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THE IMPACT OF ONSHORE WIND FARMS ON THE TOURIST VALUE OF THE ENVIRONMENT IN THE OPINION OF POLAND'S INHABITANTS. ANALYSIS OF SECONDARY EMPIRICAL RESEARCH RESULTS

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ABSTRACT: In Poland, after several years of stagnation, onshore wind energy is becoming an important subject of interest for state and local authorities and society. An optimistic outlook for wind turbine investments is therefore emerging. The aim of the present paper is to discuss the social conditions that are an expression of public awareness that supports the construction of wind farms and to understand social opinions on the influence of wind farms on the local landscape, especially on the tourist values of the landscape.

To characterise the topic under study, the methods of literature review, statistical analysis, and secondary document analysis were used. Results of the nationwide empirical studies contained in the reports indicated a high level of public awareness of Polish society accepting investments in onshore wind farms. They do not diminish its tourist and recreational values and do not limit the development of tourist traffic.

KEYWORDS: wind energy, public awareness, tourism landscape

Introduction

Poland's meeting climate and environmental goals for renewable energy sources (RES) and reduction of CO₂ emissions, and conditions for implementing Poland's energy policy strategy until 2040, is associated with the need to develop onshore wind energy. This need is becoming even more urgent in light of the effects of the COVID-19 pandemic, Russia's aggression in Ukraine, and the related economic sanctions against Russia. While there are specific resolutions and plans in this regard, implementing them is not easy. The difficulties are caused by the lack of appropriate regulations. Therefore, the development of wind energy in Poland is supported by social conditions such as a high level of public awareness of the country's inhabitants approving of the need to increase the use of wind energy. The aim of this paper is to present issues related to the state of Polish public awareness, knowledge, and interest in wind energy development in Poland and to identify behaviours that approve of its development. The paper also discusses the significance of social opinions on the impact of wind turbines on the tourist values of the landscape of a given geographic area, which are the energy investments that can limit the development of tourist activities. They can reduce resident income and local budgets obtained from the tourism economy.

However, the results of nationwide empirical research presented in the reports used for this paper show that the Polish society exhibits a high level of awareness and approves of investments in onshore wind farms. Wind farms have a positive impact on the natural and cultural values of the local landscape. They do not negatively affect its touristic and recreational value (Ministry of Climate and Environment, 2020a; 2020b). Public acceptance of wind energy should thus do more than just foster climate objectives and also encourage political authorities to create legal frameworks that would facilitate investment in renewable energy sources, especially onshore wind energy.

In our paper, we used the results of nationwide empirical studies collected using a diagnostic survey based on CATI and CAPI techniques. These results were published in reports by the Ministry of Climate and Environment (2020a; 2020b). Therefore, the method of secondary materials analysis was used. We also used the methods of literature review and statistical analysis. The results of nationwide empirical research on wind energy and its impact on the tourist landscape presented in the paper allowed for the formulation of the conclusions of a cognitive and practical character.

The analysis of the problem under analysis was juxtaposed with the foundations of the theories of behavioural economics and new institutional economics. These theories describe people's organised behaviour towards activities in their environment, such as windmill investments, for instance.

Literature review

Tourist landscape

Without going into the details of various definitions of landscape, it should be emphasised that, in general, the landscape is a system isolated in a specific spatial unit, which consists of elements of the natural, economic, social, and cultural subsystems. The landscape of a particular geographical space is formed by tangible and intangible values of human activity concerning nature, culture, and historical heritage. They are important elements in the socioeconomic development and living conditions of the inhabitants of a particular area (Armand, 1980; European Landscape Convention, 2006). The landscape is a source of aesthetic experiences for humans, and it has a beneficial effect on their psychophysical health. It undergoes constant changes due to long-term natural and anthropogenic processes related, among others, to human economic activity. As part of the landscape ecosystem, humans, through their activities, not only improve and beautify the landscape but also destroy and degrade it, especially its natural values (Simel, 2006; Urry, 2002).

Elements of the landscape, such as nature, economy, and cultural heritage, are not only protected, but they are resources used in the current and future socio-economic development of a specific area, including the development of the tourism economy. They create supply and demand values that foster tourist and recreational activities of various social groups, are of interest to tourists, and motivate them to travel. The natural and cultural values of the landscape satisfy the relevant needs of tourists and, from the economic point of view, constitute goods that are consumed by tourists. As objective and subjective elements and features of the landscape, they create its identity and tourist attractiveness and influence the tourist image of the area. The tourist image of the landscape of an area is a cognitive category, expressing knowledge describing subjective associations manifested in the opinions and emotions of tourists. Tourist values and the image of the landscape of a specific geographic space add to its tourist attractiveness, understood as a function of objective and subjective natural and cultural values, tourism development, and communication accessibility of this space.

Providing (supplying) tourist values of the landscape of a particular area that increases its tourist attractiveness is connected with appropriate land development. Development here means human activity adapted to the natural and socio-cultural environment of an area to the needs (demand) of tourism (Gaworecki, 2003).

The management of landscape values must conform to the principles of sustainable management, taking into account maintaining the balance of

economic, social, and natural objectives of the area (Richling & Solon, 2011). These principles, among others, include:

- the principle of equal access to landscape potential,
- the principle of a high level of protection of landscape functions,
- the principle of regionalization,
- the principle of ecological effectiveness and economic efficiency,
- the principle of prevention; – the principle of precaution,
- the principle of socialisation and public participation in the planning process (Sasinowski, 2007).

Landscape management aims to achieve spatial order and eliminate ecological barriers. It combines the activities of landscape system protection with the progress of civilisation and economy and leads to a gradual reduction in landscape disproportions. It minimises functional, ecological, economic, and social conflicts according to the criteria of rationality, optimality, and management knowledge (Zimniewicz, 2008). The presented idea of managing the landscape values of an area with conscious use of scientific knowledge undoubtedly favours the development of tourist and recreational activities together with the simultaneous development of wind energy (Badora, 2014).

Wind energy

People transform the landscape of their surroundings by introducing new elements with positive or negative characteristics. Tourists look for areas suitable for recreation and leisure. They prefer places with landscapes of nature or different cultures compared to the place of their permanent residence. Examples of the development of a specific area with suitable landscape values using emerging wind farms become problematic and debatable (Marcinkiewicz & Poskrobko, 2015; Ryszkowska et al., 2018). Wind farms are devices that generate electricity using wind turbines driven by wind power. Electricity generated by wind turbines is considered to be environmentally clean as no fuel is burned to generate it. Wind turbines are divided into different types based on

- application (household, street, industrial power plants),
- power (micro, small, large),
- location (onshore, offshore).

Furthermore, wind power plant complexes with accompanying infrastructure are called wind farms, connected to the power grid. Wind farms can be located onshore or offshore (Regulation of the Minister of Economy of May 4, 2007).

Conventional energy sources (hard coal and lignite, oil, natural gas), which were a progressive innovation a century ago, have now brought nega-

tive consequences in the form of environmental degradation (air pollution) and climate warming (Chodkowska-Miszczuk, 2014). These situations have contributed to the interest of international organisations and individual countries in renewable energy sources. According to a directive of the European Parliament and the Council of Europe as of April 2009, renewable energy was supposed to account for 20% of total energy consumption in European Union member states by 2020 (Mroczek et al., 2013). In Poland, this level was to be 15% (Statistics Poland, 2020). The 2015 Paris Agreement calls for a complete phase-out of fossil fuels in the European Union by 2050 (Sobieraj, 2017). However, in Poland, the achievement of even a not-too-exorbitant plan according to which alternative natural energy was expected to reach 15% in 2020 failed. Electricity in Poland has been generated from: – hard coal and lignite – 78.2%, – natural gas – 7.2%, – renewable (alternative) sources – 12.8% (Statistics Poland, 2020). In other European countries, energy based on renewable energy sources accounts for 54.6% in Sweden, 41.2% in Finland, 40.3% in Latvia, 36.1% in Denmark, and 33.4% in Austria. Alternative energy in Poland comes primarily from:

- wind (7.6%),
- biomass (3.0%),
- hydropower (1.2%),
- biogas (0.7%),
- photovoltaics (0.3%) (Statistics Poland, 2020).

In the present paper, the subject of the analysis is onshore wind energy, whose development in Poland is not limited by social but by formal and legal issues. The so-called 10 H distance law introduced in 2016 in Poland did not favour the development of wind energy (Act from 20 May 2016 on investments in wind power plants). According to this law, it became impossible to build turbines at a distance of less than ten times their height from the nearest buildings. Hence, it was colloquially known as the 10 H act for modern wind turbines. These provisions resulted in limiting the construction of turbines even to about 2,000 meters from buildings. Given the dispersed development of space in Poland, almost the entire area of the country has been eliminated from such investments. This situation has virtually contributed to the stagnation in the renewable energy market, restricting investors from building wind farms. Instead, it has led to a dominant role for the coal lobby (hard coal and lignite) in the energy industry. At the same time, it should be emphasised that due to the high cost of coal mining and the increase in the price of CO₂ emission allowances (from 5-6 € per tonne to 44 € in three years), we experienced an increase in energy prices. This increase affected large, medium-sized, and small enterprises and households, thus leading to an increase in the prices of goods and services. This situation caused the Polish authorities 2021 to take action, liberalising the legal regulations for the

construction of onshore wind farms (Król, 2022). The relaxed distance bill, known as the 10 H Act, now provides for wind turbines to be located on land with a minimum distance of 500 meters from buildings. The location of new onshore wind turbines will also depend on the decisions of local governments. Local authorities, as part of their development plans, may waive the 10 H rule requirement and agree to a closer location provided a minimum protection zone of 500 meters from buildings is maintained. New onshore wind farm investments would also need to be consulted with the local community. Unfortunately, this bill has not yet entered into force ("Cztery piąte ankietowanych," 2022). A report by the Union of Polish Rural Gminas (Związek Gmin Polskich RP) shows that about 35% of Polish gminas invest in renewable energy development on their territory, including wind energy. Renewable energy sources are often created by local governments in areas of former obsolete state-owned farms from the period of Communist rule, with wind power plants being an important part of the budget of these governments ("Jedna trzecia gmin," 2016).

The conditions being created for onshore wind energy provide ample investment opportunities for state and private investors to build and operate wind farms. They also allow Poland to meet its climate and environmental targets for the development of Renewable Energy Sources and the reduction of CO₂ emissions. It offers cheaper energy to the economy and inhabitants of Poland and will stop dirty energy from coal.

The need for wind energy development in Poland is also expressed in the public awareness of Polish society. Polish residents admit that wind energy, which is cheaper and cleaner, will improve the environment, reduce carbon dioxide emissions, bring additional revenue to local governments, and increase the competitiveness of the Polish industry (Chodkowska-Miszczuk et al., 2016). Still, it will not reduce the tourist value of the landscape.

This is evidenced by studies on the impact of wind farms on the landscape and tourism carried out in many European countries. For example, similar to Poland, the development of wind energy in the Czech Republic (Franta'l & Kunc, 2011) was delayed for economic and political reasons. It was not until 2005 that favourable conditions emerged for investment in wind turbines, supported by legal and financial foundations. This situation has created arguments to discuss and seek answers to the question of whether wind farms can destroy the visual values of the natural and cultural landscape that is conducive to tourism. Franta'l and Kunc (2011) emphasise that the construction of wind turbines cannot be approached negatively in advance. And, one should not succumb to unfounded and unscientific opinions about their negative impact on the tourism landscape. These authors concluded, based on their empirical research, that wind farm activity in an area is received positively. Such farms are seen as a symbol of clean energy

which promotes environmental protection (70%) and thus tourism. They can create positive aesthetic values of the landscape that enhance its tourism value (35%). Only 6% of respondents considered the construction of wind farms as an investment that negatively affects the image of the tourist landscape. Local communities have been particularly positive about wind farms. Residents surveyed in areas where wind turbines operate emphasised that these investments bring a clear economic benefit to landowners, investors, and local authorities. They can be a source of funding for the development of local infrastructure and its promotion, which is conducive to the development of tourism and recreation in the area. Therefore, residents perceive wind farms as a source of clean, renewable energy. They are seen as a contrast to industrial developments in the form of factories, mines, power poles, and cell phone towers, which, more figuratively and visually, harm the landscape.

The issue of the impact of wind farms on the tourist image of the landscape and the number of arriving tourists has also been the subject of scientific analysis in Portugal. For example, the results of one such empirical study conducted among the residents of a rural gmina of tourist value in the areas with wind farms and among tourists indicated that wind turbines do not have a negative impact on tourist demand (Silva & Delicado, 2017). Although there were opinions among tourists that the wind turbines pollute the rural landscape that is rich in cultural heritage sites, these imperfections are offset by the environmentally clean energy produced by the wind farms, favouring rural nature and material culture. According to tourists, the motivation for coming to a given locality is its natural and cultural heritage values. Wind farms are not a significant obstacle to visiting a tourist destination. Residents and tourists surveyed also emphasised that investment in wind farms is of great economic importance to residents and local government. Taxes paid by wind turbine investors can be partly invested into the development of local infrastructure favouring tourists and the local community nature trails, bicycle routes, supporting sports and recreation activities, and promotion of the area (Silva & Delicado, 2017).

There is also empirical research in which results show tourists' negative attitudes towards wind farms. An example, such research was conducted in Iceland by using a direct interview method among 47 tourists. The results of this research show negative opinions of tourists towards wind farms which, in their opinion, destroy the natural and historical values of the area. Therefore, they are not favourable for various forms of tourism and recreation. Investments in wind energy degrade the tourism and recreational attractiveness of a given site, its tourism image, and economic significance (Sæpórsdóttir et al., 2021).

Social awareness in the context of behavioural economics and the new institutional economics

Public awareness is a set of widespread and accepted people's views, beliefs, and ideas about given facts and phenomena. It becomes a model of thinking and appropriate behaviour for members of a given community (Sztompka, 2002). The behaviour of a human or a social group is understood as specific actions related to needs and motives that encourage meeting these needs. Public awareness is determined by socio-cultural values and norms functioning in a given community of people (Sztompka, 2002).

Taking into account the subject matter of the paper, it was assumed that the public awareness of the Polish inhabitants in relation to wind energy concerns their knowledge and interests in the subject and their beliefs about the importance of wind energy. Furthermore, behaviours toward wind energy are any actions resulting from the state of public awareness that any person or group of persons can undertake to positively or negatively affect wind energy development.

Within economics, the issue of public awareness and people's behaviour toward wind energy can be referred to as two mainstreams, i.e. behavioural economics and new institutional economics. Behavioural economics assumes that human factors such as emotions, interactions, and formal and informal social norms that are often overlooked in the standard model of economics underlie actual human behaviour. They influence the formation of public awareness of humans, their behaviour, and decision-making (Thaler & Sunstein, 2009; Thaler, 2015). They also determine the positive or negative behaviours of individuals related to the operation of wind farms in their area of residence. Behavioural economics thus assumes that humans, as subjects with their own dignity, are both personal, thinking, and economic subjects who make rational economic decisions under conditions of uncertainty. People are becoming aware of the need to know the determinants that can influence their behaviour regarding, for example, investment activities in wind farms and their decision-making in terms of the use of wind energy.

The new institutional economics fits in behavioural economics, with its basic assumptions also supporting the functioning of wind energy. This economics assumes that the decisions of personal entities (human beings) and economic entities (enterprises) are influenced by different determinants. They are of economic (benefit, loss) and non-economic (including social) nature (cultural, historical). These determinants are institutionalised. They are formed by formal institutions supported by legal norms (e.g., local government, local residents' associations, wind energy investment enterprises) and informal institutions rooted in traditions, customs, trust, and morality

(Ostrom, 1990; Hodgston, 2015). Within wind energy production, these institutions include informal neighbourhood groups that form social capital. The combination of formal and informal institutions develops the efficiency and effectiveness of social and economic activities that favour or disfavour wind energy production.

Given the theoretical and cognitive context of the importance of wind energy in Poland, it should be emphasised that it is and will be an important example of a renewable energy source which can eliminate fossil sources used for electricity generation. The social potential of a high level of public awareness and approving behaviour of Polish residents towards investments in wind energy is a favourable determinant of its development. A kind of development that would not destroy the value of the landscape and would not reduce demand and supply in the tourism sector.

Methodology

This paper aims to determine the level of public awareness in Polish society regarding the impact of wind farms on the tourism value of the landscape in a given area. This opinion is understood as a form of social awareness of the Polish population regarding onshore wind farm investments. Would it provide answers to the following questions: Does onshore wind energy reduce the tourist value of the landscape? Does it reduce tourist activities (supply) and the number of tourists visiting an area where windmills are present (demand)?

The realisation of the adopted objective entailed the analysis of secondary resources such as reports from nationwide empirical surveys and literature on the subject. We also used empirical data from reports on research conducted by the Ministry of Climate and Environment on the awareness and environmental behaviour of Polish residents regarding wind energy (Ministry of Climate and Environment, 2020a) and from a report on wind energy in Poland (Ministry of Climate and Environment, 2020b). This research was commissioned by the Ministry of Climate and Environment and carried out by PPS Spółka z o.o. (Partner in Business Strategies). Due to the ongoing COVID-19 pandemic, the study was conducted using the computer-assisted telephone interview (CATI) technique. The nationwide sample of respondents aged 15 years and older in both surveys was randomly selected and is representative of demographic characteristics such as gender, age, and place of residence. The maximum estimation error for a random sample of 1,000 individuals is +/- 3.1% (Ministry of Climate and Environment, 2020a).

The paper takes into account selected results of empirical research related primarily to the awareness and behaviour of Polish residents towards

onshore wind energy. Furthermore, the method of critical analysis of the related literature and secondary materials, mainly statistical materials published by Statistics Poland, were also used in the research.

It should be noted that an increasing number of contemporary researchers use secondary data collected by other researchers to achieve different cognitive goals. Nowadays, the analysis of secondary empirical data is an established research method in the social sciences (Frankfort-Nachmias & Nachmias, 1996).

There are three primary reasons for the growing interest in using the method of secondary materials analysis: – general (in secondary materials, data are often collected in different scientific areas, which promotes a more comprehensive and deeper analysis. In primary research, an individual researcher is not able to collect broad and multifaceted information on the problem under study); – methodological (the results of research conducted by one researcher can be combined, supplemented, and compared with data collected by other researchers); – economic (primary data collection is very expensive). Using already existing data is much less expensive than collecting new data (Goodman, 1992). A similar research approach was also used in the study of the topic of public awareness and behaviour of Polish residents towards onshore wind energy and its impact on the tourist values of the landscape. Given the adopted research methodology, it should be stressed that a quantitative and qualitative analysis of the problems studied was conducted in the paper.

Research results and discussion

Surveys of environmental awareness and behaviour regarding onshore wind energy show that Polish residents have very positive attitudes to its development. It turns out that 85% of respondents surveyed supported the development of onshore wind farms. The behaviour of Polish residents towards onshore wind farms in general and with regard to their education is shown in Figure 1.

Analysis of the data in Figure 1 shows that people with vocational education predominated among those supporting the development of onshore wind farms (89% of positive indications). High approval levels for onshore wind farms were also found among those with secondary (84%) and higher education (87%). More than half of the positive indications (65%) supporting the development of onshore wind farms in Poland were found among people with primary and junior high school education.

The results of other empirical studies also showed support for onshore wind energy development in Poland. For example, "It is also encouraging to

note that survey participants support the development of wind energy in Poland and that their majority would not mind another windmill park being built in their neighbourhood” (Ryszkowska et al., 2018).

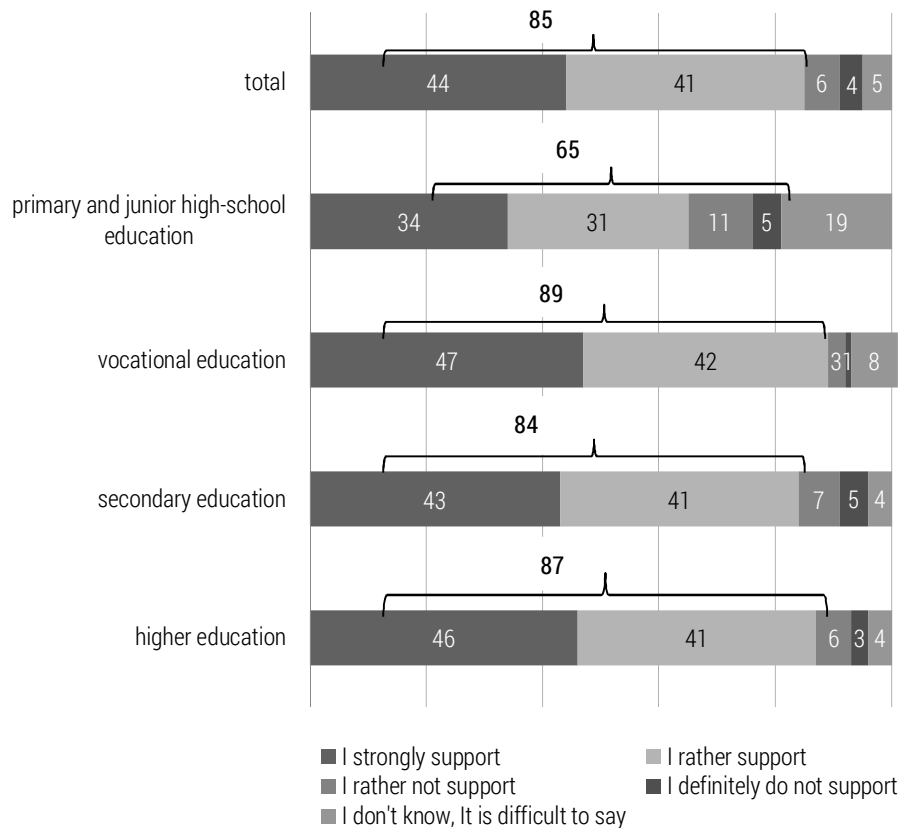


Figure 1. Attitudes towards onshore wind farms in Poland in the opinion of respondents in general and by their level of education [%]

Source: author’s work based on Ministry of Climate and Environment, 2020b.

The positive attitudes of Polish residents towards wind energy in the country were not so pronounced for wind farms located near their homes (Figure 2).

The data presented in Figure 2 shows that 75% of the people surveyed would support onshore wind farms located near their residences. This is 10% less compared to the acceptance of wind farms in general in Poland. It was found that as the level of education of the respondents increased, so did their acceptance of building an onshore wind farm in the area where they lived. These results indicate a symptom of an important phenomenon called the NIMBY syndrome. NIMBY issues refer to a set of different behaviours of

a local community towards an investment made near their place of residence. This attitude expresses opposition to the location of development at a particular site while accepting the development in general. Therefore, the object of the opposition is not the development itself but its location and the associated risks (Bednarek-Szczepańska & Dmochowska-Dudek, 2015; Wolsink, 2000). Thus, the results of the above surveys indicate that investments in wind power plants, in general, are desirable and can be completed, but it would be better if they were not close to the place of residence.

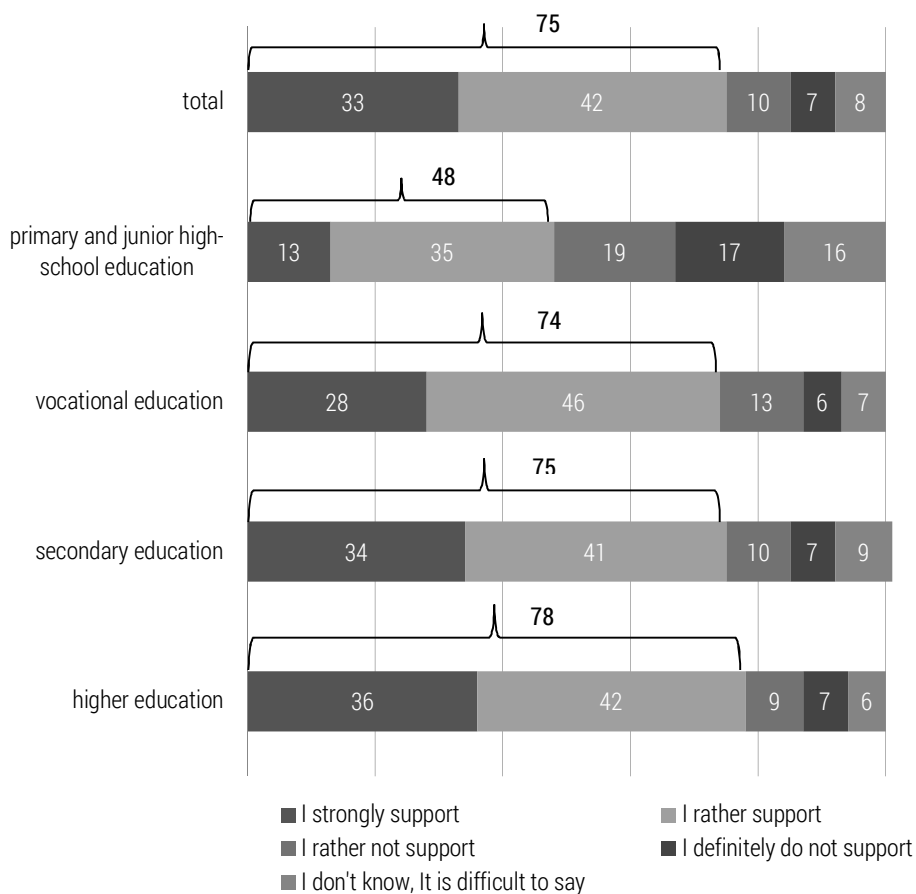


Figure 2. Attitudes towards onshore wind farms in the area of residence of respondents by their level of education

Source: author's work based on Ministry of Climate and Environment, 2020b.

The development of onshore wind farms in an area is not only influenced by the residents but also by the local government. In Poland, 24% of residents reported they lived near onshore wind farms. Among the respondents

with wind farms in their area of residence, 54% positively evaluated the actions of local authorities and wind farm investors at the stage of construction (aspects of the new institutional economy). Onshore wind farms have varying impacts on the natural and social landscape elements of the local area. Although the electricity generated by wind turbines is considered green energy, there are opinions that say it can negatively affect the natural values of the area and the health of people. Some studies indicate that wind turbines generate infrasound and low-frequency noise. They negatively affect the life of birds, bats, insects, and human health (PSEW, 2008; Pawlas, 2009).

Among the factors affecting human health, the acoustic and optical effects generated by rotating turbines are most often mentioned. In addition to noise in the audible range, wind turbines generate infrasound, i.e. waves with a frequency lower than audible and low-frequency noise (up to 500 Hz). Infrasound waves are very long waves, spreading over many kilometres and penetrating even through concrete walls of buildings (Pawlas, 2009.) Among the optical (visual) factors burdensome to health, the following are mentioned: the stroboscopic effect and the so-called „shadow flickering effect”. However, studies on the impact of these effects on human health are fragmentary, and their results are often questioned (“Wielka Brytania, Australia,” 2015).

Another example of a threat to wind turbines is their failures and the resulting threats to people in the form of personal injury and fatal accidents. Frequent accidents were wind turbine blade breakage, fires caused by an electrical short circuit or overheating of the propellers (“Elektrownia wiatrowa,” 2023).

Some research results indicate that wind farms pose a threat to birds passing by because the rotor blades cut through the air at over 150 km/h. For this reason, wind farms should not be located on seasonal bird migration routes (PSEW, 2008). World environmentalists, including those from Scotland and the USA, drew attention to this problem. It has been found that Scottish power plants contribute to the extinction of endangered bird species (including falcons, eagles and low-flying merlins). The American non-governmental organisation Center for Biological Diversity has calculated that the turbines of a single local wind power plant kill up to 1.3 thousand flying birds of prey annually (PSEW, 2008).

However, it should be noted that in many other studies, the negative impact of wind turbines on nature and people has not been confirmed. According to USA Today, wind farms kill between 214,000 and 368,000 birds a year. By comparison, 6.8 million are killed in collisions with cell and radio towers. Cats alone kill between 1.4 and 3.7 billion birds (Bujalski, 2021). This problem is illustrated in detail in Figure 3.

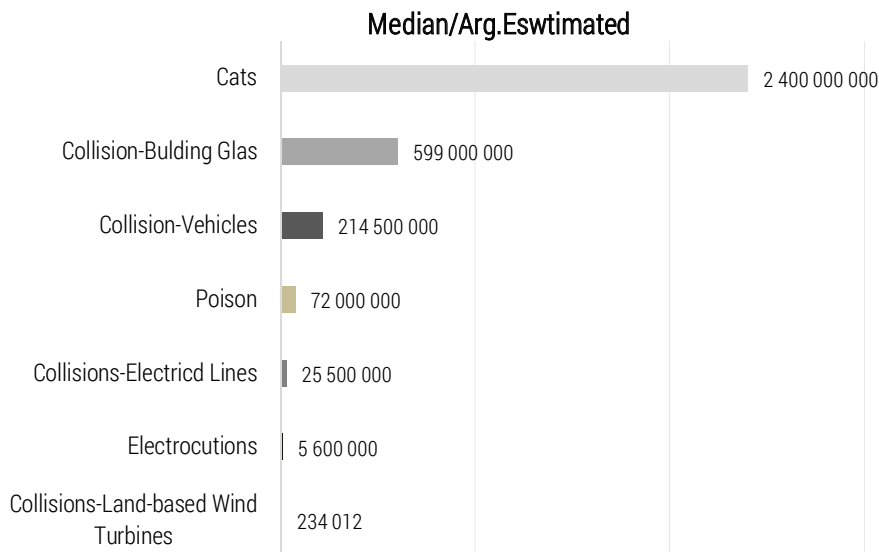


Figure 3. Wind Turbines Are Not Killing Fields for Birds. Annual estimated bird mortality from selected anthropogenic causes in the U.S. As of 2017

Source: author's work based on Feldman (2019).

Figure 3 shows the median value (middle value) of the causes of killing birds. The data from the U.S. government agency Fish and Wildlife Service shows that cats kill 2.4 billion birds a year. Another 599 million die by collisions with buildings, 214.5 million by collisions with vehicles, 72 million by poisoning, 25.5 million by collisions with high-voltage lines, 5.6 million by electrocution, and only 234,000 by wind farms. Therefore, most birds die because of cats and the fewest because of collisions with wind farms. Unfortunately, it is difficult to find similar studies for Poland (Feldman, 2019).

The presented characteristics of factors related to the operation of wind farms and their impact on the landscape of the natural and social environment conducive to tourism is not an exceptional and unique position. There are also supporters of opposite views, who believe that the results of some studies do not confirm the thesis that the location of wind farms contributes to lowering the natural and social values of a given area. They believe that wind turbines interfere with the landscape in the same way as all other buildings (Mordue et al., 2020).

Scientists from the Polish Academy of Sciences believe that the vast majority of literature information and their own research results indicate that there is no convincing evidence of the negative impact of onshore wind farms on the natural environment and its values, as well as on human health and well-being (Jasiński et al., 2022). The results of their research indicate

that at a distance of 500 m from the wind farm, the noise level is below 40 decibels. Such noise does not cause negative health effects, even for sensitive people. The authors of the monograph “Wind power plants in the human environment” (2022) state that the levels of infrasound noise from wind turbines are lower or comparable to the noise associated with typical natural sources of infrasound (e.g. wind, waves, heavy rain) or noise from common equipment, such as vehicles, loudspeakers, engines, household appliances, airplanes). They emphasise that already at a distance of about 85 m from the wind turbine; the noise level is close to 50 decibels, which corresponds to the standards for permeable noise levels in single-family housing during daylight hours. They also indicate no risk to human health from wind turbines in the case of electromagnetic and vibration impacts (Jasiński et al., 2022).

The issues of the impact of wind turbines on the terrestrial landscape were included in the discussed studies (Figure 4).

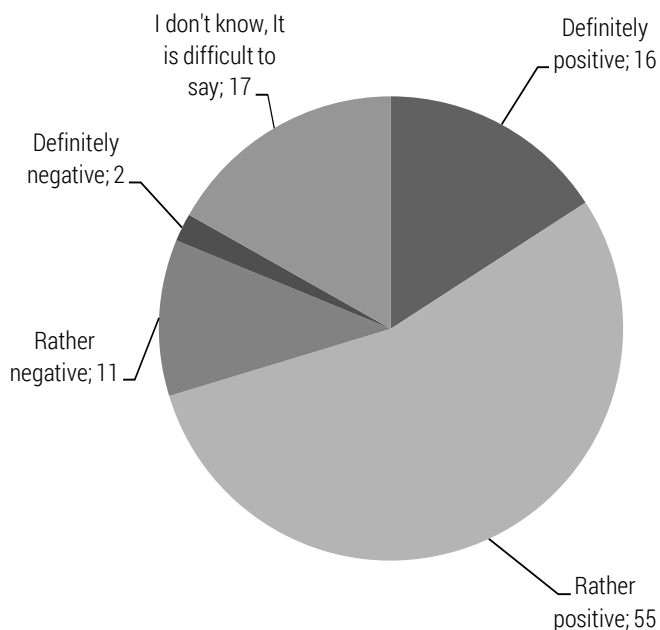


Figure 4. Impact of onshore wind farms on the landscape and the environment according to respondents [%]

Source: author's work based on Ministry of Climate and Environment, 2020b.

Analysis of the data in Figure 4 indicates that respondents have positive opinions (71%) regarding the impact of onshore wind farms on the natural and social environment of residences of places where wind turbines are located.

In the opinion of Polish residents, onshore wind farms definitely have a positive impact on the landscape and the environment. Only 13% of the respondents expressed negative opinions, and 17% had no opinion (Figure 4). The positive opinion on the problem studied depended on the age of the respondents (Figure 5).

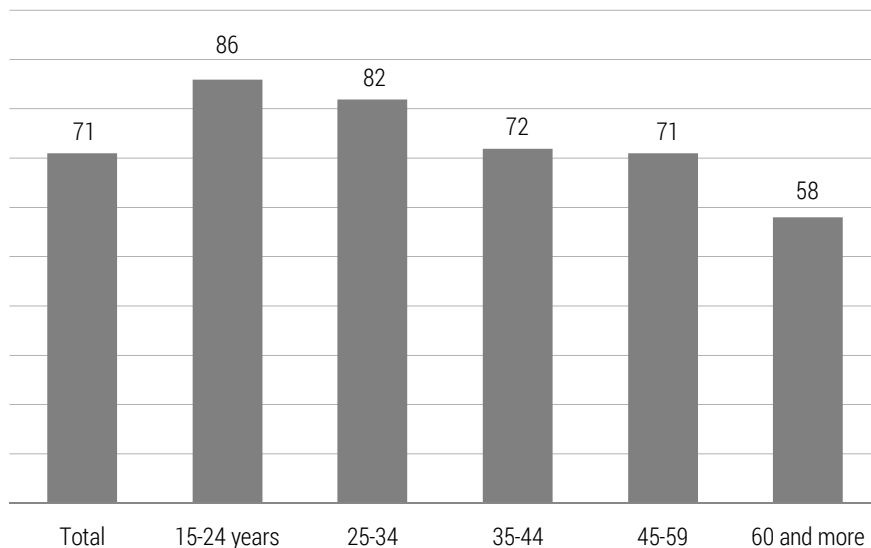


Figure 5. The positive impact of onshore wind farms on the environment and landscape as a function of the respondent's age [%]

Source: author's work based on Ministry of Climate and Environment, 2020b.

Analysis of the results by age of the respondents indicated that the greater the age range, the lower the percentage of positive opinions. Despite this fact, however, more than half of the indications were positive (58%) in the oldest age group (60 and older).

In general, it should be emphasised that the presented results confirmed the willingness of Polish residents to use clean wind energy that does not have a negative impact on the landscape of the area with wind farms. This energy does not destroy the natural and cultural values of the area, and thus it can be assumed that it does not discourage tourists from visiting these areas (Franta'l & Kunc, 2011). The opinions about wind farms expressed in the survey exemplify the public awareness of wind energy problems in Polish society (Łucki & Misiak, 2010). At the same time, they are manifestations of specific behaviours and actions toward the use of this energy (aspects of behavioural economics). One example of this behaviour is respondents' willingness to spend money for the opportunity to use wind energy. This issue is illustrated in Figures 6 and 7.

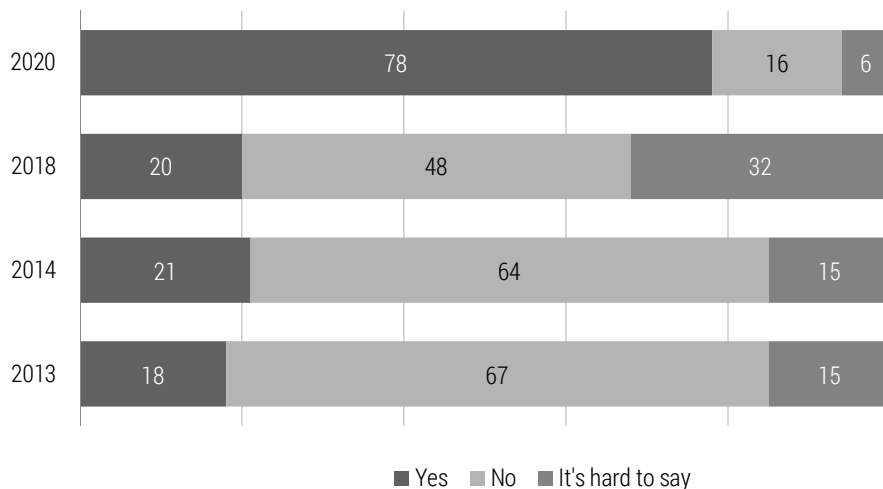


Figure 6. The willingness of Polish residents to use wind energy in 2013-2020 [%]

Source: author's work based on Ministry of Climate and Environment, 2020b.

Figure 6 shows that in 2020 compared to previous years, the residents of Poland were more willing to use clean energy and renewable energy sources, including wind energy. While only 18% of them expressed an inclination to do so in 2013, 78% of respondents decided to use such energy in 2020. Those determined to use renewable energy sources, including wind energy, are willing to spend more money on such installations. The problem is shown in Figure 7.

The data in Figure 7 shows that in 2020, the largest number of respondents (26%) said they would be willing to pay between 6 and 10% more for clean energy compared to their current energy bills. In contrast, 24% of respondents were willing to pay more than 20% more for this energy. This was the second most frequently indicated range (Figure 7).

Renewable energy sources, including wind energy, are an important subject of interest for Polish society (Biernacki et al., 2016). This is supported not only by the empirical evidence but also by the motivation for appropriate pro-environmental behaviour of consumers. The cited research shows that in 2020, 95% of Poland's population would declare energy savings at home (Figure 8).

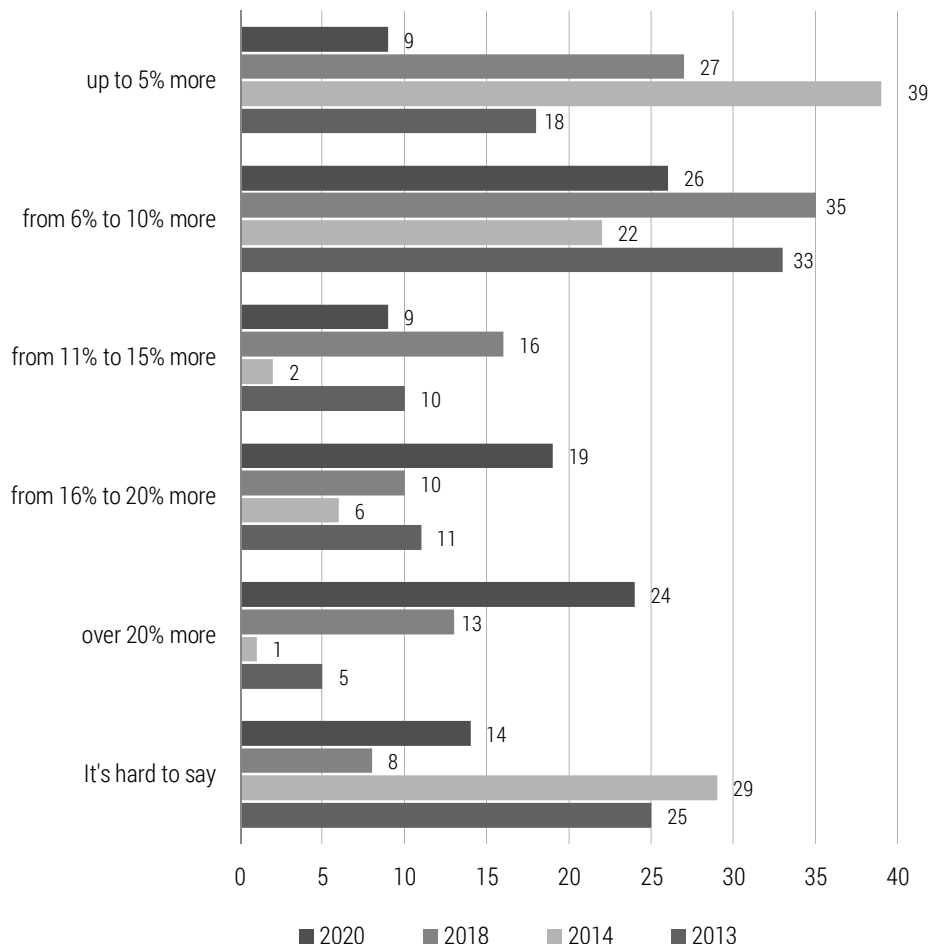


Figure 7. The willingness to pay extra money for clean energy (wind energy) compared to the current bills [%]

Source: author's work based on Ministry of Climate and Environment, 2020b.

The Polish residents surveyed planned to take additional measures in their homes to increase energy efficiency and reduce energy bills. How such actions were taken is illustrated in Figure 9.

An analysis of the data in Figure 9 shows that among those planning additional actions to increase energy efficiency and reduce household electricity bills in 2020, the use of renewable energy sources was overwhelmingly cited (57%).

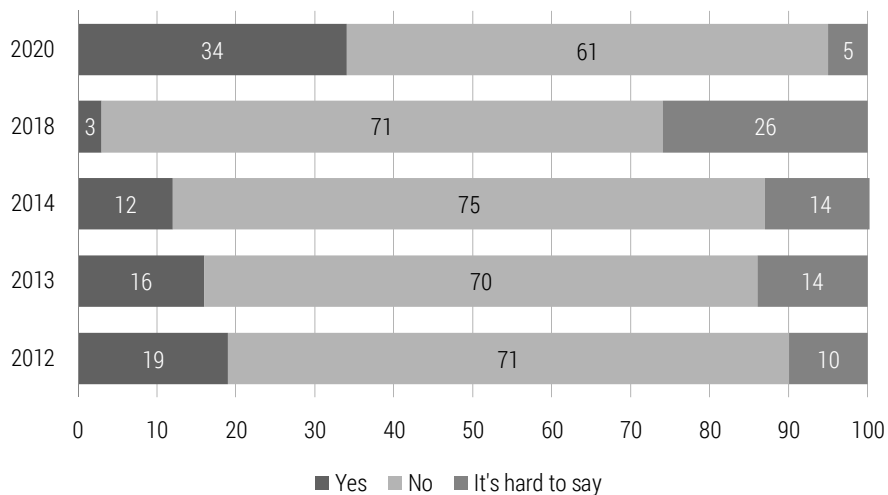


Figure 8. Planned additional behaviour aimed to increase energy efficiency and reduce electricity bills [%]

Source: author's work based on Ministry of Climate and Environment, 2020b.

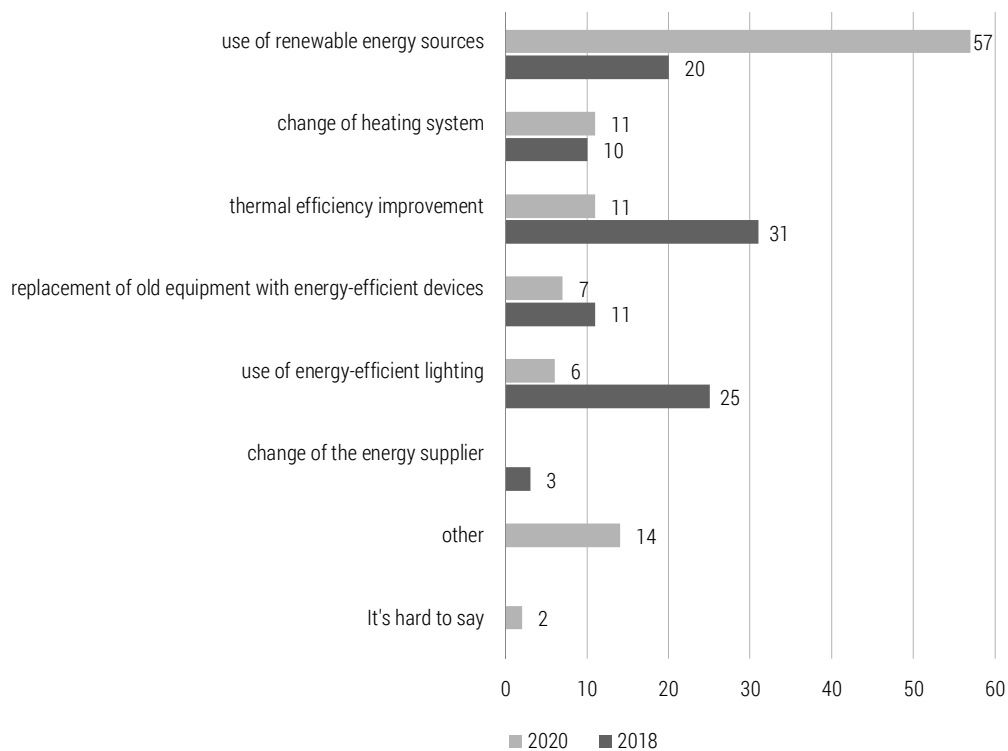


Figure 9. Planned behaviour to increase energy efficiency and reduce electricity bills [%]

Source: author's work based on Ministry of Climate and Environment, 2020b.

Renewable energy sources, especially wind energy, are an important factor in protecting the environment (Franta'l & Urbankowa, 2014). The research results discussed in the present study demonstrate the role of social conditions enabling clean energy development and decarbonisation of the economy.

A high level of public awareness of Polish society approving investments in wind farms and the associated positive behaviour of the inhabitants confirm the need to care for nature, improve air quality, and thus the need to use renewable energy sources (Łucki & Misiak, 2010). As shown by the results of the study, these priorities do not support the thesis that the location of wind power plants decreases the natural and cultural values of the landscape of a given area, conducive to tourist and recreational activities (Chodkowska-Miszczuk, 2016). Local people and local authorities who approve of the development of renewable energy based on wind turbines are of the opinion that tourists also view wind turbines positively as a sign of an active attitude towards the protection of the environment. Some gminas advertise wind turbines as tourist landmarks on walking or cycling routes (e.g. a trail of wind turbines in the Darłowo gmina). They organise information meetings to broaden knowledge about environmental protection and renewable energy sources. There are gminas that consider the presence of wind turbines in their area an additional tourist attraction that supports the promotion strategy of the locality (Sikora & Wartecka-Ważyńska, 2015).

In conclusion, it is important to emphasise that there is no perfect landscape of the area conducive to tourism and recreational activities. In terms of tourism, landscapes are characterised by positive and negative natural, cultural, social, and economic values. The landscape with wind turbines as a source of clean energy is becoming more and more tolerated and accepted in the public mind, according to the research presented here. It ceases to be an obstacle to the development of tourist and recreational activities of many social groups. Wind turbines are an accepted architectural element and a new value to our spatial landscape. They create cognitive, educational, and economic values that are absorbed by the local community and tourists. Overall, it follows that Poles see the need for onshore wind energy development and are aware that these are beneficial without compromising landscape values ("Cztery piąte ankietowanych," 2022).

Conclusions

The need to reduce environmentally degrading conventional energy sources and to activate the economy after the COVID-19 pandemic represents a strong argument for wind power development in Poland. Also important is

the country's commitment to meet climate targets for renewable energy and reduce CO₂ emissions. The development of renewable energy sources, especially wind energy, is linked to investments in wind farms. To answer the questions posed in the methodological part of this paper, we used the results of a representative nationwide survey of opinions on onshore wind farms. These opinions are indicative of the level of social awareness of the respondents on the subject under study (Ministry of Climate and Environment, 2020a). This awareness may inhibit or favour wind farm investment in a particular area with tourism and recreational values.

Based on the results of the empirical survey, the overwhelming majority of Polish residents (85%) generally expressed positive attitudes towards investments in wind farms that generate clean electricity (Ministry of Climate and Environment, 2020b).

More than half of Poland's inhabitants spoke positively about the actions of local authorities towards the construction of wind farms in their areas.

The favourable social climate for wind farms was also expressed in opinions that these farms do not harm the natural and cultural values of the local landscape and do not lower their tourist value and attractiveness (71%). Neither do they prevent tourists from coming. A positive opinion about the impact of onshore wind farms on the natural and social environment varied depending on the age of the respondents. The greater the age range, the lower the percentage of positive ratings (Ministry of Climate and Environment, 2020b).

The development of onshore wind energy was supported by the tendency of Polish residents to increasingly use this type of energy (78%), which is perceived as clean energy that is not harmful to the environment (Ministry of Climate and Environment, 2020a).

Positive social attitudes about the impact of wind farms on the tourist value of the landscape were shown by the results of studies conducted in the Czech Republic and Portugal. The study in the Czech Republic indicated that clean wind energy promotes environmental protection (70%). It does not pollute the tourist landscape but, conversely, enhances its values (35%) (Franta'l & Kunc, 2011). Wind turbines provide economic benefits to their owners, the owners of the land on which they are located, and local governments. They are, therefore, a source of additional funding for local tourist and recreational infrastructure used by residents and tourists (Portugal) (Silva & Delicado, 2017).

It should be noted that onshore wind turbines are a positive value in the tourism landscape. They are a source of clean energy that does not poison the social and natural environment and improves air quality that is conducive to tourist and recreational activities ("Cztery piąte ankietowanych," 2022; Badora, 2014).

The high level of public awareness of Polish society toward wind farms creates a social climate conducive to investments in renewable energy sources, including onshore wind energy. Such an acceptance of wind farm investments, or its lack, thus entails the need for the local authority to run social consultations (“Ustawa wiatrakowa,” 2022). It shows social acceptance for investments so much needed by humans and nature and creates social conditions to facilitate the fulfilment of Poland’s commitments to the European Union regarding the share of renewable energy sources, including wind energy, in the global energy mix (Sobieraj, 2017).

Furthermore, it should be made clear that Russian aggression against Ukraine is forcing Poland and Europe to become independent of Russia in terms of energy supply. A key element of this independence should be a dramatic acceleration of renewable energy development and the expansion of wind power.

Finally, from a theoretical point of view, the issue under analysis can be related to the assumptions of social and ecological economics. The achievements of behavioural economics and the new institutional economics play a vital role in it. Social and ecological economics presents the ontological and cognitive premises for analysing and understanding the interactions between natural, social and economic systems (Spash, 2011). It thus strengthens the theoretical aspect of empirical research. However, this would open a field for further discussion.

References

- Act from 20 May 2016 on investments in wind power plants. Journal of Laws item 961. (in Polish).
- Armand, D. L. (1980). *Nauka o krajobrazie*. Warszawa: PWN. (in Polish).
- Badora, K. (2014). Badanie społecznej percepcji krajobrazu jako podstawowa ocena predyspozycji przestrzeni geograficznej do lokalizacji farm wiatrowych. *Prace Komisji Krajobrazu Kulturowego*, 25, 19-21. (in Polish).
- Bednarek-Szczepańska, M., & Dmochowska-Dudek, K. (2015). Przestrzenny wymiar syndromu NIMBY na wsi i w małych miastach w Polsce. *Przegląd Geograficzny*, 87(4), 683-703. <http://doi.org/10.7163/PrzG.2015.4.6> (in Polish).
- Biernacki, G., Smyk, M., Dobosz, S., Górka, D., & Musiałowska, P. (2016). The Development of the Market of the Production of Wind Energy in Poland and Selected EU Countries. *Management Systems in Production Engineering*, 21(1), 40-44. <https://doi.org/10.2478/mspe-07-01-2016>
- Bujalski, Sz. (2021, February 28). *Naukowcy i konstruktorzy pracują by wiatraki mniej szkodziły zwierzętom. Gowin zapowiada poluzowanie prawa dla farm wiatrowych w Polsce*. <https://wyborcza.pl/7,177851,26817950,od-fioletowych-lopatek-po-sztuczna-inteligencje-jak-sprawic.html> (in Polish).
- Chodkowska-Miszczuk, J. (2014). Odnawialne źródła energii i ich wykorzystanie jako nowe trendy na obszarach wiejskich w Polsce. *Studia Obszarów Wiejskich*, XXXV, 227-240. (in Polish).

- Chodkowska-Miszczuk, J. (2016). Odnawialne źródła energii w rozwoju turystyki na obszarach chronionych w Polsce na przykładzie ośrodka turystyki religijnej w Kodyniu. *Studia Ecologiae et Bioethicae*, 14(2), 9-31. <https://doi.org/10.21697/seb.2016.14.2.01> (in Polish).
- Chodkowska-Miszczuk, J., Środa-Murawska, S., & Biegańska, J. (2016). Znaczenie edukacji w zakresie odnawialnych źródeł energii w upowszechnianiu zasad rozwoju zrównoważonego. *Ekonomia i Środowisko*, 56(1), 179-198. (in Polish).
- Cztery piąte ankietowanych za rozwojem lądowej energetyki wiatrowej (2022, July 13). WNP. <https://www.wnp.pl/energetyka/cztery-piate-ankietowanych-za-rozwojem-ladowej-energetyki-wiatrowej,602091.html> (in Polish).
- Elektrownia wiatrowa. (2023, May 23). In *Wikipedia*. https://pl.wikipedia.org/wiki/Elektrownia_wiatrowa (in Polish).
- European Landscape Convention, drawn up in Florence on October 20, 2000. *Journal of Laws* 2006 No. 14, item 98.
- Feldman, S. (2019, September 3). *Wind Turbines Are Not Killing Fields for Birds*. Statista. <https://www.statista.com/chart/15195/wind-turbines-are-not-killing-fields-for-birds/>
- Frankfort-Nachmias, Ch., & Nachmias, S. (1996). *Research Methods in the Social Sciences*. New York: St. Martin's Press.
- Franta'l, B., & Kunc, J. (2011). Wind turbines in tourism landscapes: Czech Experience. *Annals of Tourism Research*, 38(2), 499-519. <https://doi.org/10.1016/j.annals.2010.10.007>
- Franta'l, B., & Urbankowa, R. (2014). Energy tourism: An emerging field of study. *Current Issues In Tourism*, 20(13), 1395-1412. <https://doi.org/10.1080/13683500.2014.987734>
- Gaworecki, W. (2003). *Turystyka*. Warszawa: Polskie Wydawnictwo Ekonomiczne. (in Polish).
- Goodman, N. (1992). *Introduction to Sociology*. New York: Harper Collins Publishers.
- Hodgson, G. M. (2015). *Conceptualizing Capitalism: Institutions, Evolution, Future*. Chicago: University of Chicago Press.
- Jasiński, A. W., Kocejko, P., Matuszczak, K., Szulczyk, J., & Zagubień, A. (2022). *Elektrownie wiatrowe w środowisku człowieka*. Lublin: Komitet Inżynierii Środowiska PAN. (in Polish).
- Jedna trzecia gmin inwestuje w rozwój OZE. Dla nich nowa ustawa to kłopot. (2016, March 30). PortalSamorządowy.pl. <https://www.portalsamorzadowy.pl/ochrona-srodowiska/1-3-gmin-inwestuje-w-rozwoj-oze-dla-nich-nowa-ustawa-to-klopot,79143.html> (in Polish).
- Król, J. (2022, February 22). *Liberalizacja ustawy 10 H na tle kampanii dezinformacyjnej polskich elektrowni*. Globenergia. <https://globenergia.pl/liberalizacja-ustawy-10h-na-tle-kampanii-dezinformacyjnej-polskich-elektrowni/> (in Polish).
- Łucki, Z., & Misiak, W. (2010). *Energetyka a społeczeństwo. Aspekty socjologiczne*. Warszawa: PWN. (in Polish).
- Marcinkiewicz, J., & Poskrobko, T. (2015). Wpływ elektrowni wiatrowych na percepcję krajobrazu w świetle badań empirycznych. *Ekonomia i Środowisko*, 53(2), 77-78. (in Polish).
- Ministry of Climate and Environment. (2020a). *Survey of environmental awareness and behavior of Polish residents. Tracking survey report*. <https://www.gov.pl/web/klimat/badania-swiadomosci-i-zachowan-ekologicznych-mieszkancow-polski-w-2020-r-badanie-trackingowe>

- Ministry of Climate and Environment. (2020b). *Wind energy – onshore and offshore. Survey report*. <https://www.gov.pl/attachment/744a6a05-7000-46f9-aff-2797b503248b>
- Mordue, T., Moss, O., & Johnston, L. (2020, November 10). *Environment, Landscape, and Place in the Windfarm-Tourism “Conflict”*. EuropeNow. https://www-europe-nowjournal-org.translate.google.com/2020/11/09/environment-landscape-and-place-in-the-windfarm-tourism-conflict/?_x_tr_sl=en&_x_tr_tl=pl&_x_tr_hl=pl&_x_tr_pto=sc
- Mroczek, B., Kurpas, D., & Klera, M. (2013). Sustainable Development and Wind Farms. *Problems of Sustainable Development*, 8(2), 113-122.
- Ostrom, E. (1990). *Governing the Commons. The Evolution of Institutions for Collective Action*. Cambridge: Cambridge University Press.
- Pawlas, K. (2009). Wpływ infradźwięków i hałasu o niskich częstotliwościach na człowieka – przegląd piśmiennictwa. *Podstawy i Metody Oceny Środowiska Pracy*, 60(2), 27-64. (in Polish).
- PSEW. (2008). *Wytyczne w zakresie oceny oddziaływania elektrowni wiatrowych na ptaki*. Szczecin. https://otop.org.pl/uploads/media/wiatraki_otop_psew.pdf (in Polish).
- Regulation of the Minister of Economy of May 4, 2007 on detailed conditions of operation of the electric power system (Journal of Laws of 2007 No. 93 item 623). <https://isap.sejm.gov.pl/isap.nsf/DocDetails.xsp?id=wdu20070930623>
- Richling, A., & Solon, J. (2011). *Ekologia krajobrazu*. Warszawa: PWN. (in Polish).
- Ryszkowska, B., Starczewski, T., & Chodkowska-Miszczuk, J. (2018). Rozwój energetyki wiatrowej w przestrzeni submiejskiej a percepcja krajobrazu kulturowego. *Acta Scientiarum Polonorum Administratio Locorum*, 17(1), 63-74. <https://doi.org/10.31648/aspal.473> (in Polish).
- Sasinowski, H. (2007). Zrównoważone gospodarowanie krajobrazem. In K. Michałowski (Ed.), *Ekologiczne aspekty zrównoważonego rozwoju regionalnego i lokalnego* (pp. 34-43). Białystok: Wydawnictwo Wyższej Szkoły Ekonomicznej w Białymstoku. (in Polish).
- Sæpórsdóttir, A. D., Wendt, M., & Iverijonaite, E. (2021). Wealth of Wind and Visitors: Tourist Industry Attitudes towards Wind Energy Development in Iceland. *Land*, 10(7), 693. <https://doi.org/10.3390/land10070693>
- Sikora, J., & Wartecka-Ważyńska, A. (2015). Walory turystyczne parków krajozrazowych a farmy wiatrowe. *Ekonomia i Środowisko*, 54(3), 57-66. (in Polish).
- Silva, L., & Delicado, A. (2017). Wind farms and rural tourism: A Portuguese case study of residents ‘and visitors’ perceptions and attitudes. *Moravian Geographical Reports*, 25(4), 248-256. <https://doi.org/10.1515/mgr-2017-0021>
- Simmel, G. (2006). Filozofia krajozrazu. In G. Simmel (Ed.), *Most i drzewa. Wybór esejów* (pp. 292-318). Warszawa: Oficyna Naukowa. (in Polish).
- Sobieraj, K. (2017). Wpływ porozumienia paryskiego na zmianę polityki klimatyczno-energetycznej Unii Europejskiej i unijnych regulacji prawnych w tym zakresie. *Ruch Prawniczy, Ekonomiczny i Socjologiczny*, 79(4), 177-190. <https://doi.org/10.14746/rpeis.2017.79.4.14> (in Polish).
- Spash, C. L. (2011). Social Ecological Economies: Understanding the Past to See the Future. *American Journal of Economics and Sociology*, 70(2), 340-375. <https://doi.org/10.1111/j.1536-7150.2011.00777.x>

- Statistics Poland. (2020). *Statistical Yearbook of the Republic of Poland 2019*. <https://stat.gov.pl/obszary-tematyczne/roczniki-statystyczne/roczniki-statystyczne/rocznik-statystyczny-rzeczypospolitej-polskiej-2019,2,19.html> (in Polish).
- Sztompka, P. (2002). *Socjologia. Analiza społeczeństwa*. Kraków: Wydawnictwo ZNAK. (in Polish).
- Thaler, R. (2015). *Misbehaving*. London: Allen Lane.
- Thaler, R., & Sunstein, C. R. (2009). *Nudge – Improving Decision About Health*. London: Wealth and Happiness Penguin.
- Urry, J. (2002). *The Tourist Gaze. Second edition*. London: Sage Publications.
- Ustawa wiatrakowa utknęła w poczekalni. Rząd ma problem*. (2022, October 19). WNP. <https://www.wnp.pl/energetyka/ustawa-wiatrakowa-utknela-w-poczekalni-rzad-ma-problem,635429.html> (in Polish).
- Wielka Brytania, Australia: Energetyka wiatrowa ucieka przed roszczeniami ze strony sąsiadów* (2015, September 4). Stop wiatrakom.eu. <http://stopwiatrakom.eu/wiadomo%C5%9Bci-zagraniczne/1548-wielka-brytania,-australia-energetyka-wiatrowa-ucieka-przed-rozszczeniami-ze-strony-s%C4%85siad%C3%B3w.html> (in Polish).
- Wolsink, M. (2000). Wind power and the NIMBY – myth: Institutional capacity and the limited significance of public support. *Renewable Energy*, 21(1), 49-64. [https://doi.org/10.1016/S0960-1481\(99\)00130-5](https://doi.org/10.1016/S0960-1481(99)00130-5)
- Zimniewicz, K. (Ed.). (2008). *Bariery w zarządzaniu parkami krajobrazowymi w Polsce*. Warszawa: Polskie Wydawnictwo Ekonomiczne. (in Polish).