



THE ROLE OF RENEWABLE ENERGY SOURCES IN AGRITOURIST ECONOMY

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Abstract

The study shows an analysis of renewable energy sources in terms of their use in agritourist farms. The conducted survey aimed at finding out whether it was the respondents' age, farm size or incomes obtained from different sources that had the biggest impact on decisions to invest in ecological energy media. An answer was provided to the question whether implementation of ecological energy systems was followed by significant reduction in agritourist activity costs. The level of interest in such energy media among farmers who do not use them was assessed. The attitude of agritourist service providers toward more effective utilization of natural resources to the advantage of the natural environment was determined

Keywords: rural areas, renewable energy sources (RES), agricultural farm, agritourism

INTRODUCTION

Nowadays ecological attitude is gaining more and more popularity in modern societies. Recent years have yielded technologies for economical cars, energy efficient buildings and clean energy systems for households. This is inseparably connected with the development of the renewable energy sources (Sałagan *et al.* 2011). Poland is a country where use of solar, wind, geothermal or biomass energy determines environmentally conscious energy policy which is supposed

to bring measurable benefits for the natural environment. This is a new challenge to be faced, in particular, for rural areas as according to Wielewska *et al.* (2017), energy supplies are as important for the development of these areas as widely understood technical and social infrastructure. Electrical energy consumption in suburban areas, the demand for which is constantly growing, is conditioned by energy outlays for agricultural production and households. Rational energy management in tourism seems to be of high importance as it contributes to reduction of overall costs connected with providing accommodation services. Therefore, the study goal is to establish whether agricultural farms which provide tourist services (agritourist) invest in non-conventional energy media as well as to evaluate the level of familiarity of farmers not using renewable energy sources with development prospects of these technologies in rural areas. It was assumed that due to growing awareness of ecological issues, agritourist farm owners are interested in RES as, according to Gradziuk (2014), increasing intensity of harmful changes that have recently taken place in connection with global warming, degradation of natural environment and depletion of natural resources focus attention of the world societies to the earth capacity and the necessity to maintain balance in management of its resources.

MATERIALS AND METHODS

The survey was conducted in 2016 by the method of telephone interview using a questionnaire. The questionnaires were prepared for both groups of farmers (using and not using RES) and were used to obtain information concerning:

1. energy sources used on the farm and devices/technologies applied for this purpose;
2. financial means (individual and external) involved in this ecological investment, and information whether the investment resulted in reduction of costs connected with provision of agritourist services;
3. knowledge of RES, on the group of farmers who did not invested in such energy sources (equipment technologies, financial means);
4. the size of farms (large areas of farmlands can bring higher profits to farmers' families, making it easier for them to invest in RES) and social-demographic traits of householders (education, income sources, job qualifications which can be significant determinants or limitations in decision making).
5. the role of renewable energy sources in rural areas.

The research survey (of pilot character) was carried out on the territory of the whole country and the selection of farmers involved in non-agricultural, agritourist activities was performed on the basis of address lists collected from Agricultural Counseling Centers (ODR), Polish Federation of Agritourism „Hospita-

ble Farms” and portal: agroturystyka.pl. On the average, 10 interviews with two distinguished groups of respondents (A-using RES and B-not using RES) were carried out in each voivodeship. The questionnaire consisted of three parts (I, IIA and IIB). The first part included 6 questions covering basic information about the surveyed individuals. Farmers who used clean energy sources answered 17 questions from the survey part IIA, and those who did not use them were supposed to answer 12 questions from part IIB. In order to obtain initial information about the role of RES in agritourist farms, only a part of provided information was analyzed for the needs of this study. It was explored (using Pearson correlation coefficients) to what degree the variables (including farmers’ age and education, income sources, farm size) affect the overall planning in the field of investments in renewable energy sources.

RESULTS AND DISCUSSION

As many as 239 phone calls, out of 458, (64%) were refused. Only 165 persons (36%) agreed to participate in the research, with slight prevalence of those who did not use renewable energy sources (50.9% vs 49.1%). Respondents (owners of farms from group A), who invested in green energy media, represented mainly two age groups: 46-59 (45.4%) and 26-45 (28.6%). Such an initiative can also be found for respondents from the elder age group, that is 60-65 (17.4%). In total, agri-farmers (A) accounted for 69.7% (150) of all the residents of those farms (215) (tab. 1). A great majority of them were high school graduates (59.4% – therein 71.9% agricultural) and university (40% – therein 30% agricultural), and their main income sources were agritourism (56.6%) and agricultural activity (29.3%). The respondents, who had implemented renewable energy equipment (B), were characterized by similar demographic structures, though they had more children (usually aged under 15) and older people (66 plus) were not members of their households. In this group, young persons (19-25) were less frequently farm owners (tab.1). Farmers from group B were high school graduates (67.4% – including 64.3% agricultural) or university graduates (32.6% – including 12.2% agricultural). The main income source of these respondents were agritourist activity (55.3%), agricultural production (37.3%) and odd jobs (11.3%). The level of education and total income of all A and B household members are presented in fig. 1 and 2.

Diversified financial means supplying the family budget could have had a significant impact on willingness to invest in RES including those which were obtained from agritourist activity, as according to the research, for 69.5% of farms (A) profits from agritourist services were obtained through the year (the remaining respondents have guests seasonally). It should be emphasized that mainly female farmers engage in this non-agricultural activity. Merely 1.4% of

them support their partners in farm work, and only 14.5% of farmers support their wives in agritourist business.

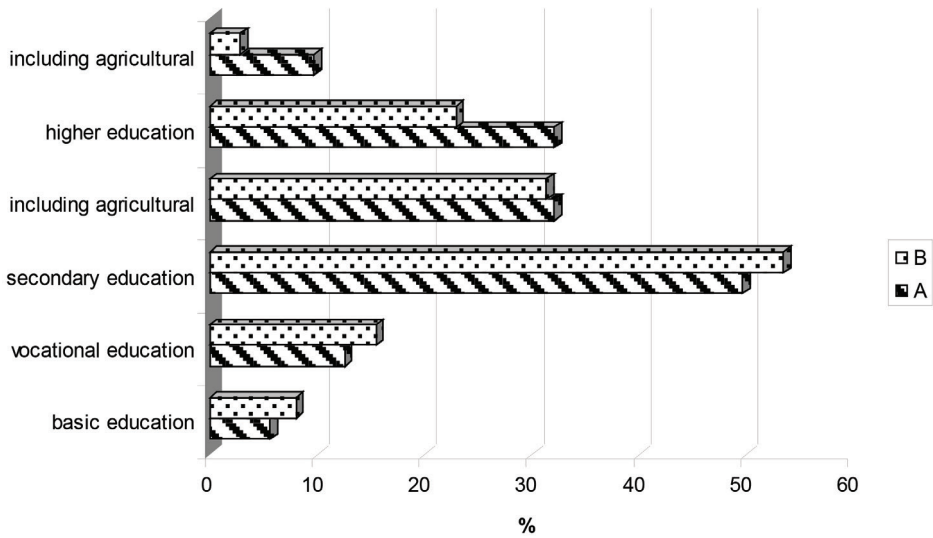
Table 1. Family structure of agritourist farms, which invested and did not invest in RES (along with the mean land area)

Specification	Mean size of farms (in ha)	Number of family members*	Including age (in years) in % of all farm residents:							
			under 15	15-18	19-25	26-45	46-59	60-65	66-75	more 75
Farms (A) using RES	16.3	total 215	4.2	8.4	11.6	26.9	32.1	12.1	3.3	1.4
		including farmers								
		81								
		150	-	-	5.4	28.6	45.4	17.4	2.6	0.6
		and remaining family members								
		65	3.9	27.6	26.2	23.1	1.5	-	4.6	3.1
Farms (B) not using RES	12.1	total 213	5.6	4.2	16.5	22.5	29.6	21.6	-	-
		including farmers								
		84								
		150	-	-	0.6	31.4	41.4	26.6	-	-
		and remaining family members								
		63	19.1	14.2	53.9	1.6	1.6	9.6	-	-

* both in group A and group B were the same number of farmers (76) and female farmers (74)

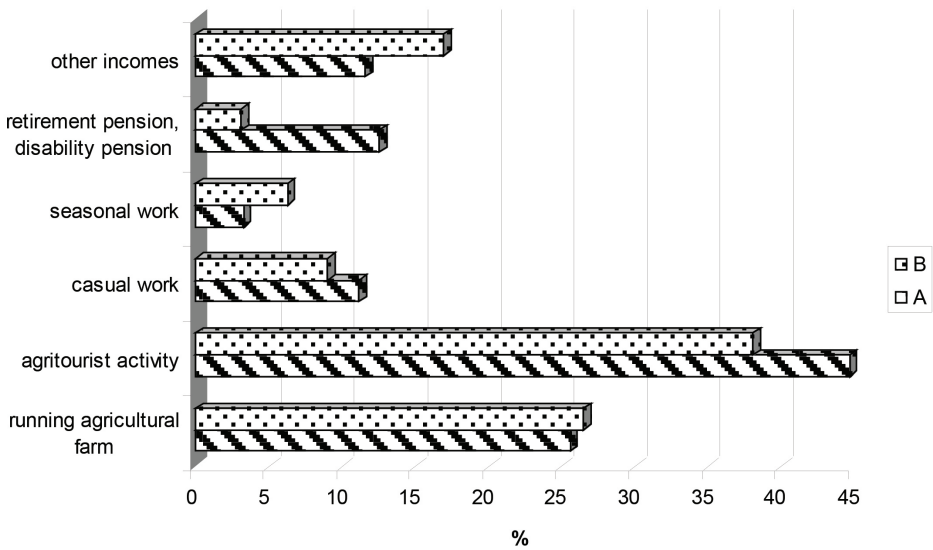
Source: own study

In the period between 2000-2016 farmers from group A invested in 102 ecological devices to obtain energy. As many as 47.1% of respondents decided to invest in RES in the period between 2010-2014 (especially in voivodeships: Podkarpackie, Pomorskie, Wielkopolskie), whereas 34.3% in the years 2015-2016 (mainly in Śląskie). The remaining farmers decided to start using RES in the years 2005-2009 (14.7%) and 2000-2004 (3.9%) (tab.2). The earliest RES systems were installed by farmers whose farms are situated in Kujawsko-Pomorskie Voivodeship and Dolnośląskie Voivodeship (biomass boilers and solar collectors). In voivodeships: Lubelskie, Pomorskie and Świętokrzyskie the systems were purchased at one time period, and in the remaining analyzed regions, farmers invested in RES even two times.



Source: own study

Figure 1. Level of farm residents' education using (A) and not using (B) RES (total).



Source: own study

Figure 2. Main sources of income of farms using (A) and not using (B) RES (total).

Table 2. The year of agritourist activity start and RES investment by (A) farmers

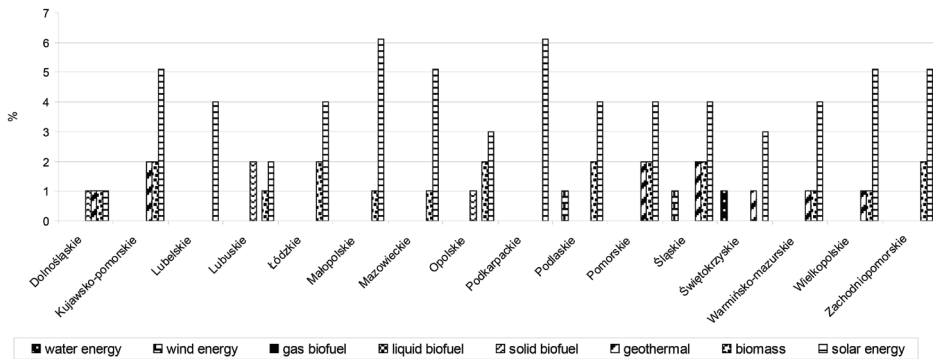
Lp.	Voivodeship*	1995-1999		2000-2004		2005-2009		2010-2014		2015-2016	
		A**	RES***	A	RES	A	RES	A	RES	A	RES
1.	Dolnośląskie 3	-	-	1	1	2	1	-	1	-	1
2.	Kujawsko-Pomorskie 6	2	-	3	2	1	2	-	4	-	-
3.	Lubelskie 4	2	-	1	-	-	2	1	2	-	-
4.	Lubuskie 4	1	-	2	-	1	-	-	2	-	3
5.	Łódzkie 5	-	-	3	-	2	1	-	2	-	3
6.	Małopolskie 6	1	-	3	1	1	3	1	3	-	1
7.	Mazowieckie 5	-	-	1	-	1	1	3	4	-	2
8.	Opolskie 4	1	-	2	-	-	1	1	2	-	3
9.	Podkarpackie 6	-	-	1	-	2	1	3	5	-	-
10.	Podlaskie 5	-	-	4	-	1	1	-	2	-	4
11.	Pomorskie 7	1	-	3	-	2	1	1	5	-	2
12.	Śląskie 4	-	-	1	-	1	-	2	-	-	6
13.	Świętokrzyskie 5	1	-	-	-	2	-	2	4	-	1
14.	Warmińsko-Mazurskie 5	-	-	2	-	1	1	1	4	1	2
15.	Wielkopolskie 6	-	-	1	-	2	-	3	5	-	3
16.	Zachodniopomorskie 6	-	-	-	-	2	-	3	3	1	4
Total number of farms 81		9		28		21		21		2	
Total number of RES systems 102			-		4		15		48		35
In % total		11.1	-	34.6	3.9	25.9	14.7	25.9	47.1	2.5	34.3

*with the number of surveyed farms, **establishment of agritourist activity, ***investment in RES

Source: own study

Agritourist farm owners were most often interested in solar energy (63.3% – with prevalence of this energy type in Małopolskie and Podkarpackie Voivodeships) and biomass energy (20.2% – mainly from voivodeships: Dolnośląskie, Łódzkie, Opolskie, Podlaskie, Pomorskie, Śląskie and Zachodniopomorskie) (fig. 3). It was observed that agritourist farm owners with the largest farm areas (16-20 ha and more 20 ha) were most often interested in energy from hay biomass, utilizing thus the surplus of this resource, produced in their own farms. These farmers accounted for 17.2% of the respondents and the average area of their farms is reported to be approx. 41.8 ha. In the case of solar energy, it was found that the respondents most often used solar collectors (41.5%), rather than photovoltaic panels (25.7 %). Simultaneous use of these media was reported for Wielkopolskie, Warmińsko-Mazurskie, Mazowieckie and Małopolskie Voivode-

ships. Solar energy, in a direct form, was used for the production of electrical and heat energy (including water heating). There were also persons who took advantage of geothermal energy (9%), especially from Kujawsko-Pomorskie, Pomorskie and Śląskie Voivodeships. Investments of this type were reported in places such as: Śliwice, Tuchola, Ponikle, and Junoszyńie. These regions are characterized by optimal geothermal conditions in which the temperature of groundwater, ranges between 70°C to 90°C at the depth of 3 km and these conditions are suitable for such investments to be carried out. A subsidy to be achieved from the Voivodeship Environment Protection and Water Management Funds was an additional incentive for the respondents to place capital in individual geothermal systems. It covered as much as 80 % of the equipment purchase costs, up to 300 kW of power, with all the fixture. As many as 5.2% of farmers using ground source heat pumps were reported (fig. 4).



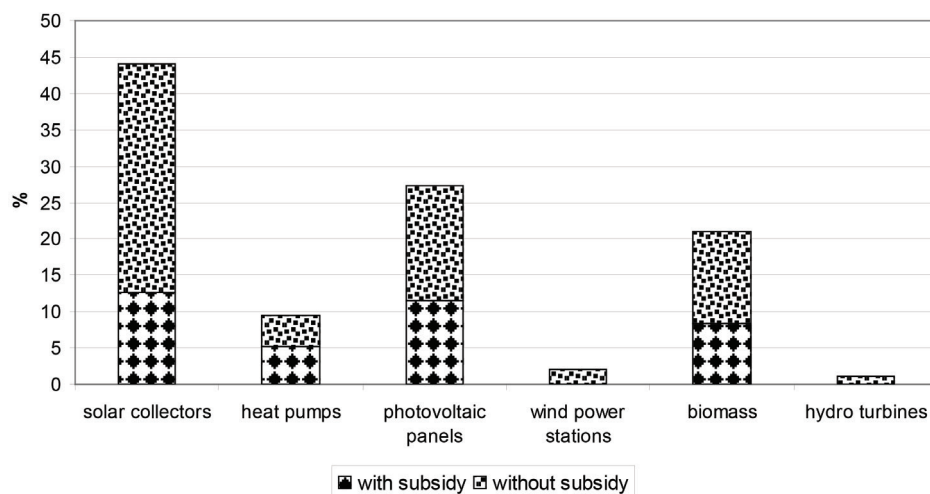
Source: own study

Figure 3. Energy sources used by the respondents in their farms (according to voivodeship).

The providers of tourist services decided to undertake investments to use flowing water energy (only in Świętokrzyskie Voivodeship) and water (only in Podlaskie and Śląskie). None of the respondents invested in liquid and gas bio-fuels which might have been caused by their relatively high investment prices. According to Chodkowska-Miszczyk (2015), government financial support is a significant incentive for farmers to choose the RES. However, according to the survey, this kind of support was not often used by farmers upon launching ecological energy sources (fig. 4). Most frequently respondents invested their own means, ranging from: 11-20 thousand PLN (48.5%) and 6-10 thousand PLN (37.2%). Only (11.4%) of farms invested the highest sums, exceeding 21 thousand PLN, and 2.9% of respondents paid for energy media less than 5 thousand PLN. A group of 11 farmers did not provide a response on this subject. On the

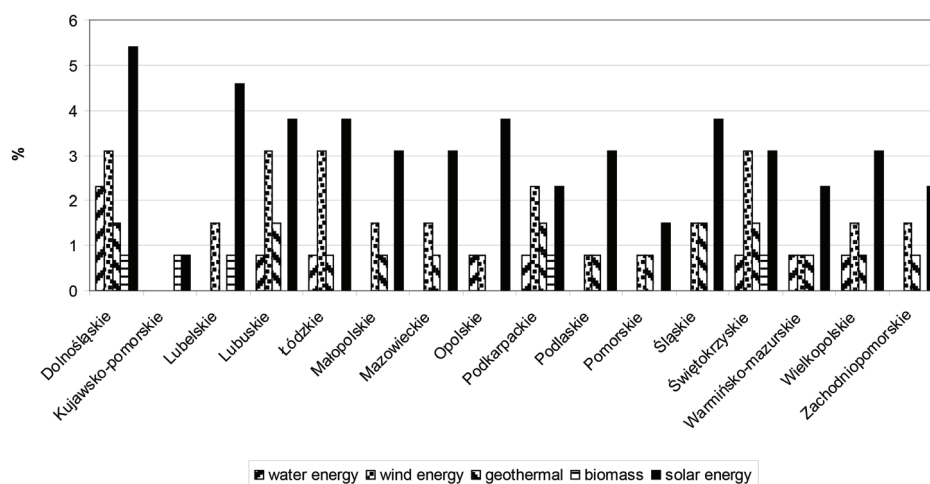
average, the sum of 10 131 PLN was spent on RES. Farmers from the age group 46-59 invested the highest amounts of their own money into RES (35.1% of all the costs), they also had the largest farmlands and the most diversified farm incomes. Agritourist farm owners of the youngest age group 19-25 invested more money in RES (by 10%) than those of the group 26-45. Analyses have revealed that there is no distinct correlation between the year of agritourist activity start and the time of RES system installation (-0.171). Delayed decisions might have been caused by the fact that the respondents were just getting familiar with the clean energy sources and estimating costs of the whole investment. Such an assumption is confirmed by a significant time correlation between launching agritourist activity and choosing a concrete energy medium (0.603). Thus, it can be seen that it took farmers some time to undertake the best possible decision adequate to their possibilities and needs. What is interesting, education of the surveyed persons did not have an influence on the decision to choose RES (a low dependence was found to be at the level of 0.249), however, age of the respondents did (0.975). This option was chosen mainly by young persons (26-45) and medium aged ones (46-59). Age was found to be an important indicator of sums spent on the investments (0.975). The correlation was much stronger than the one between financial means and the farm areas (0.717), which in turn had no reflection in the choice of given devices (0.162). The level of correlations proves that younger owners of tourist farms are more willing to undertake investment risk, regardless of the farm area they own. Undoubtedly, the major income sources of farmers have an impact on the decision to choose energy sources (0.760) as well as financial means available from the government for installation of RES (0.605).

The survey shows that the compensation for costs involved in RES installation was obtained averagely, after 2 – 3 years (mainly in relation to energy generating devices). Such responses were given by 51.8% (61) of the respondents. Farmers from voivodeships: Pomorskie (10.9%), Kujawsko-Pomorskie, Lubelskie, Łódzkie, Małopolskie, Świętokrzyskie, Wielkopolskie (8.7% of answers for each), Warmińsko-Mazurskie, Zachodniopomorskie (6.5% for each), Dolnośląskie, Lubuskie, Mazowieckie, Opolskie, Podkarpackie (4.3%) and Podlaskie (2.4%), reported cost return. In the remaining cases, that is, 43.3% (35) cases, farmers did not report any cost return, which was due to a short time of the system operation (since 2015 for 2 farms) and further investments in new devices (8 farms bore to high RES purchase costs in 2014). The other 25 respondents acknowledged that high costs make fast return of investment costs impossible, especially with low incomes from agricultural and non-agricultural activity. 4.9% of the respondents (4) could not provide unequivocal response.



Source: own study

Figure 4. RES investments launched with and without financial support of the state.



Source: own study

Figure 5. B group farmers' knowledge on renewable energy sources (according to division into voivodeships).

The survey revealed that 65% of farmers reported significant energy savings. They amounted to 304 PLN monthly, on the average, which in turn found reflection in the tourist offer price reduction (in the farms of 74.1% of respon-

dents). Only farmers from three voivodeships (Lubuskie, Mazowieckie, Śląskie) did not report reduction of those costs. In turn, 2.9% of agritourist farm owners could not specify whether energy bills decreased and 13.6% shared that, though there were savings, they were not able to specify the level. Economic benefits from RES are also reported by Kujda *et al.* (2016), who proves their beneficial influence on reduction in rural areas pollution. This has been confirmed by the respondents, since as many as 98.8% of them are of the opinion that ecological systems largely contribute to environment protection.

Farmers who did not invest in ecological energy sources were eager to provide answers to prove their knowledge of the issue, primarily solar energy (49.4%) and wind energy (24.3%). Farmers from three voivodeships: Dolnośląskie, Podkarpackie and Świętokrzyskie showed the best knowledge of this subject, being able to list five clean energy sources (fig. 5).

Among farmers of B group, 97% were able to choose a technology suitable to the type of RES. Solar collectors, as the most popular method for the sun radiation utilization, were indicated by them more often than photovoltaic systems (36.4% vs 23.3%). On the other hand, a low level of the respondents' knowledge was reported for microbiogas plants or biomass boilers (1.2 % of responses). Although the respondents were familiar with the issues of renewable energy sources, most of them 67.9% did not plan to make such investments in the nearest future and 2.3% had no interest in RES. Those who were interested in such possibilities (29.8%), considered buying photovoltaic panels (34.3%), solar collectors (22.9%) and biomass boilers (5.7%). According to the research carried out by Gradziuk (2014), as many as 87% of respondents declared interest in RES systems, and though the rate of positive answers was significantly higher, the type of energy was similar (apart from windmills), that is, solar collectors and biomass boilers. The results of Gradziuk's research show that inhabitants of voivodeships: Kujawsko-Pomorskie and Łódzkie (97% each), showed the highest interest in those sources, whereas the lowest was reported for Zachodniopomorskie and Warmińsko-Mazurskie (73% and 77%, respectively). According to the author's own study, farmers from voivodeships: Dolnośląskie (16%), Lubelskie and Mazowieckie (12% each) were most interested in those energy sources and the least interest was reported for Łódzkie, Pomorskie and Wielkopolskie (4% each). According to Gradziuk's research results, the highest percentage share (90%) of respondents willing to invest in RES was reported for age group up to 29 and the lowest for those over 60 (76%). In this research, it was the group of farmers aged 30-45, who were most interested in renewable energy sources, whereas those from age group 19-29, were found to be less interested. 59% of the surveyed farmers were of the opinion that agritourist farms should be willing to invest in ecological energy for the sake of the environment, regardless of high costs, which were estimated to be at the level of 32 500 PLN. The highest sums were given by the youngest respondents from the age group 26-45. Exactness of

the sums provided by them results from the fact that they knew farmers who had already installed green energy systems and were satisfied with small ecological technologies. This is an interesting observation because among this group of respondents there were persons who opposed such investments in their own farms, understanding, at the same time, the need to take such ecological steps by other agritourist service providers. Krupnik and Brożek (2008), as early as 10 years ago, wrote about an implemented, market oriented mechanism whose purpose would be to promote modern, ecological solutions within the country energy management, at each administration level (rural, commune, district), and financial support to be provided for fast implementation of this type of investments. Not all the respondents might have had an opportunity to get familiar with this opinion; this trend of prosumer energy in rural areas is still being continued in Poland, however. According to Ginalski (2016), functioning of a modern farm is closely connected with the necessity of meeting the growing demand for electrical and heat energy. The author of this study observes that these needs are higher for those who provide agritourist services (especially throughout the year). Ginalski highlights diversification of rural resources which provide vast possibilities of innovation creation and development of renewable energy sources. He says that he would rather promote scattered energy sources and aim at obtaining a farm self-sufficiency through development of a prosumer energy system (electrical energy produced for individual needs with its excess being returned to the power grid). Renewable Energy Sources Act provides important procedures, rules and terms to be complied in generating energy as well as instruments to be used to support this activity.

Summing up, it needs to be highlighted that although the economic aspect is well reflected in RES applicability in rural areas, all the respondents (A and B) emphasize that the main purpose of such investments is to protect the environment. Most importantly, it is reduction in emission of pollutants to the atmosphere (92.9%), slowdown in exploitation of natural resources (7.1%) and reduction of deforestation (3.6%). As the survey shows, farmers focused on the ecological aspect rather than the economic one, which reflects their profound ecological awareness. For comparison, Wielewska (2014) says that farmers should invest in non-conventional energy sources for two major reasons: reduction in agricultural farm and household maintenance costs (60.9%) and decreasing harmfulness of agricultural production impact on the natural environment (14.3%). Thus, the research results are different than the presented author's own research.

CONCLUSIONS

The following conclusions have been formulated on the basis of the carried out survey:

1. Renewable energy sources play a very important role in agritourist management as, according to the survey results, after their implementation, the respondents reported significant reduction in electrical energy costs in their farms, which in turn encouraged them to reduce the prices of the tourist offers.
2. The time of being involved in agritourist activity could affect decisions of farmers to implement renewable energy generation equipment. Many respondents had launched their farms prior to 2009 (71.6% of farmers), thereby being able to estimate whether profits from non-agricultural and agricultural activities incoming to the family budget (and other sources) would be sufficient to cover the costs involved in a purchase of renewable energy media. Majority of investments have been carried out since 2014 (81.4%), which reflects consciousness of the decisions and minimization of failure risk.
3. Investments in RES were carried out by middle aged persons, well educated, owners of largest farm areas and with diversified income sources. The amount of sums invested in RES was reported to be highest for them. All these indexes can be evidence of good capital and technical equipment of the surveyed farms and high quality of the human factor in the form of entrepreneurship and organizational abilities.
4. It is necessary to extend access to counseling services, especially for those respondents whose attitude to ecological energy media is found to be skeptical and who regard them as an economic rather than ecological issue. It would be advisable to arrange meetings with the agritourist service providers, at the commune and district levels, who are willing to share their observations and experiences connected with a purchase of such systems.
5. It seems to be crucial to define energy sources preferable for a given area and support to be given to agritourist farm owners in the choice of the best investment to match their needs and financial capability.

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