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ATTITUDE OF THE POLISH SOCIETY TOWARDS RENEWABLE ENERGY SOURCES. SEGMENTATION BY GENDER

Abstract. The concept of sustainable development has been transferred to the energy sector, resulting in defining a new term: the sustainable energy development. Its underlying principle is the efficient use of energy, human, economic and natural resources. Renewable energy sources (RES) play an increasingly important role in the energy mix and in the functioning of local communities. The purpose of this study was to discover the attitude of Polish society towards renewable energy sources, disaggregating the data by gender. Efforts were also made to determine the importance of renewable energy sources for the functioning of a modern society. A diagnostic survey method was used in this study. The survey was conducted with a representative sample of 1067 respondents. The statistical analyses were performed with Statistica 10.1 PL, and were based on the discriminant function with an analysis of the classification function. The respondents declared to save energy by turning off the light when leaving a room, and that they would prefer to use the solar collectors as an alternative future source of energy. In the opinion of respondents, investments in energy significantly contribute to environmental protection. The biggest barriers to the use of renewable energy sources are: the lack of mechanisms supporting the reduction of energy consumption across the economy; the increase in energy prices because of a lack of competition on the wholesale market; and the lack of a coherent policy for sustainable development addressing air protection issues. The respondents were found to significantly differ by gender in their approach to renewable energy sources.

Keywords: sustainable development, Polish households, preferences, benefits of investing

INTRODUCTION

Across the globe, climate changes have brought the need to reduce greenhouse gas emissions, making the global community look for new renewable energy sources that would not involve direct emissions of carbon dioxide into the atmosphere. Currently, the leading environmentally-friendly and the most cost-effective way to reduce CO_2 emissions is the use of solar energy which meets to the greatest extent the growing demand for energy (Sener and Fthenakis, 2014). Over the last 30 years, solar energy costs have consistently decreased (Vartiainen et al., 2015). Today, renewable energy (including solar energy) benefits from large tax relieves and is therefore even more demanded (Timilsina et al., 2012). The growing number of different solutions for the use

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of renewable energy sources provides financial benefits associated with the reduction of CO_2 emissions (Breyer et al., 2015) while also affecting energy security, production diversification and job creation. Renewable energy can also be a way to improve the supply of electricity to rural areas and to reduce the number of power cuts, and thus could contribute to reducing economic losses (Sener and Fthenakis, 2014). Renewable energy has been recognized as an ideal way to balance the energy supply mix required for a growing population (González et al., 2016).

The primary goal of a sustainable energy policy is to limit the adverse impact of energy on the atmosphere by: supporting measures and initiatives taken to promote the use of energy from unconventional renewable sources in a way which is both environmentally safe and cost effective for the economy; implementing less harmful and more efficient systems for energy production, transmission, distribution and use; and maintaining a balance between energy security, social needs, economic competitiveness and environmental protection (Pultowicz, 2009).

In the last decade, a rapid development of different renewable energy solutions has been observed (Del Rio and Burguillo, 2009). Considering that most renewable energy solutions are implemented in rural areas (OECD), it has undoubtedly a positive impact on the development of rural communities (Cuellar, 2009; Del Rio and Burguillo, 2008). As shown by some studies, introducing renewable energy solutions can increase local budget revenues and reduce rural unemployment (Cebotari and Benedek, 2017). Also, RES projects have a positive impact on demography, agricultural development and social capital levels (Dincer, 2000; Faulin et al., 2009; Kammen et al., 2004; McKendry, 2002).

Poland – just like Ireland, Portugal, Finland, Greece, Romania and other countries who joined the European Union – is regarded as a European developing country in the relevant research (Amri, 2017). For this group of countries, a strong correlation was demonstrated between the introduction of RES solutions and GDP growth. Also, the energy sector offers employment opportunities for the local population (Arellano and Bond, 1991; Wojciechowska-Solis and Soroka, 2018).

The purpose of the study was to determine the attitude of Polish society towards renewable energy sources. The respondents' gender was a determinant that helped emphasizing the importance of renewable sources of energy in the functioning of the Polish society. The analysis covered the Polish households' electricity saving methods; preferences for the use of renewable energy sources in the future; and benefits of investing in renewable energy sources. Also, the barriers affecting the use of renewable energy sources in Poland were identified.

METHODOLOGY

This study relied on a diagnostic survey method. The research tool was a questionnaire with 5 closed-ended questions. Following the construction and validation process, a five-point Likert scale was applied to measure the attitudes.

The sample was selected from the whole adult population of Poland which is 31,532,048 people[1]. The index of scale reliability was calculated with the Cronbach's alpha set at 0.84. The methodological procedure enabled calculating the size of the research sample with a confidence level set at 0.95, the estimated size of fraction set at 0.50 and the maximum error set at 0.03. The sample size was set at 1067, and the following criteria were considered when choosing the respondents: place of residence (village; town with a population of up to 30,000; town with a population over 30,000), age (up to 25 years; 26 to 40 years; 41 to 55 years; 56 years and more), gender, and 6 regions of Poland. The number of respondents was representative for the following regions: central (220), southern (222), eastern (188), southwestern (109), northwestern (164) and northern (164). The study was conducted in September and October 2016. The respondents' gender was a determinant used to disaggregate the research sample; the share of women and men in the total sample was 51.6% and 48.4%, respectively.

The statistical analysis was performed with Statistica 10.1 PL, and involved the analysis of the discriminant function. The classification function was used, and consisted in calculating the coefficients for each of the groups created. Prior to the analysis, multivariate normality was examined by testing each variable for normality of distribution. Variance matrices were assumed to be homogeneous across groups. Standard deviation was not covered due to a large number of respondents in each group. The differences in means were considered

[1] As at June 30, 2016, according to a publication of the Central Statistical Office: "Population. Size and territorial distribution," Warsaw, 2016. Available online at www.gov.pl.

statistically significant if the probability of randomness was less than $p < 0.05$.

STUDY RESULTS

The most popular way to save electricity was to turn off the light when leaving the room. The value of the classification function for women (who paid more attention to that practice) and men was 3.577 and 3.304, respectively, with a statistically significant difference at $p < 0.001$. Additionally, women made more efforts to avoid the use of standby mode in audio-video and household equipment. In this case, the difference was statistically significant at $p = 0.016$, with the mean values for women and men being 1.084 and 0.928, respectively. Both genders reached similar values of the classification function when it comes to using energy-efficient electricity (1.723 and 1.620 for men and women, respectively). The energy efficiency labeling of audio-video and household equipment was less important for the respondents. Men were more interested in this information (0.269) at a significantly higher level (at $p = 0.032$) than women (0.133) (Table 1).

Both groups of respondents found solar energy to be the most promising solution for the future. The mean value of the classification function for women (4.833) was significantly higher, at $p < 0.001$, than the mean value for men (4.492). Also included in the model, geothermal sources of energy were significantly more often (at $p < 0.001$) mentioned by men (1.257) than by women (0.890) who were significantly more interested (at $p < 0.001$) in obtaining energy from water: the value of the classification function for women and men was 1.248 and 1.006, respectively (Table 2).

Table 1. Energy saving practices of Polish households

Energy saving practices	Wilks' lambda: 0.687 $F = 5.139$, $p < 0.001$*			Gender of respondents	
	Wilks' lambda	*F* value	*p* value	woman	man
I always turn off the light when leaving the room	0.678	12.113	0.001*	3.577	3.304
I pay attention to energy efficiency labels when buying audio-video and household equipment	0.658	4.561	0.032*	0.133	0.269
I avoid using standby mode in audio-video and household equipment	0.649	5.767	0.016*	1.084	0.928
I use energy-efficient electricity	0.688	2.256	0.133	1.620	1.723
Constant				12.604	13.139

*Significant difference at $p < 0.050$.
Source: own analysis based on research material.

Table 2. Preferences for the future use of different renewable energies

Type of energy source	Wilks' lambda: 0.662 $F = 13.675$, $p < 0.001$*			Gender of respondents	
	Wilks' lambda	*F* value	*p* value	woman	man
Solar	0.638	18.198	0.001*	4.833	4.492
Geothermal	0.650	21.259	0.001*	0.890	1.257
Water	0.698	12.390	0.001*	1.248	1.006
Constant				13.640	13.481

*Significant difference at $p < 0.050$.
Source: own analysis based on research material.

Of all renewable energy sources, solar collectors were the most popular among the respondents, thus confirming their interest in using solar energy. The value of he classification function for women (2.951) was significantly higher (at $p < 0.001$) than the corresponding value for men (2.468). Men (1.255), unlike women (0.833), were more interested in heat pumps; the difference was significant at $p < 0.001$. Also, photovoltaic panels were more popular among men than women; the values of the classification function were 0.990 and 0.577, respectively, at $p < 0.001$. Less attention was paid to the use of biomass furnaces. The classification function reached a higher value for women (0.630) than men (0.400). The difference was significant at $p = 0.002$ (Table 3).

Both groups of respondents agree that environmental protection is the greatest benefit from renewable energy sources. This was mentioned more often by men than women, as reflected by the values of the classification function, reaching 5.014 and 4.739, respectively (statistically different at $p = 0.012$). An important aspect of renewable energies was the assurance of energy security and gradual independence from external energy sources. This issue, too, attracted more attention from men (at $p = 0.005$), with a mean value of the classification function of 2.015 (compared to 1.747 for women). Additionally, men saw a much greater potential (at $p < 0.001$) in investing in renewable energy sources in order to become independent from fossil fuels and to reduce greenhouse gas emissions. As regards these aspects, the

Table 3. Interest of Polish society in using renewable energy sources

Type of energy source	Wilks' lambda: 0.673 $F = 19.287$, $p < 0.001$*			Gender of respondents	
	Wilks' lambda	*F* value	*p* value	woman	man
Heat pumps	0.638	30.573	0.001*	0.833	1.255
Solar panels	0.650	34.501	0.001*	2.951	2.468
Photovoltaic panels	0.698	31.428	0.001*	0.577	0.990
Biomass boilers	0.684	9.198	0.002*	0.630	0.400
Constant				9.823	11.047

*Significant difference at $p < 0.050$.
Source: own analysis based on study material.

Table 4. Benefits of investing in renewable energy sources

Type of benefit	Wilks' lambda: 0.696 $F = 13.011$, $p < 0.001$*			Gender of respondents	
	Wilks' lambda	*F* value	*p* value	woman	man
Local/regional development	0.672	32.865	0.001*	1.250	0.732
Independence from fossil fuels	0.702	12.789	0.001*	1.402	1.716
Reduction of greenhouse gas emissions	0.721	13.387	0.001*	0.351	0.678
Energy security and gradual independence from external sources	0.698	7.762	0.005*	1.747	2.015
Environmental protection	0.731	6.256	0.012*	4.739	5.014
Constant				17.816	19.029

*Significant difference at $p < 0.050$.
Source: own analysis based on research material.

Table 5. Barriers affecting the use of renewable energy sources

Type of barrier	Wilks' lambda: 0.632 $F = 6.923$, $p < 0.001$*			Gender of respondents	
	Wilks' lambda	*F* value	*p* value	woman	man
Excessively complicated permit procedures and energy accounting methods	0.677	65.872	0.001*	0.966	1.650
Lack of a coherent sustainable development policy focused on air protection	0.752	29.178	0.001*	2.286	1.802
Increase in energy prices resulting from the lack of competition on the wholesale market	0.727	28.478	0.001*	2.117	1.645
Lack of a stable policy to promote RES (energy market monopoly)	0.693	1.187	0.276	0.782	0.889
Lack of mechanisms supporting the phasing-out of energy-intensive economic sectors	0.735	1.462	0.226	2.442	2.551
End-of-life power network infrastructure	0.692	1.427	0.233	1.218	1.330
Constant				19.819	19.028

*Significant difference at $p < 0.050$.
Source: own analysis based on research material.

mean values of the classification function were 1.716 and 0.678, respectively, compared to 1.402 and 0.351 calculated for women. The model also addressed the benefits related to local or regional development which were significantly more often (at $p < 0.001$) emphasized by women (1.250) than men (0.732) (Table 4).

The most commonly mentioned barrier to renewable energy sources was the absence of mechanisms supporting the phasing-out of energy-intensive economic sectors. This barrier was cited with a similar frequency, reaching a level of 2.551 for men and 2.442 for women. The increase in energy prices resulting from the lack of competition on the wholesale market was mentioned significantly more often (at $p < 0.001$) by women (2.117) than men (1.645). Similarly, the respondents identified some problems related to the lack of a coherent sustainable development policy focused on air protection. The replies were also significantly different (at $p < 0.001$), with the values of the classification function reaching 2.286 for women and 1.802 for men. The excessively complicated permit procedures and energy accounting methods were significantly more important (at $p < 0.001$) for men (1.650) than women (0.966). The model also covered the barriers that give rise to problems with the power network infrastructure, and the lack of a stable policy promoting renewable energy sources. These issues are related to the monopoly on the energy market. The value of the classification function for women and men was similar for both barriers (Table 5).

DISCUSSION

The purpose pursued and achieved by this study was to determine the attitude of Polish society towards renewable energy sources. The paper points to the readiness of the Polish society to protect the environment by using renewable energies, which is consistent with the recommendations of the European Union (Paska and Surma, 2014; Igliński et al., 2016). The recommendations of the European Community play a key role in ensuring access to affordable, reliable, sustainable and modern energy: the main goal of the new global program for sustainable development (United Nations, 2015).

This study corroborates the results of Romanian research according to which more than half of the population surveyed was interested in installing dedicated equipment to access energy from renewable sources; such solutions are associated with innovative attitudes among the local community (Cebotari and Benedek 2017).

In Germany, just as in Poland, the construction of renewable energy facilities has impacted regional development through job creation, as emphasized by Ulrich et al. (2012). Regional self-sufficiency in energy was very important, and so were the effects on fiscal policy. According to a study by Gamel et al. (2017) on the preferences of renewable energy consumers, gender is not important in terms of motives behind, or barriers to, the use of renewable energies. Both populations surveyed

were aware of environmental issues and willing to invest in RES solutions.

As confirmed by studies, the Polish population finds it important to become less reliant on fossil fuels, energy secure and gradually independent from external sources of energy (Lund et al., 2015). Moving away from traditional fossil fuels to renewable energy sources, Europe is also able to eliminate nuclear power plants which significantly damage the environment (Conolly et al., 2016).

Italian researchers emphasize the importance of shifting to a low-carbon economy, which has brought measurable economic benefits in Italy. Also, an increase in employment and earnings was observed (Raitano et al., 2017).

This study, the analysis of its results and the relevant literature emphasize the great importance of energy policies implemented by different countries of the European Union. A suggestion is made that the future of energy depends on the political will and the ability of societies to implement appropriate technologies related to renewable energies (Lund and Hvelplund, 2012).

CONCLUSIONS

The promotion of renewable electricity, especially based on social collectors, should have an even greater impact on the use of RES, which could become a leading sector of the energy industry.

The environmental motivation behind the use of renewable energies should be coupled with other factors affecting the protection of natural resources.

A sustainable development policy focusing on air protection should be implemented, and adequate mechanisms should be deployed to support the phasing-out of energy-intensive economic sectors.

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STOSUNEK POLSKIEGO SPOŁECZEŃSTWA DO ODNAWIALNYCH ŹRÓDEŁ ENERGII. SEGMENTACJA WEDŁUG PŁCI

Abstrakt. Idea zrównoważonego rozwoju została przeniesiona na grunt energetyki, dlatego powstał termin: zrównoważony rozwój energetyczny. Jego fundamentalną zasadą jest efektywne wykorzystanie zasobów energetycznych, ludzkich, ekonomicznych i naturalnych. Odnawialne źródła energii (OZE) odgrywają coraz większą rolę w strukturze dostaw energii oraz w funkcjonowaniu społeczności lokalnej. Celem artykułu jest określenie stosunku polskiego społeczeństwa do odnawialnych źródeł energii z uwzględnieniem determinanty, jaką jest płeć. Starano się również wskazać znaczenie odnawialnych źródeł energii w funkcjonowaniu współczesnego społeczeństwa. W badaniach zastosowano metodę sondażu diagnostycznego. Przeprowadzono je na grupie reprezentatywnej liczącej 1067 respondentów. Do analiz statystycznych wykorzystano program Statistica 10.1 PL, w szczególności analizę funkcji dyskryminacyjnej z analizą funkcji klasyfikacyjnej. Respondenci deklarowali, że oszczędzając energię elektryczną, zawsze wyłączają światło, opuszczając pomieszczenia, a najchętniej skorzystaliby z kolektorów słonecznych jako alternatywnego i przyszłościowego źródła energii. W opinii ankietowanych inwestycje ukierunkowane na pozyskiwanie energii istotnie wpływają na ochronę środowiska naturalnego. Największe bariery w wykorzystaniu odnawialnych źródeł energii to: brak mechanizmów wspierających obniżenie energochłonności gospodarki, wzrost cen energii wynikający z braku konkurencji na rynku hurtowym oraz brak spójnej polityki zrównoważonego rozwoju w kwestii ochrony powietrza. Stwierdzono istotne różnice w podejściu do problemu odnawialnych źródeł energii, przy uwzględnieniu płci badanych.

Słowa kluczowe: rozwój zrównoważony, polskie gospodarstwa domowe, preferencje, korzyści inwestowania