*INFRASTRUKTURA I EKOLOGIA TERENÓW WIEJSKICH*
*INFRASTRUCTURE AND ECOLOGY OF RURAL AREAS*

No IV/1/2018, POLISH ACADEMY OF SCIENCES, Cracow Branch, pp. 865-877
Commission of Technical Rural Infrastructure

DOI: https://doi.org/10.14597/INFRAECO.2018.4.1.059

# BARRIERES TO THE USE OF RENEWABLE ENERGY SOURCES IN AGRITOURIST FARMS

***Jolanta Cichowska***
*University of Science and Technology Bydgoszcz*

***Abstract***

The study deals with barriers to be overcome by agritourist farm owners who choose to invest in renewable energy sources. Research was done in order to check whether before undertaking the investment they raised their qualifications and used financial means offered by the government. In order to obtain information on the possibilities of ecological technologies development in rural areas, also farmers who do not use ecological energy media were interviewed. Both farmer groups were surveyed for information on development prospects of small technologies in rural areas. Farmers involved in agritourist activity were asked whether undertaking the risk of purchasing 'green equipment' provided them with measurable benefits.

**Keywords**: barriers to renewable energy development, agritourism farm, rural area, energy policy

## INTRODUCTION

Possibilities of using renewable energy (RES) in rural areas are conditioned by many internal and external factors. According to Księżopolski and Pronińska (2017), the key factors that determine the development or lack of interest in green energy supply systems are of legal-administrative and economic-technical nature. In the first group there are domestic regulations, whose transparence, clarity, stability and attractiveness, from the point of view of investors, play an

This is an open access article under the Creative Commons BY-NC-ND license
(http://creativecommons.org/licences/by-nc-nd/4.0/)

important role in choosing RES. According to the authors, the second group of factors includes: availability of financial means and forms of investment encouragement, as well as access to transmission and distribution infrastructure. According to Wielewska (2016), there is a need to increase utilization of renewable energy in rural areas as agricultural farms have access to its sources. The author emphasizes that rational use of these sources would allow not only to reduce costs of households maintenance but also provide an additional source of income through using animal and plant production waste for energy supply purposes. The goal of this study is to provide an answer to the question: which factors (economic, institutional, ecological) prevent agritourist farm owners from making decision to invest in RES. It was checked whether running an agritourist business makes farmers more open to undertake such investments and affects the way they are perceived in the eyes of their guests. Such research is found to be justified from the point of view of the environment protection, especially that the according to the requirements of the European Union, Poland is supposed to obtain 15% of energy from clean sources by 2020 (in 2030 – 27%). Subsequently, to comply with the assumptions of the European Council, our country should by 2050 obtain an average $CO_2$ emission coefficient at the level of 550kg/MW. Thus, it is important to encourage inhabitants of rural areas to invest in renewable energy micro sources which can motivate the local communities involved in tourism to create community organizations that will meet the assumptions of prosumer energy. Such actions will both contribute to farm maintenance cost reduction (property), and lowering expenses connected with running a non agricultural business.

## MATERIALS AND METHODS

The survey was performed in 2016, on a group of 165 agritourist farm owners. A diagnostic survey was applied by using an anonymous questionnaire prepared for farmers who utilize RES (they were asked 17 questions, including 8 closed ones) and those who do not use RES were asked (12 questions, including 7 closed questions). The survey lasted from November to December, and on the basis of individual telephone interviews (open) it was found:

1. what forms of government support were used by agritourist farmers to launch green energy systems and whether they found the support sufficient to be sufficient for them;
2. barriers hampering RES development in rural areas;
3. whether farmers explored the issue of green energy sources before investing in them;
4. what the farmers involved in agritourism thought about development prospects of clean energy sources on the local market;

5. what is the approach of agritourist farm owners, who do not use clean energy media, to RES.

The survey was of pilot character and only some fragments of the questionnaire were selected for the needs of this study. Statistical material was collected from agritourist farm owners from all over the country. Respondents were chosen on the basis of address lists received from Agricultural Counseling Centers (ODR), Polish Federation of Rural Tourism 'Hospitable Farms' and portal: agroturystyka.pl. 458 telephone calls were made, in 64% (293) of cases the interview was refused. The remaining 36% (165) farmers, who were willing to take part in the interview were divided into two groups: A (agritourist service providers having RES) and B (farmers without RES). The collected empirical material was completed by the methods of analysis and description. It was explored (using Pearson correlation coefficients r) to what degree the variables (including participation in courses and other forms of training, area of farms, government support programs) affect the overall planning in the field of investments in renewable energy sources.

## RESULTS AND DISCUSSION

The survey was preformed among farmers from 96 districts, located on the territory of all 16 voivodeships in Poland (tab. 1).

**Table 1.** Presentation of residence places of farmers who are involved in agritourist activity

| | Place of residence of agritourist farm owners: | | | |
|---|---|---|---|---|
| | Voivodeship* | | using RES (A) | not using RES (B) |
| | | | Districts ** | |
| 1. | Dolnośląskie | 10 | Lubański ,Kłodzki | Kamiennogórski, Kłodzki |
| 2. | Kujawsko-Pomorskie | 10 | Chełmiński, Sępoleński, Tucholski | Bydgoski, Nakielski, Żniński |
| 3. | Lubelskie | 8 | Hrubieszowski, Tomaszewski, Zamojski | Puławski, Tomaszewski, Zamojski |
| 4. | Lubuskie | 10 | Krośnieński, Strzelecko-Drezdeński, Świebodziński, Żagański | Gorzowski, Międzyrzecki, Żagański, Żarski |
| 5. | Łódzkie | 10 | Łaski, Piotrowski, Rawski, Sieradzki, Zagierski | Łęczycki, Opoczyński, Sieradzki, Zgierski |
| 6. | Małopolskie | 10 | Chrzanowski, Gorlicki, Limanowski, Krakowski, Olkuski | Krakowski, Tatrzański, Wadowicki |
| 7. | Mazowieckie | 10 | Grójecki, Makowski, Nowodworski, Ostrowski, Płoński | Gostycyński, Grójecki, Makowski, Płoński |

| | | | Place of residence of agritourist farm owners: | |
|---|---|---|---|---|
| | Voivodeship* | | using RES (A) | not using RES (B) |
| | | | Districts ** | |
| 8. | Opolskie | 10 | Oleski, Opolski, Strzelecki | Brzeski, Strzelecki, Opolski |
| 9. | Podkarpackie | 11 | Bieszczadzki, Jarosławski, Leżajski, Łańcucki, Krośnieński | Lubaczowski, Jasielski, Sanocki |
| 10. | Podlaskie | 11 | Bielski, Grajewski, Łomżyński, Sokólski, Suwalski | Białostocki, Hajnowski, Mariecki, Sokólski, Suwalski |
| 11. | Pomorskie | 11 | Bytowski, Gdański, Pucki, Nowodworski, Wejherowski | Bytowski, Kwidzyński, Słupski |
| 12. | Śląskie | 10 | Dąbrowski, Gliwicki, Żywiecki | Częstochowski, Kłobucki, Zawierciański, Żywiecki |
| 13. | Świętokrzyskie | 11 | Kazimierski, Konecki, Sandomierski | Jędrzejowski, Konecki, Kielecki, Sandomierski |
| 14. | Warmińsko-Mazurskie | 11 | Bartoszycki, Ełcki, Nidzicki, Piski | Bartoszycki, Ostródzki, Piski |
| 15. | Wielkopolskie | 11 | Gnieźnieński, Gostycyński, Grodzki, Koniński, Złotowski | Międzychodzki, Koniński, Złotowski |
| 16. | Zachodnio-pomorskie | 11 | Choszczeński, Drawski, Kamieński, Koszaliński | Goleniowski, Gryficki, Stargardzki |
| | Total 165 | | 64 | 54 |
| | | | Total 96 | |

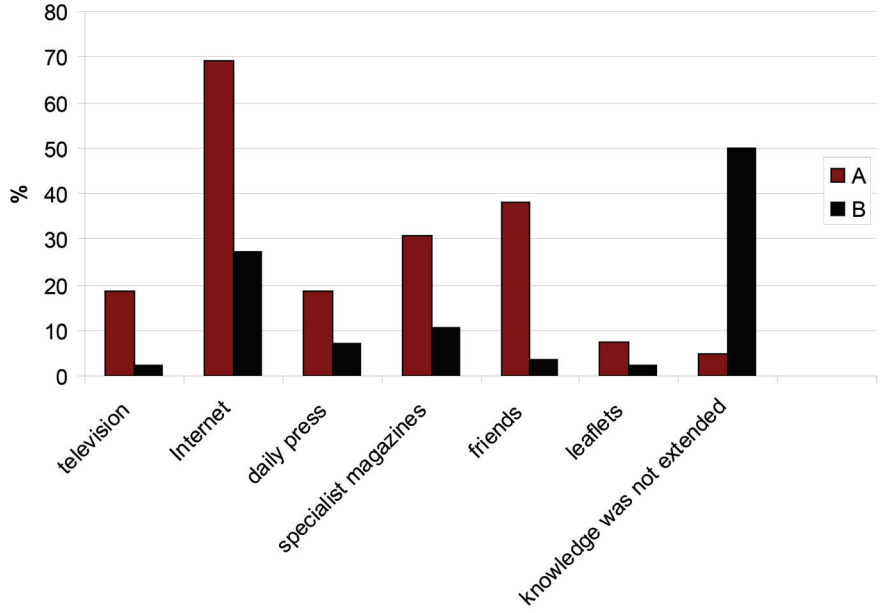
*with the total number of analyzed farms, **total number of districts from group A and B is not equal to number 96, due to the fact that agritourist farm owners often came from the same district.
**Source:** own study

From among all the respondents, 81 (i.e.49.1% – A) were in possession of ecological energy media, whereas, 84 (50.9% – B) did not use them. However, the latter farmers (B) are of the opinion that agritourist farms should invest in in RES because as many as 58.3% answers were 'yes' and 38.1% were 'rather yes'. Only 3.6% of answers were 'rather no'. However, no significant correlation dependence was found between general positive attitude to RES, on the part of farmers from B group, and their interest in purchasing small energy systems in the future (-0.315). Only 11.9% of the respondents declared that they were going to have them installed in the future (from voivodeships: Dolnośląskie, Lubelskie, Małopolskie, Opolskie, Śląskie and Wielkopolskie), and 17.8% said that 'rather yes', but were not sure about it. The majority of respondents were interested in solar energy, that is, photovoltaic systems and solar collectors. The respondents' previous view that agritourist farms should turn to RES was connected with the satisfaction level of their neighbors and friends who had already invested in renewable energy media. Although a high correlation dependence was reported

in this respect (0.889), it was observed that the positive opinions found no reflection in decisions of farmers who were willing to invest in RES in the future (-0.358) as it turned out that the main inspiration to choose RES were coursed they had attended (the correlation force was 1.0). These farmers were in the group of 30.5% of all the respondents (33), who had attended courses organized by local Councils and Agricultural Counseling Centers. (ODR). Significance of correlation dependence, at the level of 0.932, confirmed that the lack of interest in RES systems is associated with high investment costs. At the same time it was noted that the costs cannot be compensated by support from the government (-0.935). Similarly, the respondents who were surveyed by Ropuszyńska-Surma and Węglarz (2017) acknowledged that biggest barrier to RES installation is the economic factor (52.9%). Farmers of group B did not know any support forms offered by the government, though as mentioned before, they expect such assistance. One person gave an answer that financial support can be received from the National Fund of Environment Protection and Water Management (NFOŚiGW), 8 respondents listed Voivodeship Funds of Environment Protection and Water Management (WFOŚiGW), and 7 farmers expected support from local Councils and ODR (Agricultural Counseling Centers). Undoubtedly, the financial factor is a serious barrier to development of small RES technologies in rural areas. According to the respondents, if this obstacle is overcome, there is a chance to step up ecological actions which, as the correlation force shows, will contribute to environment protection in rural areas (0.995) by reduction of $CO_2$ emission. Although the respondents from group (B) understand their positive influence on the environment, as compared to respondents of (A) group, they are not particularly willing to obtain information on RES (fig. 1). If they do search for it, it is by means of the Internet (27.3%). What is interesting, significant correlation dependence was noticed in group B, between the search of information about RES and the size of farm (0.830). The area of the farm was much larger than the farm area of group A farmers (fig. 2). Most probably the farmers (especially those with farm areas 16-20 ha and more than 21 ha) were searching for economic justification of ecological energy sources use in different technologies of agricultural production. Such a relation was not, however, found for RES owners of group (A), much more active in search of knowledge on this subject (0.158). It could be caused by the fact that those farmers did not treat their agricultural material as the main source of materials to be used for electric energy production.

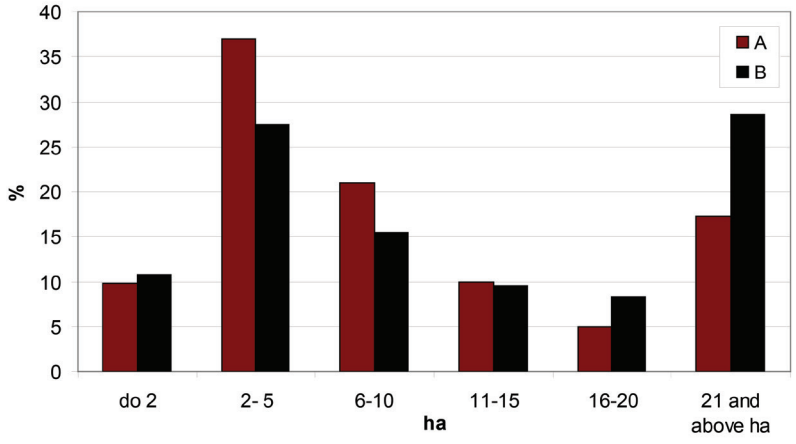
The respondents from group A, rarely used support programs offered by the government for launching small RES systems in their farms. Only 26.9% of the respondents, from 12 voivodeships, (fig. 3) used the support. Only farmers from Łódzkie Voivodeship and Śląskie Voivodeship took advantage of two external support forms. Apart from the Program for Rural Areas Development (PROW), and the Special Pre-Accession Program for Development of Agriculture and Rural Areas (SAPARD) and consulting company RESULTO, the sup-

port was offered by Voivodeship Fund of Environment Protection and Water Management (WFOŚiGW) and Regional Operational Programs (RPO) (fig. 3).



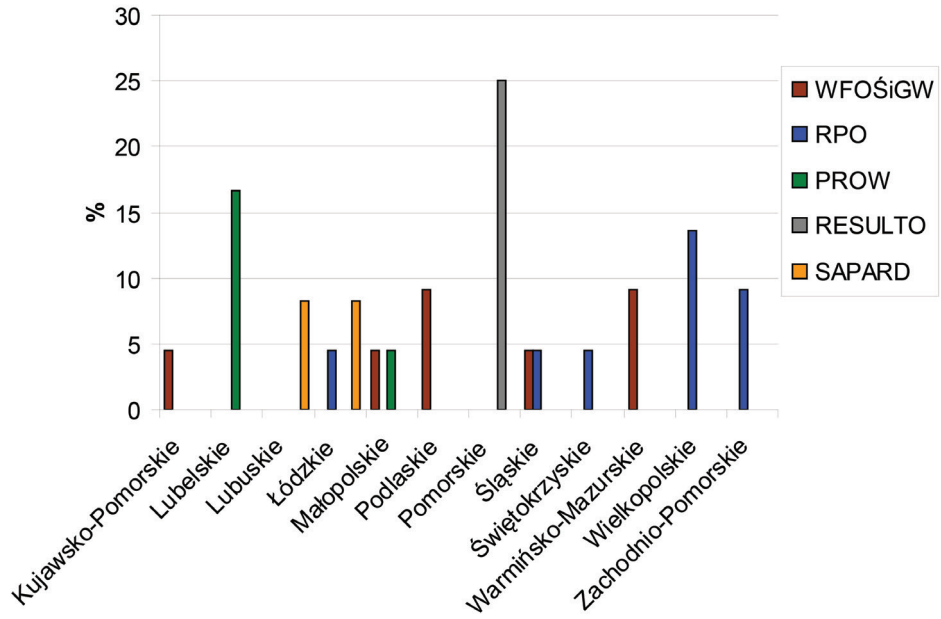

Source: own study

**Figure 1.** Sources of information used by farmers from A and B groups to extend knowledge of renewable energy sources.




Source: own study

**Figure 2.** Area structure of farms from groups A and B.




Source: own study

**Figure 3.** Forms of outside support accepted by farmes from group A, for implementation of investments in renewable energy sources.

Training courses attended by the farmers played a special role in development of ecological innovations as the acquired knowledge and experience helped the respondents make the most difficult decisions which energy sources would be the best ones and where they should obtain funds for this purpose (correlation dependence was found here to be at the level 1.0). On the whole, 44.4% farmers had taken part in the training courses which were offered mainly by Agricultural Counseling Centers (44.4%) and local authorities (41.6%). In some cases, the courses were organized by consulting companies (2), community associations (1), European Union Funds Local Information Point (1) and Voivodeship Agricultural Counseling Center (1). Solar and biomass energy were found to be the most popular energy sources (63.3% vs 20.2%). Special emphasis was put on solar collectors (41.5%), which, in the condition of Poland, according to Kopeć (2017), are very useful for domestic and swimming pool water heating, though not much for central heating. They can also be used for drying, e.g. farming produce. The author adds that, in the best season of solar collectors operation, that is, from April to September, to coverage of heat to be used for water heating can reach even 100%, and the heating boiler can be totally replaced by the collec-

tors. In the analyzed farms, the solar collectors were usually fixed on the roofs and terraces. Photovoltaic panels were less frequently used (25.7%) – modules ready to operate in connection with the electric grid. Smaller interest in this form of energy conversion might be connected with its low sale prices, as 50% of respondents who used them, were of the opinion that this is a serious barrier to this kind of energy source to become popular on the local market. A prosument pays for storing energy in the grid by transferring part of the generated electrical energy (apart from which there is no financial or tax settlement). The system of rebates (new settlement rules) is supposed to encourage prosuments to use possibly the biggest amount of produced energy without transferring it to the grid. Unfortunately, in production of energy from photovoltaic panels there are differences in its generation throughout a daily and yearly cycles (the most energy is produced during a day or in the summer, whereas the highest demand for energy in a household is in the morning, in the evening or in the winter). Therefore, use of energy for domestic purposes is not easy (Kopeć 2017). In turn, the potential of biomass to be used for energy purposes is conditioned by many factors (regional differentiation of the crop sowing pattern, level of organization and management, output of crops, and production marketability). The share in fallow areas and badlands in the land structure is significant (the highest was found for Podkarpackie Voivodeship, slightly lower for Lubuskie, Zachodniopomorskie and Warmińsko – Mazurskie, whereas the lowest was reported for voivodeships: Opolskie, Wielkopolskie, Kujawsko – Pomorskie Podlaskie and Lubelskie). Apart from the size of arable lands, a very important feature determining the volume and efficiency of biomass is its quality which, in Poland, is quite low. Adverse conditions for agricultural production occur in in Podlaskie Voivodeship, whereas, the best ones in Opolskie and Dolnośląskie Voivodeships (Chyłek, Kopiński et.al. 2017). The research has shown that respondents from only three voivodeships (Lubelskie, Podkarpackie and Świętokrzyskie) did not use biomass for electrical energy production. However, those who did, most frequently used straw (for heat generation) as a waste left from agricultural activity. Agriculture has significant potential to generate biomass for energy. However, the use of biomass for renewable energy can have unintended consequences, such as land use change, which could increase GHG emissions from agriculture (Liu et.al 2011).

It was noticed that although farmers express satisfaction with ecological investments in their farms (76.6% respondents declared ‘yes’, and 21%, rather ‘yes’), this satisfaction does not find reflection in willingness to take this type of actions in the future (-0.487). Certainly, such decisions are not the effect of lack of support from the government, as correlation has shown that there is poor dependence in this respect (0.176). Most likely the devices they purchased (most farmers bought them twice) meet their expectations so there is no need to purchase others. The respondents, having in mind the fact that the use of ecological

energy media has significantly reduced the electric energy bills and decreased the costs of agritourist activity, (full correlation dependence (1.0) was reported for the first and the second case), were willing to recommend this solution to the neighbors. This significant change in the household budget is particularly important as 72.5% of farmers offer their services all the year round. The respondents are fully aware that farmers investing in 'clean technologies' will contribute to more popularity of RES in rural areas (0.993), thus they will support environment protection (0.982). It should be highlighted that using 1 $m^2$ of solar collectors in a detached house, we reduce $CO_2$ emission by 125 kg, annually (Kopeć 2017). Unfortunately, the respondents do not perceive their ecological initiatives as a means of their farm promotion as only 33.3% of all the farmers inform their guests that they are in possession of RES systems. In order to increase interest in their offer, the farmers include information on the subject of the system they use, in their promotion ads. They also provide the information, that thanks to the innovative solution they have implemented, the costs of stay in their farms are lower. According to the Design Team Konsorcjum Bluehill Sp. z o.o. oraz Quality Watch Sp. z o.o. headed by Wacław Idziak, Ph.D. (*Rural tourism and agritourism in financial perspective 2014-2020, 2015*), rational water and energy management, waste segregation, use of such solutions as: solar collectors, domestic wastewater treatment plant, biomass boiler room, or rain water containers should be distinctive features of agritourist farms. Possibilities of implementing such projects seem to be good and can be carried out at many levels as social acceptance for this type of initiatives is growing. The tourist offer of such a farm should also include additional eco services for guests, that is, information on ecological aspects of the farm operation and cooperation with other farmers in this respect. However, in order to make these positive interactions come true and enable fast development of these small technologies, a number of barriers need to be overcome. Respondents of group A warn future investors of large financial outlays involved in launching such systems. They emphasize that the governmental support should be directed primarily to small size farms which are not able to bear the costs of self-financing (83.9%). They also pay attention to a small number of community programs for green energy (59.2%), unclear regulations (53%), lack of the investment profitability (23.4%) and knowledge of procedures connected with energy marketing in case of energy excess (39.5%). The research carried out by ISECES (Institute for Security, Climate and Energy Studies) seem to confirm these fears of farmers – mayors and people involved in non-agricultural activity in rural areas (Księżpolski, Pronińska 2017). Although the respondents acknowledged that RES provides a chance to gain some additional income, they did not have knowledge of detailed regulations for a prosument, and subsequently they did not understand them. They could not determine profitability of the investment or indicate legal and procedural barriers limiting the investments. They expected support from some unspecified governmental and local institu-

tions organizations. Some farmers, especially owners of large farms with non – agricultural activity were not satisfied due to breaks in electricity supply (situation reported in the author's own research by 62.9% of farmers who claimed that the energy grid is underinvested). Although these persons stressed that they were able to meet the energy demand by means of electricity generating aggregates, they would like to produce electrical energy on their own. Most frequently they indicated photovoltaics (unlike in the author's own research and in the research of Ropuszańska-Surma and Węglarz 2017). The investment itself raises concern because of the possibility of financial loss. The author's own research shows that the 'farmers knowledge of RES was better (both from group B and A) than the knowledge of respondents from the above discussed surveys. Nevertheless, one can have the impression that the inhabitants of rural areas need much assistance and information to help them understand what kind of risk they are about to take while investing in renewable energy sources (legal, political, technological, procedural) and whether they will be able to cope with it. Wasiuta (2015) provides a detailed description of these barriers. Less popularity of water turbines (1), small wind facilities (2), micro bio gas plants (3) or ground heat pumps (8) certainly results from the geographic conditions of the farm location and possibilities offered by nature. Therefore, application of solar collectors and photovoltaic systems enjoyed the biggest popularity of the respondents. It is worth noticing, that in 2018, those who choose to purchase such equipment can take advantage of different support programs. For example, authorities of Łódzkie Voivodeship offer two programs: Regional Operational of Łódzkie Voivodeship for 2014-2020 and a program financed from the means of the Voivodeship Environment Protection Fund and Water Management in Łódź (here, up to 40% of costs qualified for a purchase of solar collectors installation can be returned; also photovoltaic panels and heat pumps are co-financed). In turn, in Lubelskie Voivodeship the farmers can use program EKODOM II (WFOŚiGW), which provides the possibility of co-financing solar panels, photovoltaic systems and heat pumps for the needs of households in the form of a sum granted for 100% of the qualified cost, 25-30% of which can be terminated. In Mazowieckie Voivodeship (WFOŚiGW) a grant was prepared as part of program 'Pollution emissions reduction through purchase and montage of solar collectors, photovoltaic systems and water pumps' (it covers up to 50% of qualified costs), whereas, in Opolskie Voivodeship, RES co-financing by (WFOŚiGW) includes a loan (up to 95% of costs) for purchase and montage of solar collectors with the possibility of it being amortized (maximum 20% of the borrowed sum). Other programs which finance purchase and installation of solar collectors include a program known to the respondents, designed only for farmers and agricultural companies (PROW) and a regional program (RPO). Loans with low interest rate are also offered by the Environment Protection Bank to RES investors (www.jakbudować.pl). At the same time a project on novelization of *the act on renewable energy sources*

accepted by the Council of Ministers in 2018 assumes introduction of a number of new regulations (removing interpretation or legal doubts in different areas), which will certainly contribute to more effective utilization of RES in rural areas. Similarly, Chel and Kaushik (2011) write that the farmers should be encouraged by subsidies to use renewable energy technology. The authors emphasize how important is renewable energy for sustainable farming. Use of renewable energy resources is of primary importance in order to cope with the climate changes which threaten the global growth and prosperity and create severe natural disasters in various countries all over the world (Vourdoubas 2015). Renewable sources in agricultural sector, in fact, are an alternative energy source which guarantees maximum energy security while at the same time having a less disruptive environmental impact (Testa, Tudisca 2016).

## CONCLUSIONS

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

1. Farmers have a positive attitude to the initiative of renewable energy sources development in rural areas, however, in order to increase their interest in this kind of energy the government policy needs to provide favorable conditions of financial and legal – administrative support.
2. Low awareness of farmers on the subject of what programs and funds are available for RES installation confirms the need to provide consulting and advisory meetings and support from specialists in choosing appropriate energy system would be particularly useful.
3. Development of effective support programs for green technologies in rural areas will require more openness in communication with the state administration and encouragement through meetings with leaders whose positive experiences can encourage them to overcome the fear of making right though sometimes difficult decisions.
4. Development of micro sources of renewable energy will not replace conventional methods of energy production but the ecological attitude of farmers who are aware of the environment protection needs through pollution emission reduction is a good sign and gives hope that ecological energy media are becoming more and more appreciated and have a develop in rural areas.

## REFERENCES

Chel, A., Kaushik, G. (2011). Renewable energy for sustainable agriculture. Agronomy for Sustainable Devlopment, Springer Verlag/EDP Sciences/INRA, 31(1): 91-118.

Chyłek, E. K., Kopiński, J., Madej, A., Matyka, M., Ostrowski, J., Piórkowski, H. (2017). Conditionings and development directions of bioeconomy in Poland. Ministry of Agriculture and Rural Areas Development. Warszawa-Falent: 5-190.

Kopeć, A. (2017). *Use of Energy from the Sun*. Pomorski Center of Agricultural Counseling in Lubań. Stare Pole: 1-15.

Księżopolski, K., Pronińska, K. (2017). *Study of administrative and procedural barriers to RES development in rural areas*. Foundation: European Fund for development of Polish villages, Warszawa: 3-63.

Liu, T., McConkey, B., Smith, S., McGregor, B., Huffman, T., Kulshreshtha, S., Wang, H. (2011). Potential Renewable Bioenergy Production from Canadian Agriculture. World Renewable Energy Congress. Policy Issues (PI): 2485-2492.

*Rural areas and agritourism in terms of finances 2014-2020 for the Ministry of Agriculture and Rural Areas Development* (2015). Design Team Consorcium Bluehill Sp. z o.o. and Quality Watch Sp. z o.o. headed by Wacław Idziak Ph.D.. Warszawa: 3-26.

Ropuszyńska-Surma, E., Węglarz, M. (2017). Barriers to development of dispersed renewal energy sources in the light of survey research . Electrotechnical Survey. 93 NO 4: 90-94.

Testa, R., Tudisca, S. (2016). An Opportunity for the Agricultural Sector: The Renewable Energy Sources. American Journal of Agricultural and Biological Science, 11 (3): 100-102

Vourdoubas, J. (2015). Possibilities of Using Renewable Energy Sources for Covering all the Energy Needs of Agricultural Greenhouses. Journal of Agriculture and Life Sciences, ol. 2, No. 1:111-118.

Wasiuta, A. (2015). *Identyfication and assessment of barriers to renewable energy sourced development*. Selected problems of public administration. Law-Management – Politics (Prawo-Zarządzanie-Polityka) (ed.) W. Mikołajczewska, P. Kierończyk. Publisher of Gdańsk University (Gdańska Szkoła Wyższa. Gdańsk: 153-169).

Wielewska, I. (2016). *Destination of renewable Energy sources in rural areas of pomorskie viovodeship*. Association of Economists of Agriculture and Agribusiness .Scientific annuals T.XVIII, Z.15: 274-280.

www.jakbudować.pl

Jolanta Cichowska PhD
University of Science and Technology Bydgoszcz
Faculty of Civil and Environmental Engineering and Architecture
Al. prof. S. Kaliskiego 7
85-796 Bydgoszcz
Phone.: 48 52 340 84 40, 609 187 082
e-mail: jolanta.cichowska@utp.edu.pl

Received: 07.05..2018
Accepted: 04.09.2018