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## THE EVALUATION OF THE PUBLIC PERCEPTION OF THE IMPLEMENTATION OF "RAJGRÓD FW6 POLSKA WIND FARM"

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**ABSTRACT:** Renewable energy sources play a key role. The Polish legal system takes into account public participation in the investment process. This also applies to the construction of a wind power plant. In Poland, there is still opposition from local communities to the choice of location and the implementation of an investment project involving the construction of a wind power plant. The aim of this article is to assess the public perception of the construction of a wind farm located in the municipality of Rajgród. The survey of the local community opinion was conducted on the basis of a questionnaire carried out through a direct interview. By using the conditional valuation method (CVM), which uses the ready-to-pay (WTP) techniques, residents' preferences regarding participation in investment financing costs were also examined. Surveys carried out show that the inhabitants of the commune support renewable energy sources and some of the respondents are willing to partially subsidize them. The research has shown that there is a correlation between the age, education and income of the respondents and the amount of co-financing declared by them for the construction of a wind farm in the commune of Rajgród. The largest group of people willing to finance the investment were people in the age groups 26-40 and 41-65. The declared willingness to finance the investment was 1,86 EUR (10% of people) and 2,33 EUR (15% of people). These were people aged between 41-65 with their income of over 232,56 EUR. Only 2% of the respondents declared the amount of 1,16 EUR and they were people over 65 years of age with an average monthly income of about 116,28 EUR.

**KEY WORDS:** wind farms, social perception of investments, opinion pool

## Introduction

Today, humanity is facing global warming and climate change. Therefore, renewable energy sources play a key role, not only in solving the problems of dwindling natural resources, but also in reducing greenhouse gas emissions. Wind is one of the key sources of renewable energy for the energy sector (Krawiec, 2010).

The world fossil reserves are limited and gradually becoming depleted. Different sources give the approximate year of depletion of natural resources. According to the data of the Institute of Systematic Research of the Polish Academy of Sciences, oil resources will be used up around 2050, hard coal after 2020, and gas after 2060. Today, more and more countries in the world are seeing the potential of renewable sources of energy, reducing their dependence on fossil fuels. Wind power is already being used in more than 80 countries in Asia, Europe, the Americas, Australia and even Africa. Wind energy has considerable potential to be used. It is estimated that from a technical point of view, the world's usable wind energy resources are 53,000 TW-h/year, i.e. three times the world's energy consumption. Wind energy is currently expected to account for 12% of global electricity production by 2020 (Lewandowski, 2013).

The conditions for the use of renewable energy sources are still subject to changes in Polish law and in the financing system. In Poland, there is still opposition from local communities to the choice of location and the implementation of an investment project involving the construction of a wind power plant. Therefore, there is still a conflict resulting from the need to improve air quality by reducing emissions of gases and dust from the combustion of conventional fuels and the potential impact of wind farms on the deterioration of the comfort of life of the local inhabitants (Jakóbowski, 2016).

The Polish legal system takes into account public participation in the investment process. This also applies to the construction of a wind power plant. Therefore, it is also worth getting to know the opinion of the local community before taking action. It is important to interview the local population in order to determine whether the local community, and in particular the owners of the plots selected for the construction of wind farms, are willing to lease the land and whether the owners of neighbouring plots will allow for the implementation of the connection infrastructure if the project requires it. Site inspections are also part of the process of assessing the acceptance of the planned investment. These activities make it possible to estimate the risk of local social protests against the construction of wind farms, and if such a risk occurs, to develop a project for its prevention.

The aim of this article is to assess the public perception of the construction of a wind farm located in the municipality of Rajgród. The survey of the local community opinion was conducted on the basis of a survey carried out through a direct interview. By using the conditional valuation method (CVM), which uses the ready-to-pay (WTP) survey, residents' preferences regarding participation in investment financing costs were also examined.

## Energy technology in Poland and worldwide

Today's energy policy strategy is to reduce conventional energy production in favour of green energy. Reducing greenhouse gas emissions is a global problem. The action to reduce greenhouse gas emissions aims at reducing their negative environmental impact, combating climate change, and it is one of the ways to achieve sustainable development (Jakóbowski, 2016).

Globally, the share of conventional energy in global energy production continues to decline. The ever-increasing prices of fuels and the ever-increasing pollution of the natural environment are becoming a global problem. The solution to this problem may be the use of unconventional (renewable) energy sources, including wind energy (Krawiec, 2010).

The public has now realized the importance of the natural environment and that recovering lost environmental assets is a long-term process, which can sometimes be no longer possible (Jakóbowski, 2016).

According to some data from 2016, which can be found at the Global Carbon Atlas online platform, China is the largest producer of carbon dioxide, the second largest is the United States and the third one is India ([www.globalcarbonatlas.org](http://www.globalcarbonatlas.org)).

The principles of the Chinese government, announced in February 2016, assume a reduction in coal production by 500 million tons by 2020. The energy revolution also aims to achieve the level of 15% of renewable energy in total production of energy by 2020. According to data from the Global Wind Economic Council of 10 February 2016, in China, the installed capacity of the wind turbines is 145 105 MW. This country has become a leader in the development of wind farms, which has installed more than 30 GW of power over the course of a year. The production of energy by wind turbines not only involves reduced emissions of pollutants into the air, but it is also profitable. Modern Chinese technologies have contributed to an increase in innovation in the energy sector.

In August 2015, the *Clean Power Plan* project was implemented in the United States to reduce air pollution from the energy sector. The plan set out to reduce the level of carbon dioxide emissions from power plants by 32%

compared to the year 2005 by 2030. The Americans have the fastest growing sources of renewable energy. There is also an increase in the number of wind turbines installed. According to the American Wind Energy Association (AWEA), 4,300,000 turbines (37 wind farms) have been installed in the USA with a total capacity of 5 GW.

The Indian government has also drawn attention to the need for sustainable energy development. The result is the installation of facilities producing about 50,000 MW from renewable energy sources. However, this represents only 11% of the generated power. India's energy policy indicates that by 2022, the capacity from renewable energy sources will have been 74.4 GW. This concept will reduce carbon dioxide emissions by 20-25%. Currently, the share of wind energy in this country is about 10%.

The European Union's energy policy aims to ensure energy security, protect the environment, including the fight against climate change, and build a strong energy market based on the harmony of its member states.

According to data from the Global Wind Economic Council (GWEC) of February the 10<sup>th</sup>, 2016, the share of wind energy in the total energy volume in the countries of the European Union is still increasing. It is the following for some selected countries: Denmark – 40%, Portugal and Ireland – over 20%, Spain and Cyprus – about 20%, Germany – 16%. It should also be mentioned that Denmark is the largest producer of wind turbines and it plans to increase the share of wind energy in the overall electricity balance to 50% by 2030 ([www.gwec.net](http://www.gwec.net)).

In Poland, research into wind energy resources is carried out by the Institute of Meteorology and Water Management. At the of 2012, the annual growth of rate of installed wind power capacity was 880 MW (54%), and in 2013 – 893 MW (38%). In 2013, Poland was ranked 8<sup>th</sup> in terms of attractiveness for the wind energy market. According to data collected in 2013 by the Global Wind Energy Council, the share of energy produced from wind turbines amounted to 3.6% of all electricity produced (*Stan energetyki wiatrowej w Polsce w 2015 roku*, 2016).

As far as the Polish energy policy is concerned, its fundamental objectives are were defined in the Energy Law Act of 10 April 1997 (Prawo energetyczne, 1997). In addition, Poland, becoming a member of the EU, has assumed obligation related to the sustainable development of energy policy based on alternative energy sources. Since 1999, the country has had a non-governmental organization Polish Wind Energy Association (PWEA). The mission of the Association is to support the development of wind energy as a clean source of energy. The members of PWEA are companies that operate on the Polish wind power market and turbine manufacturers from Poland and abroad. In Poland, at the end of 2015, the capacity of the installed power

plants amounted to 4 978 MW. Wind power plants produced in 2015 10 041 GWh of electricity, which accounted for approx. 6.21% of total electrical energy production in the country (Maj et al., 2016).

According to the report of PWEA about 80% of wind investments belong to the so-called independent energy producers. Only 19% of the installed capacity is held by state-owned companies (PGE Renewable Energy – 529 MW, Tauron Ecoenergy – 200.75 MW, Energy – 185 MW, and ENEA – 56 MW) (Niedziółka, 2012).

### Wind energy in the public opinion

The Act of 3 October 2008 on the provision of environmental information and its protection, public participation in environmental protection and impact assessments on the environment (Ustawa o udostępnianiu informacji o środowisku..., 2008) refers to the right of the public to submit comments and requests when decisions are taken and when documents are drawn up (articles 33-43). In addition, the authorities conducting the proceedings, concerning the planned investment, have the obligation to inform about it and give reasons for their decisions. Every investment can have a potential impact on the development and possible improvement of the living standards of the local community. The public's interest in the project may result in its acceptance, which may result in their support for the implementation of the investment project. However, the public often has some concerns about the planned investment, which can lead to numerous protests.

The society considers the positive effects of the investment the following things: the additional revenue for landowners, the improvement of road quality and the increase in revenue in municipalities' budgets (that is the property tax). Investments related to the construction of wind power plants are often accompanied by protests from nature conservationists as well as local communities. According to nature conservationists, the construction of wind farms may have a negative impact on the natural environment (in particular on the avifauna and landscape). On the other hand, the protests of local community's concern mainly the impact on their health (noise emission), the deterioration of the landscape quality, as well as the decline in the value of land that could be used for construction or recreation purposes in the vicinity of the power plant. In most cases, these concerns result from the public's ignorance of the real impact of wind farms on the environment.

When constructing wind farms, it is very important that the investor consults the local authorities. It is worth getting acquainted with the plans of a village, commune and district development in order to get acquainted with

the needs of the local community. For this purpose, the project design, the scale of the project and a report on the environmental impact of the project should be presented to the inhabitants. Some of the local population's fears are due to ignorance, so it is necessary to provide the local community with as much information as possible about the planned project and wind power industry, i.e. to carry out the so-called educational process. It includes, among other things, promotional campaigns and information meetings aimed at raising people's awareness of wind energy (Niecikowski et al., 2008).

In Poland, public acceptance studies for the construction of wind farms were carried out. Respondents in communes where the farms were located stated that their concerns about wind energy proved to be unfounded. The presence of wind farms did not adversely affect their health, they did not feel annoying noise, they did not complain about bad mood and they did not notice a negative impact of these investments on the natural environment.

In 2011, employees of the Department of Public Health of the Pomeranian Medical University in Szczecin, commissioned by the Polish Wind Energy Association, conducted research on the acceptance of wind energy and other renewable energy sources by adult Poles. The research was carried out all over Poland by means of a diagnostic survey using a questionnaire, taking into account the following characteristics of respondents: income, education, age, gender and the place of residence. The conclusions of the study were as follows:

- the obtained results indicate that the research participants perceive the benefits of wind energy in the following areas: ecology, human health, and the technological progress of the country,
- despite the dynamic development of wind energy, stereotypes and myths about it continue to exist (*Akceptacja dorosłych Polaków dla energetyki wiatrowej i innych odnawialnych źródeł energii*, 2011).

In 2012, Veolia Environment commissioned the Millward Brown SMG/KRC Institute to conduct a public acceptance survey for wind farms. The aim of the survey was to verify public acceptance of wind farms in areas where investments had already been made. Whereby, half of them were built by 2007 (10 wind farms, which were the only ones existing at that time). The aim was to compare the results of new and existing investments over a longer period of time. The conclusions of the study were as follows:

- residents of the areas where wind farms are located are positively disposed to this type of investments, and most of them would again give their consent to the construction of a wind farm,
- 1/3 of the residents were afraid of starting up a wind farm, and the most frequent concerns were: noise (70%), negative impact on health (49%) and the deterioration of life comfort (32%),

- the vast majority of the residents (78%) stated that the presence of a wind farm did not adversely affect their health, 63% did not feel the noise caused by the operation of the turbines, and 61% did not feel the negative impact of a wind farm on the environment,
- 73% of the respondents were of the opinion that the launch of the wind farm brought some environmental benefits (63% of the respondents indicated the benefits of increasing the tourist attractiveness of the area, and 57% of the increase of the commune's tax revenues paid by the investor) (*Poziom akceptacji społecznej dla farm wiatrowych, 2012*).

In 2013, a survey was conducted in order to obtain information on the attitude of the inhabitants of the Warmińsko-Mazurskie Voivodeship towards wind energy. One of the most important assumptions of the study was to investigate the differentiation of the level of support for wind energy depending on whether you live in the commune with or without wind power plants. Such a survey design was to show the experience of the inhabitants of Warmia and Mazury with wind energy to date and to diagnose the character of the inhabitants' attitudes towards wind farms, and in particular their impact on the nearest environment: landscape, the health of the inhabitants, the development of tourism, the natural environment, and power management of particular communes. The conclusions of the study were as follows:

- the vast majority of the inhabitants (78%) of the Warmińsko-Mazurskie Voivodeship see the potential of wind energy investment for their region (the most frequently indicated benefits are: environmental protection, the increase in a commune's income from taxes paid by the investor and the decrease of unemployment),
- the research has shown that the inhabitants of communes with wind farms, in comparison to the general population of the region, see much more benefits associated with the construction of wind farms,
- the vast majority of respondents (87%) were of the opinion that wind power plants are a good source of energy,
- the majority of respondents (75%) agreed that a wind farm should be established in their commune, whereas in communes with power plants this percentage was 82% (*Energetyka wiatrowa, 2013*).

## Characteristics of “Rajgród Wind Farm FW6 Polska”

Rajgród commune is situated in the north-eastern part of Grajewo county in Podlaskie Voivodeship. Rajgród commune has an agricultural and tourist character. The area of the commune is 20716 ha, of which 5879 ha are forests and 1254 ha are waters. The areas used for agricultural purposes account for 58% of the total area of the commune. The majority of soils used for agricultural purposes are classified as IV (45%) and V (23%) of the bonus class. Classes V and VI soils constitute a significant percentage – 28% of the commune’s area. Forests, which constitute 28.37% of the commune’s area, both public and private, are managed and supervised by Rajgród Forest Inspectorate. From the southeast the commune borders with the Biebrza National Park forest complex. Slightly more than 6% of the commune area is covered by water. These are mainly areas connected with Rajgrodzkie Lake and the Jegrznia river. Rajgrodzkie Lake, with the total area of 1514 ha, is crossed by the border of voivodships and within the boundaries of Rajgród commune there are 1000 ha of its area. Within the administrative boundaries of the commune there is the entire eastern bay, part of the main reservoir (the biggest depth is 52 m) and most of the picturesque southern bay. From the eastern bay flows the Jegrznia river, which after numerous meanderings flows into Dręstwo Lake (the lake itself is not located in the commune, and the border with the neighbouring commune Bargłów Kościelny runs along a part of the coastline), then it flows out and falls into the vast area of Czerwone Bagna. The Kuwasy canal, which together with some smaller canals and drainage ditches forms a network of surface waters in the agricultural part of the commune, originates from the southern bay. There are 10 holiday resorts by the lakes. The seat of the commune authorities is the town of Rajgród, located on the eastern bay of Rajgrodzkie Lake. There are 5969 people living in the commune, and in the town of Rajgród there are 1799 people. Apart from Rajgród, the commune consists of the following villages: Będa, Biebrza, Bukowo, Czarna Wieś, Ciszewo, Danowo, Karczewo, Kołaki, Kosiły, Kosówka, Kozłówka, Kuligi, Łazarze, Miecze, Orzechówka, Pieńczykowo, Pieńczykówek, Przestrzele, Rybczyzna, Rydzewo, Skrodzkie, Sołki, Stoczek, Turczyn, Tworki, Wojdy, Woźna Wieś, Wólka Mała, Wólka Piotrowska. The effect of the attractive location of the commune is the development of ecological agriculture and agritourist. In the whole commune there are 390 business entities, 13 of which belong to the public ownership sector, and the remaining 377 are private entities ([www.umrajrod.pl](http://www.umrajrod.pl)).

The investment of the wind farm was carried out in the area of Rajgród commune, in 7 villages, such as Turczyn, Bukowo, Kołaki, Kosiły, Karwowo, Skrodzkie and Wólka Piotrowska. The wind farm was established in the area



of the commune about 10 km south-west of Rajgród. The land on which the farm was built is an irregular area with numerous small glacial hills and closed valleys. The area in which turbines are located is rural. The land was used for arable farming. The predominant vegetation is cultivated vegetation and the plants that grow on the meadows. There are also some roadside and mid-field trees and bushes. In the adjacent areas on the northern side of the wind farm there are forest complexes.

This area has a network of paved roads. In order to construct access roads to particular turbines and shunting yards, changes in terrain were planned during the investment planning process so as to meet the design requirements for new transport systems. In the village of Turczyn two trees were cut down, which collided with the scope of the access road. The resulting internal roads are made of a hardened surface with a variable roughness of 4 m in width.

The analysed area for wind farm development is fully covered by the local spatial development plan. The building and architectural design takes into account the assumptions of the local plan. The owners of the land, which constitutes the area for the investment, are natural persons (agricultural land) and the management of the commune and the town of Rajgród (the area of communal roads). The investment has not changed the current purpose of the areas located in the vicinity. Wind turbines were distributed irregularly as their optimal location was taken into account. Considering the guidelines of the local spatial development plan and the existing standards "Rajgród wind farm FW6 Polska" meets the location guidelines (The Municipal Office in Rajgród).

The construction of "Rajgród Wind Farm FW6" involved the construction of 11 repetitive wind turbines, including the main power supply point (GPZ), network connection with the transformer station through underground power cables, and internal access roads with a manoeuvring area.

The wind farm is an object consisting of a reinforced concrete foundation, a tower and a three-pane wind turbine with a horizontal axis of rotation. The turbine consists of a gondola and a rotor. The maximum height of the wind turbine tower, counted to the rotor axis, is 125 m. The diameter at the base of the tower is approx. 4.8 m. The energy produced is transmitted via underground cable lines to the main power supply (GPZ). The entrance to the interior of the building is led by technological stairs, which are located on the side of access roads. The facility is equipped with SWT-2.3-108 turbines with a total capacity of 25.3 MW and a nacelle rotation system. A wind turbine (WTG) consists of a tower and a nacelle which consists of a rotor and a measuring system. The rotor consists of blades connected by a hub. The blades are moved by wind and transmit power to the hub, which is connected to the

drive shaft, which increases the speed of the axis. The mechanical energy is transferred from the gearbox to the electric generator, which converts it into electricity that is then transferred to the output of the power grid. In addition, the facility is equipped with devices regulating the parameters of turbines in order to obtain acceptable levels of noise. In addition, the nacelle casing has a weather protection function. The core of the tower is located in a reinforced concrete foundation of 20 cm above ground level. The tower of the wind turbine is made of steel segments. The rotor wings have a housing protecting the interior girder, which is the structure of the wing. In addition, the power plant was equipped with a daily signposting of an air obstacle. This marking is in the form of five painted strips of equal width which are perpendicular to the axis of the wing from the outside. Out of five lanes, three are red and two white and they cover 1/3 of the length of the wing. A wind turbine operates both during the day and at night (*Farma wiatrowa Rajgród FW6 Polska*, 2013).

### The method of researching the public perception of investments

Among the inhabitants of 7 villages, covered by the investment of the construction of a wind farm in the commune of Rajgród, surveys were conducted using the direct interview method, in order to test the knowledge of their inhabitants about renewable energy sources and their attitude towards the implementation of "Rajgród wind farm FW6 Polska".

The research tool was a survey questionnaire containing 12 questions. The first part, consisting of 4 questions, concerned the general knowledge of the inhabitants about renewable energy sources. Residents were asked whether they knew what renewable Energy sources were and whether they supported their use, as well as if they believed that wind farms had a negative impact on the environment. The second part of the questionnaire, containing 8 questions, made it possible to examine the attitude of the respondents to the construction of a wind farm in the commune of Rajgród. Respondents were asked about the benefits the commune and they themselves would have from building a wind farm and whether its construction would have an impact on their lives and health. The preferences of the inhabitants with regard to participation in the cost of investment financing were also examined. The last part of the questionnaire included a metric in which the respondents were asked about their gender, age, income and education.

To assess the social perception of investment financing costs, the Contingent Valuation Method (CVM) was used, based on the Willingness to Pay (WTP) study (Graczyk, 2005). Each respondent, after receiving a question-

naire, could determine the amount of money they would be willing to spend on the construction of a wind farm.

The survey was conducted on a group of respondents who were the inhabitants of rural areas covered by the impact of the analyzed investment, 60 people (60% of whom were women and 40% men) representing households agreed to fill in the questionnaire. The majority of the respondents were aged 26-40 (37%) and 41-65 (38%). Most of the respondents had secondary or vocational education (28% in each of the analyzed groups).

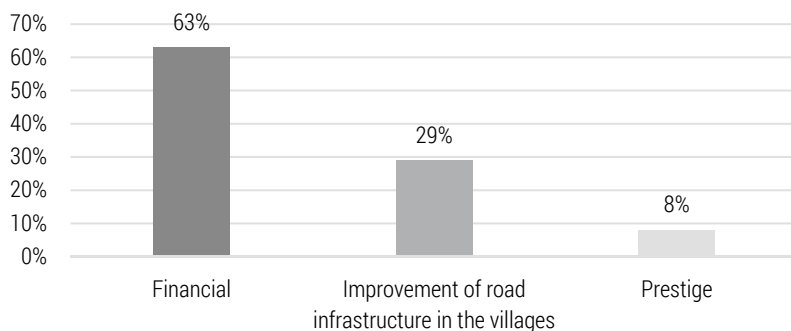
### The analysis of the results of the survey for the reception of the „Rajgród wind farm FW6 Polska” investment project

The research has shown that regardless of age and level of education of the commune inhabitants, all the respondents know, what renewable energy sources are. They also understand the need to use renewable sources for energy purposes. The support for the implementation of wind farms decreases in the situation of constructing facilities in the respondent's area of residence.

On the basis of the questionnaire, the opinion of the inhabitants was also examined in relation to the negative impact of wind power plants on the environment. The vast majority of respondents, i.e. 67% stated that wind farms do not have a negative impact on the environment, as the energy generated comes from renewable energy sources. The remaining 33% were against the construction of power plants, claiming that wind farms have a negative impact on the environment, as well as being a nuisance for people and animals (noise emitted by wind turbines) and contribute to the mortality of birds and bats. These were people aged 18-26 (18% of the respondents) and 26-40 (15% of the respondents) with secondary education.

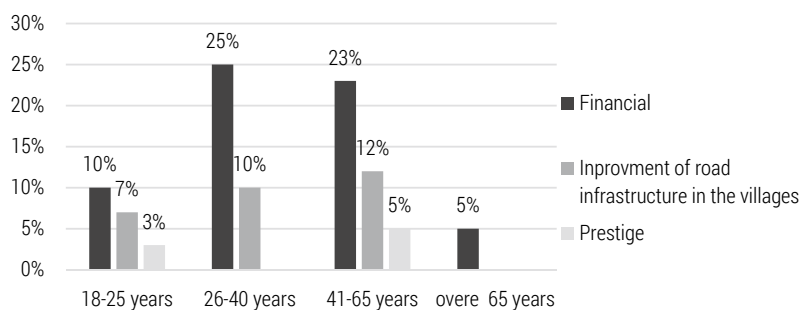
When asked about the benefits of building a wind power plant in the commune, 63% of respondents said that the commune has financial benefits from the investment, especially concerning the property tax. The largest group were people aged 26-40 (25% of the respondents) with secondary education and 41-65 (23% of the respondents) with vocational and university education. On the other hand, 29% of the respondents indicated that the benefit is the improvement of the technical condition of road infrastructure in rural areas. The largest group were people aged 41-65 (12% of the respondents) with primary and vocational education and 26-40 (10% of the respondents) with secondary education. On the other hand, 8% of the inhabitants stated that thanks to the investment the commune increased its prestige in relation to other communes and in relation to the county. These were

people aged 18-25 (3% of the respondents) with University education and aged 41-65 (5% of the respondents) with primary education (figure 1 and 2).



**Figure 1.** The benefits for the commune of Rajgród from a construction of a wind farm

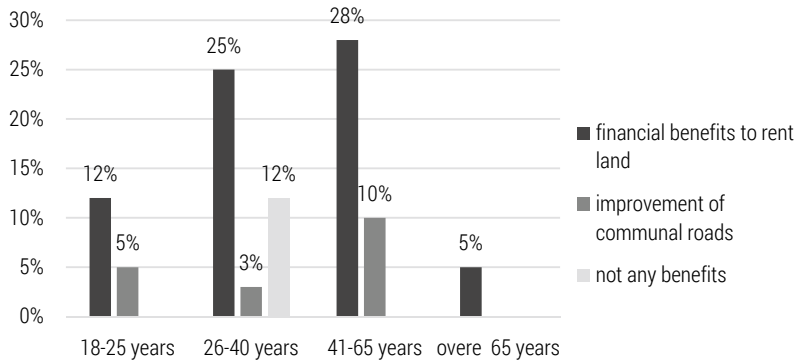
Source: author's own work.



**Figure 2.** The benefits for the commune from the construction of a wind farm and the age of respondents

Source: author's own work.

In the survey 88% of the respondents stated that the investment will bring more benefits. The largest group were people aged 41-65 (35% of the respondents) with income over 1000 PLN and aged 26-40 (22% of the respondents) with income between 500 and 1000 PLN. They, first of all, pointed out all the financial benefits to farmers who rent land for the investment. Additionally, the statements mention the improvement of communal roads used by the inhabitants of particular villages. Only 12% of the respondents said that the investments have not brought any benefits to them. These were people aged 26-40 with an average monthly income of about 500 PLN (figure 3).

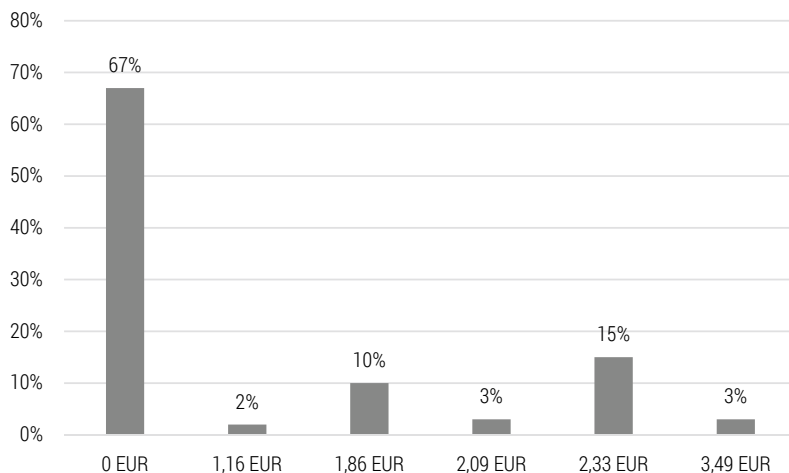


**Figure 3.** The benefits from the building of a wind farm for the inhabitants of the commune of Rajgród

Source: author's own work.

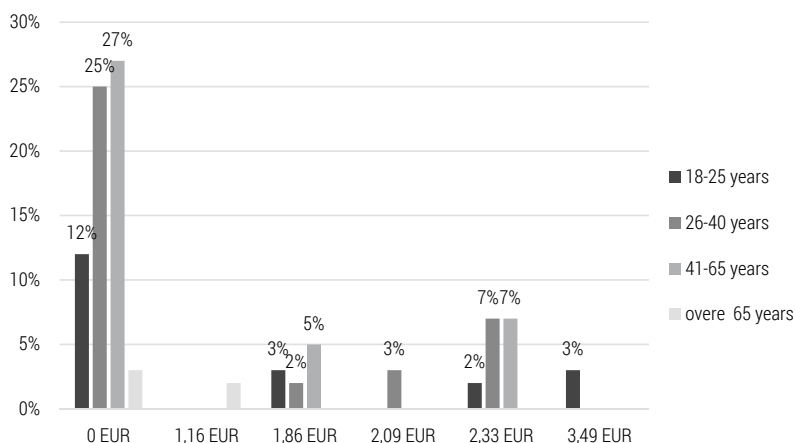
Preferences to participate in investment financing costs were also examined. The majority of respondents (68%) were against its co-financing. The largest group were people aged 41-65 (27% of the respondents) with incomes over 232,56 EUR and 26-40 (25% of the respondents) with incomes up to 232,56 EUR. On the other hand, in the 18-25 age group 12% of respondents did not want to participate in financing investments, while in the 65+ age group – 3% of people with an average monthly income of about 116,28 EUR. The respondents claimed that EU programs or the investors themselves should provide financing for the construction of the wind farm. On the other hand, those who agreed to co-finance the investment (33%) stated that they were ready to declare small amounts of money. The largest group of these people were persons aged 26-40 and 41-65 (respectively 12% of the respondents), while people aged 18-25 constituted 8% of the respondents, and persons aged 65 ±1% of the respondents.

Among all the respondents, the largest number of them, i.e. 15%, declared that they were able to co-finance the construction of a wind farm with the amount of 2,33 EUR. They were people aged 26-40 and 41-65. And the smallest amount of investment co-financing was 1,16 EUR declared by 2% of the respondents aged over 65. The maximum amount of co-financing among the respondents was 3,49 EUR, declared by 3% of the respondents aged 18-25 (figure 4 and 5). It was a one-time declaration of the surveyed financing of investments related to renewable energy sources, including wind farms.



**Figure 4.** Respondents' declared amounts for the construction of a wind farm in the commune

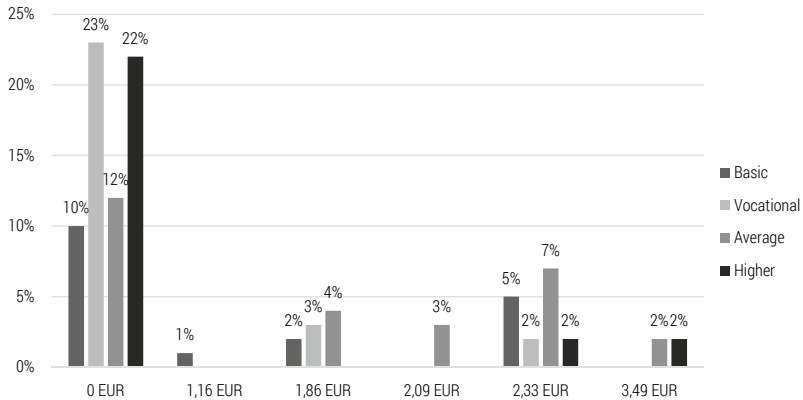
Source: author's own work.



**Figure 5.** The relationship between the age of respondents and the amount of co-financing for the investment

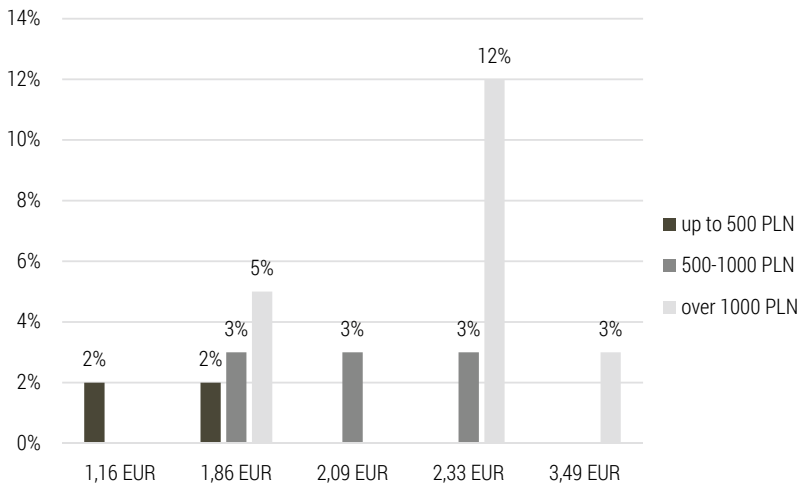
Source: author's own work.

It was also examined the relationship between the level of education and the readiness of respondents to finance the construction of a wind farm in the commune. In the group not willing to pay, the majority of the respondents (23%) were people with university and vocational education (22%). People declaring their readiness to finance investments are those with secondary education (16% of people) (figure 6).



**Figure 6.** The level of education of the respondents declaring their willingness to pay  
Source: author's own work.

Another issue was to check the relationship between the declaration of co-financing and the average monthly income of the respondents (figure 7).



**Figure 7.** Average monthly income per person of respondents declaring their willingness to co-finance the construction of a wind farm in the commune

Source: author's own work.

The research has shown that there is a relation between the income and the amount of investment co-financing declared by the respondents. The highest amount of 3,49 EUR was declared by 3% of the respondents, while 2,33 EUR would be ready to be paid by 12% of the respondents. These people indicated income of above 232,56 EUR. On the other hand, the smallest

amount of 1,16 EUR was declared by 2% of the respondents with their incomes below 116,28 EUR.

When asked about the impact of the wind farm location on their lives, 55% of the respondents said that the wind farm located in the commune does not directly affect their lives. On the other hand, 45% of the respondents complained about the noise and changes in the landscape. The inconvenience of a wind farm, or its absence, is related to the distance of the wind farm from the place of residence of individual respondents.

The last question concerned comments and objections concerning the construction of the wind farm in the area of the commune of Rajgród. Most respondents did not object it, but 15% of the residents pointed out that the distances between the turbines and residential buildings were too short, claiming that a longer distance would be more appropriate due to the nuisance of the noise emitted by the turbines.

In summary, all respondents support the use of renewable energy sources. The majority of the respondents support investing in wind farms in their commune. The positive attitude of the commune inhabitants towards the construction of a wind power plant is also related to the distance between them and the wind turbines.

## Conclusions

On the basis of the conducted analysis, the following conclusions can be drawn concerning the public perception of the implementation of wind power projects:

1. The residents are familiar with the concept of renewable energy and understand its importance for the energy industry development at local and national level.
2. Local communities point to financial benefits resulting from the location of wind farms in the area of the commune.
3. The residents understand the importance of renewable energy for the environment and are concerned about the risks and nuisance that wind-mills can pose to humans and animals.
4. The inhabitants of the commune support renewable energy sources. Most of the respondents accept wind farms in their commune, and 33% of the respondents are willing to partially subsidize them.
5. The research has shown that there is a correlation between the age, education and income of the respondents and the amount of co-financing declared by them for the construction of a wind farm in the commune of



- Rajgród. The largest group of people willing to finance the investment were people in the age groups 26-40 and 41-65.
6. The declared readiness of the respondents to finance the investment was at the level of 8 PLN (10% of people) and 10 PLN (15% of people). These were people aged 41-65 with their income of over 1000 PLN. Only 2% of the respondents declared the amount of 5 PLN and they were people over 65 years of age with an average monthly income of about 500 PLN.
  7. People with low incomes were unwilling to finance investments or declaring low amounts. In the group not willing to pay, the majority of respondents were people with university and vocational education. On the other hand, those who declare their readiness to finance investments are mostly people with secondary education.

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### The contribution of the authors

Krystyna Rauba – literature review – 60%; acquisition of data – 20%; analysis and interpretation of data – 70%

Agata Zimińska – literature review – 40%; acquisition of data – 80%; analysis and interpretation of data – 30%

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