wind turbines near their places of residence. The literature about public attitudes toward new investments, suggests that people tend to accept changes if they are not in their close neighborhood [3, 10, 24]. It is quite the opposite with our study – irrespective of the place of residence (urban or rural area), the majority of respondents demonstrated positive active attitudes toward wind energy and other renewables, and definitely approved of wind energy projects. Similar results were obtained by Eiser, 2010, and Walker, 2010 [29, 30]. The respondents living at a distance of more than 3 km from wind farms considerably more often identified wind energy as a renewable energy source, had a preference for this source of energy, and supported wind power projects. They also significantly more often expressed the opinion that wind energy has favorable effects on human health and the natural environment. The results indicate the acceptance of wind energy sector resulting both from experiences and economic benefits. Farmers who expected financial benefits from leasing their lands thought about an increase in land prices in terms of profits associated with the investment. However, other residents who were unaware of this possibility, were afraid that their lands would lose value, and thus the prices would fall. Aesthetic feelings about the visual effects of wind turbines, and their perception as a strange element of the landscape, which disturbs its harmony, are essential for social attitudes and social acceptance of the renewables energy sector [31]. An additional element perceived negatively by residents of places located in the vicinity of wind farms is light effects regarded by people as irritating and disturbing their peace, rest and sleep, especially at night [9]. Also Pedersen and Person Waye (2004, 2007, 2008) proved that people who reap economic profits, or can see the prospects of economic and social development for their community in relation to wind power investments more often approve of this sector, and pay less attention to the harmful effects of noise on mental health [20, 21]. The authors obtained interesting results concerning benefits of wind energy investments. Factors which have a significant influence on the perception of such benefits are education (higher/secondary) and gender. Women and those with higher level of education more often than others choose wind power stations as renewable sources of energy and approve of investments in wind energy sector can see potential benefits for themselves, for their communities, the environment and the whole country. Similar results were reported by other researchers [4, 11, 25]. Two-third of the surveyed Poles mentioned a chance for Poland to become independ-

ent of natural gas supplies. One-third of the respondents held the opinion that wind energy is not able to make Poland self-reliant in terms of energy. These results show that there is a need to broaden Pole's knowledge of the energy security and the energy future of Poland, especially when interest in information meetings concerning renewable energy projects is very low. Even though, only about one-third of people living in the vicinity of wind farms ( $n = 354$ ) are interested in wind energy, as many as 44% took part in information meetings organized in their area. This may suggest that individual actions are strongly influenced by the community, the local worthies, and small social groups [22–24]. Based on the four-case study carried out in Australia, Hall (2013) demonstrated that positive social attitudes toward sustainable development and an increase in the acceptance of wind farms are possible, provided that social consultations are founded on four pillars, namely: trust, distributional and procedural justice, and place attachment [5, 31]. A lack of legislative transparency at the stage of planning, and choosing the location without social consultations result in hostile attitudes toward investments [4]. The tendered study showed that the surveyed had positive attitudes toward wind and other renewable energy sources. The question is, to what extent these opinions are only declarations made by people convinced that the problem does not apply to them. Similar observations on social acceptance of new technologies, displayed by people living in further neighborhood were described by other researchers [4, 10, 29–31]. On the other hand, it should be remembered that the surveyed could have given their preferences *ad hoc* on the spur of the moment [32]. There were significant differences between behaviors of people living in the vicinity of wind farms and those of other respondents. The first ones were more interested in wind energy and the planned investments, which was reflected by their participation in information meetings concerning plans of wind farm construction in their area.

## CONCLUSIONS

Poles who do not live near renewable energy investments support the development of this sector. Thus, the NIMBY syndrome cannot be excluded. Therefore, it is necessary to conduct research on two groups – a group of people living near renewable energy investments and residents of places where such investments are not planned. Polish people also declare pro-ecological actions and demonstrate pos-

itive attitudes toward wind power and other renewable energy sources. They can see benefits for humans and the environment resulting from the development of wind energy and other renewables, and support for pro-ecological actions. They can see benefits for humans and the environment resulting from the development of wind energy and other renewables, and declare pro-ecological actions. Some respondents, indicate to negative effects of wind farms on human health and the environment. They claim that wind turbines generate too much noise, are a blot on the landscape, and make the region less attractive for tourists. Putting emphasis on these negative aspects of wind energy investments is associated with the anxiety for health and the economic situation. The key to overcome people's resistance and increase their acceptance of the wind power industry is the involvement of local communities in the process of making decisions about their places of residence as early as at the stage of planning [3, 12, 38].

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