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THE ATTITUDE OF POLISH SOCIETY LIVING IN RURAL AND URBAN AREAS TOWARDS RENEWABLE ENERGY SOURCES

Abstract

The aim of the study was to determine the attitude of Polish society towards renewable energy sources and identify the benefits posed by activates that use renewable energy sources. A method of diagnostic survey was applied, conducting the study on the representative sample of 1,067 respondents. The Statistica 10.1 GB program and the analysis of discriminant function were used in statistical analysis.

It was shown that inhabitants of rural areas and small towns up to 30,000 residents were to the highest extent interested in renewable energy sources. Mainly, they saw the future in solar-powered devices to obtain the energy from renewable sources. Additionally, this group of respondents at the highest level was committed to protecting natural environment through the use of renewable energy sources. The main barriers to the use of renewable energy sources were the lack of mechanisms to support the reduction of energy intensity of

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the Polish economy, the increase of energy prices due to the lack of competition in the fuel wholesale market and the exploited transmission network.

The main benefits of the use of renewable energy sources are nature protection and savings associated with this kind of energy.

Keywords: renewable energy, benefits and barriers, rural and urban development

JEL codes: Q13, M31

Introduction

In many countries, especially these with high economic growth, the energy absorption is so great that energy resources without using renewable energy would not be sufficient. This is the reason why renewable energy and its acquisition policy are widely accepted by the societies (Borchers, Duke, Parsons, 2007, p. 3327; Kaenzig, Heinzle, Wüstenhagen, 2013, p. 312; Litvine, Wüstenhagen, 2011, p. 462; Visschers, Siegrist, 2014, p. 117). Increasing demand for energy resources is also associated with slow but systematic growth of the global population (Warner, Jones, 2017, p. 65).

These factors caused that the energy resources in the form of non-renewable energy resources started to decrease, making it necessary to search for alternative sources (Hodana et al., 2012, p. 6). A model of functioning global energy, created by Jones and Warner (2016), has shown that the energy sector in the coming years will not be able to deal with meeting the needs of the industrial economy and individual consumers in providing the energy without a support of renewable energy sources (Ahmed, Islam, Karim, Karim, 2014, p. 223).

The vast majority of Europeans, namely almost 90%, believe that their governments should pursue a policy of decisive increase of energy production from renewable sources (Eurobarometer, 2014), as these systems are far more effective than obtaining energy from fossil fuels or nuclear systems (Spence, Poortinga, Pidgeon, Lorenzoni, 2010, p. 385). Unlike the nuclear energy, renewable energy sources are associated with the benefits of environmental protection and significantly lower costs of acquiring such energy. These are the two main factors of technology acceptance in modern societies (Perlaviciute, Steg, 2014, p. 362).

The introduced ecological standards are very well received by European consumers (Kaenzig, Heinzle, Wüstenhagen, 2013, p. 311). They proved to be effective

in stimulating and channeling societies to use green energy (Pichert, Katsikopoulos, 2008, p. 64; Sunstein, Reisch, 2014, p. 128).

In 2013, the produced renewable energy accounted for only 19.1% of the world consumption (Gasparatos et al., 2017, p. 161). However, by 2014 the number of countries that adopted policies aiming at the production of renewable energy increased three and a half times compared to 2004. European Union directive on the use of energy from renewable sources assumes that by 2020 it will be used in 20% by the EU Member States (EC. Directive, 2009).

The aim of this paper was to define the attitude of Polish society to renewable energy sources. There were identified the benefits of using renewable energy and the motives for potential buyers to use different techniques to produce it. The criterion of the respondents' division was their place of residence. The research hypothesis is as follows: The place of residence does not affect the attitude of Polish local communities to renewable energy sources.

1. Methodology

A method of diagnostic survey was used in the study. The research tool was a questionnaire, which included 5 closed-ended questions. Additionally, a five-point Likert scale was applied, after the use of activities related to the construction and validation. There was calculated the index of scale reliability, where Cronbach's alpha was set at 0.84. The methodological procedure allowed calculating the size of research sample, where the confidence level was set at 0.95, the estimated size of fraction – at 0.50 and the maximum error – at 0.03.

The sample size was selected from the whole adult population of Poland, which amounted to 31,532,048 persons.¹ The sample size was set at 1,067 respondents, who were chosen taking into account sex, place of residence, age and individual six Polish regions. The number of the respondents was representative for these regions: central – 220, southern – 222, eastern – 188, southwestern – 109, northwestern – 164 and northern – 164 persons. The study was conducted in September and October 2016.

¹ Balance at 06.30.2016 according to GUS. Population size and structure by territorial division. Warsaw, 2016. The publication is available at www.gov.pl.

The Statistica 10.1 GB program and the analysis of discriminant function were used in statistical analysis. The classification function was used in the form of calculating coefficients that were determined for each of the created groups. Prior to the analysis, there was examined a multivariate normality, verifying each variable for normality of distribution. It was assumed that the matrices of variances were homogeneous in groups. A standard deviation was not included due to a large number of respondents in each group. Statistically significant were those differences in means, of which the probability of randomness was less than $p < 0.05$.

2. Study results

According to the respondents, the renewable energy sources which use solar energy have the greatest chance for development. This type, in a created discriminative function model, gained the highest value of classification function, which in the case of the inhabitants of rural areas amounted to 5.108. This value was significantly higher (at $p < 0.001$) than in the case of the inhabitants of towns up to 30,000 (4.662) and over 30,000 (4.789). Inhabitants of rural areas (0.849) to a significantly lesser degree, at $p < 0.001$, than other two groups of the respondents (respectively: residents of towns up to 30,000 – 1.192 and over 30,000 – 1.198) saw the future in the use of wind as a renewable energy source. A similar situation occurred in the case of the use of biogas, where a significant difference in the size of classification function between groups of respondents was $p = 0.035$ and constituted respectively: urban areas – 1.400, inhabitants of towns up to 30,000 – 1.764 and above 30,000 – 1.692. Inhabitants of urban areas (1.219) to a significantly higher degree, at $p < 0.001$, saw the future in the use of biomass to energy production than inhabitants of towns up to 30,000 (0.688) and over 30,000 (0.703). It is worth noting that in the created model there were not included water tanks and rivers, so often used today for energy production (table 1).

Table 1. Preferences regarding the future of various renewable energy sources

Type of renewable energy sources	Wilks' lambda: 0.702 F=10.131 p<0.001*			Classification function (place of residence)		
	Wilks' lambda	F value	P level	Village	town up to 30 thousand inhabitants	towns over 30 thousand inhabitants
Water	0.692	12.987	0.001*	0.849	1.192	1.198
Biogas	0.732	3.501	0.035*	1.400	1.764	1.692
Biomass	0.708	14.226	0.001*	1.219	0.668	0.703
Solar	0.708	8.186	0.001*	5.108	4.662	4.789
Constans				17.113	16.340	16.362

* level of significant difference at $p < 0.050$

Source: author's own analysis based on study material.

The respondents' answers on the potential consumption of renewable energy sources indicated solar collectors as the most commonly used energy source. Inhabitants of rural areas (3.516) and bigger towns (3.272) were to a significantly higher degree interested in gaining energy in this way than residents of towns up to 30,000 (2.730). Differences in the size of classification function were significant at $p < 0.001$. The inhabitants of rural areas to a significantly lesser degree, at $p = 0.032$, were interested in using heat pumps as a source of energy than in the case of the inhabitants of towns up to 30,000 (1.029) and over 30,000 (1.014). In the model of created discriminatory function, there were also biomass boilers as the willingly used renewable energy source. To a significantly higher degree, at $p < 0.001$, the inhabitants of rural areas (0.935) and small towns (0.910) were more interested in such energy than residents of towns above 30,000 (0.588) (table 2).

Table 2. Sources of energy preferred by the respondents

Sources of energy	Wilks' lambda: 0.693 F=9.323 p<0.001*			Classification function (place of residence)		
	Wilks' lambda	F value	P level	Village	town up to 30 thousand inhabitants	towns over 30 thousand inhabitants
Solar collectors	0.694	27.362	0.001*	3.516	2.730	3.272
Biomass boilers	0.682	8.775	0.001*	0.935	0.910	0.588
Heat pumps	0.698	3.778	0.032*	0.693	1.029	1.014
Constans				11.391	10.254	10.030

* level of significant difference at $p < 0.050$

Source: author's own analysis based on study material.

The respondents treated protection of the environment as the greatest benefit in the use of renewable energy sources. Such approach to renewable energy sources to the highest degree (at $p < 0.001$) was declared by the inhabitants of towns up to 30,000 (4.433) and rural areas (4.260) than of towns over 30,000 (3.663). Also high values of classification function were shown in the case of declaration of higher energy savings while using renewable energy sources. In this case, such declaration at a more significant level (at $p < 0.001$) was expressed by the inhabitants of rural areas (3.368) and large towns (3.795) than the residents of towns up to 30,000 (2.761). For the inhabitants of rural areas (2.177), at $p < 0.00$, more important issue was to become less dependent from fossil fuels than in the case of the inhabitants of large towns (1.888) and towns up to 30,000 (1.846). A reduction of greenhouse gas emission, thanks to the use of renewable energy sources, was significantly more important, at $p = 0.017$, for the inhabitants of towns up to 30,000 (1.0890) than of rural areas (0.947) and large towns (0.763). The classification function also reached high values in the created model when declaring energy security and gradual independence from foreign sources of energy. This, in a significant way, at $p = 0.031$, was emphasized by the inhabitants of towns up to 30,000 (1.913) and those living in rural areas (1.905) than the inhabitants of towns over 30,000 (1.667) (table 3).

Table 3. The benefits of investing in renewable energy sources

Type of benefits from the use of renewable energy sources	Wilks' lambda: 0.692 F=8.665 p<0.001*			Classification function (place of residence)		
	Wilks' lambda	F value	P level	Village	Town to 30 thousand inhabitants	Towns over 30 thousand inhabitants
Energy security and the gradual dependence on external sources	0.698	3.484	0.031*	1.905	1.913	1.667
Reduction of greenhouse gas emissions	0.692	4.047	0.017*	0.947	1.089	0.763
Savings in energy use	0.683	28.223	0.001*	3.368	2.761	3.795
Independence from fossil fuels	0.692	7.278	0.001*	2.177	1.846	1.888
Protection of natural environment	0.687	11.649	0.001*	4.260	4.433	3.663
Constans				23.564	23.560	21.748

* level of significant difference at p<0.050

Source: author's own analysis based on study material.

According to the respondents, the most important barrier that affects the level of consumption of renewable energy sources is the lack of mechanisms supporting the reduction of energy intensity of the Polish economy. This factor was significantly more important, at p<0.001, for the respondents of rural areas (2.705) and small towns (2.606) than the residents of larger towns above 30,000 (2.234). Similar correlations, at p=0.021, were shown in the case of a factor indicating an increase in energy prices as a result of the lack of competition on the fuel wholesale market. The value of classification function in the case of the inhabitants living in rural areas was 2.198, while towns up to 30,000 inhabitants – 2.242, and in the case of bigger towns over 30,000 inhabitants – 1.028. Also high values of classification function in the created model were demonstrated in the case of a factor indicating the lack of coherent sustainable development policy on air protection. Significantly higher declarations, at p<0.001, were declared by the residents of towns above 30,000 (2.311) and towns up to 30,000 inhabitants (2.285) than in the case of those living in rural areas (1.854). The exploited electricity grid was treated as a barrier at a significantly higher level (at p<0.001) by the inhabitants of rural areas (1.591) and towns up to 30,000 residents (1.504) than it was in the case of the inhabitants of large towns (2.209). The indicated barrier was the lack of a stable policy to promote the use of renewable energy sources. At the highest level, at p<0.004, this factor was pointed by

the inhabitants of towns up to 30,000 (1.105) than those living in rural areas (0.681) and large towns (0.678) (table 4).

Table 4. Barriers affecting the use of renewable energy sources

Type of barrier	Wilks' lambda: 0.688 F=10.622 p<0.001*			Classification function (place of residence)		
	Wilks' lambda	F value	P level	Village	Town to 30 thousand inhabitants	Towns over 30 thousand inhabitants
The lack of mechanisms to support the reduction of energy intensity of the economy	0.662	7.255	0.001*	2.705	2.606	2.234
The increase in energy prices resulting from the lack of competition in the wholesale market	0.682	3.858	0.021*	2.198	2.242	1.928
The lack of stable policy to promote renewable energy sources – monopoly of the energy market	0.674	5.465	0.004*	0.681	1.105	0.678
Too complicated procedures for obtaining permits and energy accounting	0.699	3.704	0.024*	1.231	1.192	0.917
Exploited infrastructure of power grids	0.669	9.879	0.001*	1.591	1.504	1.209
Lack of coherent policy on sustainable development in air protection	0.679	7.535	0.001*	1.854	2.285	2.311
Constans				19.987	18.712	17.977

* level of significant difference at $p < 0.050$

Source: author's own analysis based on study material.

The respondents declared at the highest level that the most important support of investing in the use of renewable energy sources is through financial activities in the form of grants from environmental and EU funds. At significantly higher level, at $p < 0.001$, such declarations were reported by the respondents living in rural areas (5.165) than small (4.685) and large towns (4.753). In the created model there were also included tax reliefs as a compensation for introducing devices using renewable energy sources. To a significantly higher degree, at $p = 0.007$, such declarations were given by the inhabitants of towns up to 30,000 (2.539) and those living in rural areas (2.449) than the residents of towns over 30,000 (2.239). Additionally, the inhabitants of rural areas (2.112) at significantly higher level, at $p = 0.007$, declared that legal quantitative commitments could stimulate the society to use the renewable energy sources on a larger scale (table 5).

Table 5. Type of support that will encourage investments in renewable energy sources

Type of support	Wilks' lambda: 0.660 F=12.128 p<0.001*			Classification function (place of residence)		
	Wilks' lambda	F value	P level	Village	Town to 30 thousand inhabitants	Towns over 30 thousand inhabitants
Financial (subsidies from environmental funds and EU funds)	0.698	14.199	0.001*	5.165	4.685	4.753
Legal (quantity commitments)	0.689	4.939	0.007*	2.112	1.833	1.845
Tax (relief in excise tax) market	0.698	4.927	0.007*	2.449	2.539	2.239
Constans				20.917	18.525	18.914

* level of significant difference at $p < 0.050$

Source: author's own analysis based on study material.

Conclusion

The research hypothesis was not fully confirmed in the study. It was shown that the inhabitants of rural areas and towns up to 30,000 were to a greater extent interested in renewable sources of energy, as it was proved by numerous significant differences in comparative studies of particular groups of the respondents. A similar situation was also observed in the United Kingdom, where the residents of smaller towns were very interested in renewable energy sources. An example of such town is Leeds, where small roof installations were very popular and required no special permission for their installation (Adam et al., 2016, p. 45).

The inhabitants of rural areas to a greater extent saw the future in devices using solar energy to obtain energy from renewable sources. However, it should be stated that this factor, to the highest degree, gained the acceptance of all groups of the respondents. It was observed that towns which are actively involved in strategic energy management contributed to achieving goals set by national energy policies, aiming at the reduction of carbon dioxide emissions and increase of the inhabitants' income of the population (Allman, Fleming, Wallace, 2004, p. 271; Platt, Straw, Aldridge, Williams, 2014, p. 10).

Production of electricity using sun energy is an alternative energy system which gains the highest social recognition and support in the European Union (Borchers, Duke, Parsons, 2007; Kaenzig, Heinzle, Wüstenhagen, 2013, p. 316). The inhabitants of rural areas were the most interested group of the respondents in such type of energy, as they ought to maintain residential and farm buildings.

The inhabitants of towns up to 30,000 and those living in rural areas were to the utmost extent interested in the environmental protection. Also the inhabitants of rural areas treated new sources of energy as the energy savings in contrast to traditional ways of energy production. They also want greater independence from fossil fuels, mainly coal, as well as energy security. It should be noted that this problem, to a great extent, also concerned the inhabitants of small towns.

The main barriers observed by Polish society in acquiring new energy sources are the lack of mechanisms supporting the reduction of energy intensity of the Polish economy, the increase in energy prices due to the lack of competition in the fuel wholesale market, and exploited transmission network. These factors were most closely addressed by the inhabitants of small towns and rural areas. The inhabitants of Western Europe also pointed to the lack of investment capital, complex organizational structures in local government, frequently changing national policies, and the lack of knowledge about the energy value of assets (Kelly, Pollitt, 2011, p. 462; Bale, Foxon, Hannon, Gale, 2012, p. 242).

The inhabitants of rural areas in particular were interested in providing financial support in the form of grants from ecological and EU funds and tax reliefs that would encourage the use of renewable energy sources. Such solutions were mostly attractive for the inhabitants of rural areas and small towns. This was dictated by the fact that new technologies that use the energy, especially solar one, are mostly created in these areas. A confirmation of the rightness of such actions in Poland is the West Pomeranian region, where the inhabitants who use solar collectors recorded savings of up to 90% during the summer and 40% in the winter (Igliński, Buczkowski, Cichosz, Piechota, 2013, p. 772). However, without financial support from the EU funds, because such installations are expensive, economical savings on such scale would not take place (Lambert, Silva, 2012, p. 4667).

Financial incentives are used in the light of climate changes in Asia and Japan (Chen, Kim, Yamaguchi, 2014, p. 319). This is a market-independent model, as the price of renewable energy is set by the government and is not subject to market fluctu-

tuations. The policy pursued by the governments of so-called “Asian tigers” was a big step not only in the economic development, but also in the use of ecological solutions. Currently, China has the largest share of the global solar heating market (Hua, Oliphant, Hu, 2016, p. 1044). In Taiwan, subsidies are adjusted by the government on the basis of the cost of energy production from renewable sources. There are various subsidies that are directed to the consumers, effectively solving problems with electricity (Zeng, Liu, Lui, Nan, 2017, p. 860).

The main benefits of the use of renewable energy sources are nature protection and savings associated with this kind of energy. These two factors are very important for developing countries, including Poland (Banshwar, Sharma, Sood, Shrivastava, 2017, p. 1390). Such declarations were also expressed by the respondents in the conducted study.

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STOSUNEK SPOŁECZEŃSTWA POLSKIEGO ZAMIESZKUJĄCEGO TERENY WIEJSKIE I MIEJSKIE DO ODNAWIALNYCH ŹRÓDEŁ ENERGII

Abstrakt

Celem pracy było określenie stosunku polskiego społeczeństwa do odnawialnych źródeł energii i wskazanie korzyści, jakie niosą działania wykorzystujące odnawialne źródła energii. W badaniach zastosowano metodę sondażu diagnostycznego, przeprowadzając badania na grupie reprezentatywnej 1 067 respondentów. Przy analizach statystycznych wykorzystano program Statistica 10.1 PL, a w nim analizę funkcji dyskryminacyjnej.

Wykazano, iż w wyższym stopniu odnawialnymi źródłami energii zainteresowani byli mieszkańcy wsi i małych miast do 30 tys. mieszkańców. Widzieli oni przyszłość w pozyskiwaniu energii ze źródeł odnawialnych, głównie w urządzeniach wykorzystujących energię słoneczną. Także tej grupie respondentów w największym stopniu zależy na ochronie środowiska naturalnego poprzez wykorzystanie odnawialnych źródeł energii. Wskazano na główne bariery w wykorzystaniu odnawialnych źródeł energii, którymi są: brak mechanizmów wspierających obniżenie energochłonności polskiej gospodarki, wzrost cen energii w wyniku braku konkurencji na rynku hurtowym paliw oraz wyeksploatowana sieć przesyłowa.

Korzyści płynące z wykorzystania odnawialnych źródeł energii to przede wszystkim ochrona przyrody i oszczędności płynące z tak pozyskiwanej energii.

Słowa kluczowe: odnawialne źródła energii, korzyści i bariery, rozwój obszarów wiejskich i miejskich