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Public Perception and Acceptance of Wind Energy Projects: A Case Study in the Western Macedonia Region of Greece

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ABSTRACT

The aim of the present study was to identify the factors that may affect the perception and acceptance of wind energy projects in the Western Macedonia region of Greece. The objectives of the study were to gauge the level of support, measure perceived economic and environmental effects, understand the effects of visual and noise impacts and establish the relationship between trust in government and developers. In the present study, a quantitative research approach was used, and more specifically, a cross-sectional survey with a structured questionnaire was applied on a sample of 384 residents of the Western Macedonia region of Greece. The study adopted equal probability sampling technique by employing stratified random sampling to include all the population groups. Descriptive and multiple regression analyses were employed in the examination of the association between public acceptance and various factors. This study also discovered that perceived economic advantages like employment opportunity and local economic growth enhance the acceptance of wind energy projects among the public. On the other hand, perceived environmental impacts, such as visual intrusiveness and noise sensitivity, lower acceptance substantially. Trust in government and developers was also revealed as an important variable; the level of trust was positively related to the level of support for wind energy projects. The results concern the multifaceted nature of common opinion, which is shaped by economic, environmental, and social indicators. Thus, the successful implementation of the wind energy projects in Western Macedonia has to involve not only economic stimuli but environmental considerations and public participation as well. There is a need to engage the stakeholders and the public more often and keep them informed in order to gain their trust. Thus, incorporating these factors, the stakeholders can strengthen the support of the public and help the region to switch to renewable resources. To enhance acceptance by the public, it is suggested that key players should aim at creating stakeholders' values in terms of economic returns, minimizing negative effects on the environment, minimizing visual and noise intrusion, and attracting public confidence through proper consultation and engagement.

Keywords: Acceptance, Confidence, Economic Advantage, Environmental Effects, Greece, Noise Effects, Perception, Renewable Energy, Visual Effects, Western Macedonia, Wind Energy

JEL Classifications: Q42, Q58, D72

1. INTRODUCTION

1.1. Background to the Study

Renewable energy is gaining popularity on the global scene due to the rising concerns of climate change, greenhouse effects, and energy security (Botsaris et al., 2021; Hassan et al., 2024; ÓhAiseadha et al., 2020). Wind energy is one of the most evolved and implemented RE technologies and hasa central role in this shift. In Europe, the push for wind power has been informed by EU policies that call for sustainability, low-carbon, and energy security (Andreou and Kontakos, 2019; Enevoldsen and Sovacool, 2016). Greece, a country with abundant wind resources especially in areas such as Western Macedonia, is gradually developing wind energy projects to achieve its national and EU energy goals

(Baltima, 2021; Giatrakos et al., 2009; Tsoutsos et al., 2009). However, the implementation of these projects strongly depends on the public perception, which is influenced by various social, economic, and environmental factors (Đurašković et al., 2021; Trbojević et al., 2024). Local acceptance is a vital component in the implementation of wind energy projects since community rejection may result in project delay, cost escalation or even project termination (Djurisic et al., 2020; Ruddat, 2022). In the case of wind energy integration in Western Macedonia, the following challenges exist; The socio-economic changes associated with the shift from lignite-based energy production to renewable sources in Western Macedonia has implications for the present and future of the communities (Demesouka et al., 2024; Farmaki et al., 2021). Further, the visual, acoustic, and ecological nuisance of wind farms including visual screening, noise, and fauna and flora influence the acceptability of wind farms but incite local communities' resistance (Karamountzou and Vagiona, 2023; Loukogeorgaki et al., 2022).

Western Macedonia has been described as a region that had a rich history of lignite mining in the past, which affected the economy and the profession of the area (Kafetzis et al., 2023). As the country moves forward to a process of decarbonization, the region is in the process of transition from fossil fuel reliance to renewable energy like wind and solar energy (Tranoulidis et al., 2022; Ziouzios et al., 2021). This transition is not without its challenges; the region has challenges with regards to jobs loss in the traditional energy sector, requirement of workforce transition, and the socio-economic effects on the communities (Katsaprakakis et al., 2022; Theodosiou and Mantzaris, 2020). Thus, they consider the understanding of the public perception and acceptance of wind energy projects as crucial for the success of the transition to a green energy domain in the area. Some of the factors that influence the acceptability of wind energy projects include the perceived economic benefits of the projects, the impacts of the projects on the environment, as well as the perceived credibility of the organizations involved in the implementation of wind energy projects (Ioannidis et al., 2023; Kleanthis et al., 2022; Ragazou et al., 2024). Other attributes like employment opportunities, savings in energy bills, and local development can also increase the support rate (Hanger-Kopp et al., 2019; Shaban et al., 2023). At the same time, concerns associated with the loss of environment, particularly in terms of the modification of the landscape, noise, and effects on fauna and flora elicit public outrage (Leiren et al., 2020; Vlami et al., 2020). In addition, public confidence in government and developers is crucial; where it is absent, the lack of information, poor community involvement, and perceived bias in decision-making may increase opposition (Enevoldsen and Sovacool, 2016; Loukogeorgaki et al., 2022).

According to the previous research, the active participation of people in the planning and design phases of wind power projects can significantly improve the acceptance level (Botsaris et al., 2021; Loukogeorgaki et al., 2022). In the case of Western Macedonia, participation of the public in the siting and design of wind farms has been noted as one of the strategies of enhancing support (Karamountzou and Vagiona, 2023). For instance, the District Heating Delignification Project in the region has revealed that engaging stakeholders and responding to their questions can result in the achievement of positive outcomes (Demesouka et al., 2024). Furthermore, concepts like green public purchases and the creation of renewable hydrogen projects are being considered as additional measures to enhance the share of renewable energy sources in the region (Kafetzis et al., 2023; Kilintzis et al., 2023). However, beyond the local and regional influences, there are higher-level policy and regulatory influences that also affect the public awareness and acceptance of wind energy (Gourgiotis et al., 2021; Kalogiannidis et al., 2024). According to the Greek Energy Plan and the EU directives 2009/28/EC, 2009/72/EC and 2010/31/EU, the development of RES and the decrease of CO_2 emissions are main objectives of the Greek national energy policy (Koukakis, 2024; Mezartasoglou et al., 2020). Nevertheless, local policies are one thing, and their social and environmental consequences are another; therefore, the involvement of communities in the decision-making process is a crucial matter that has to be considered (Đurašković et al., 2021; Mytilinou et al., 2017; Trbojević et al., 2024). There are some hurdles that Western Balkan countries including Greece face whilst embracing the renewable energy regime, these include the following hurdles or barriers: infrastructural barriers, financial barriers and political barriers (Frey, 2024; Ignjatović et al., 2024; Knez et al., 2022). For instance, integration of wind energy into the current systems entails a lot of changes on the grids which may be very costly and time-consuming (Katsaprakakis et al., 2022; Koukakis, 2024). In addition, socio-political factors such as historical dependence on coal and resistance from conventional energy players may hinder the advancement of renewable projects (Koukouzas et al., 2021; Tranoulidis et al., 2022). However, there are those main possibilities for the wind energy in the Western Macedonia and other places in Greece. Research has shown that the region has high wind parameters and good wind resource potential for wind power advantages (Krystalidis, 2022; Tercan et al., 2020). Furthermore, the consideration of the brownfields or former mining areas for the deployment of the renewable energies have been discussed as the approach to reduce the land use competition and to enhance the acceptance (Batel, 2020; Fiti et al., 2022; Ioannidis and Koutsoyiannis, 2020). However, for such projects to work, the following technical, social, and environmental approaches are important (Georgopoulou et al., 2024; Javaid et al., 2022; Kleanthis et al., 2022; Luna-Nemecio et al., 2020). Consequently, the level of awareness and support from the public is crucial for wind energy projects in Western Macedonia. Therefore, it is crucial to engage and listen to citizens, establish the institutions and earn the public's trust as the region is moving away from lignite towards renewables (Kafetzis et al., 2023; Katsaprakakis et al., 2022). When these factors are better studied and addressed, stakeholders can help in the shift towards sustainable energy and can help Greece in attaining its climate and energy targets (Andreou and Kontakos, 2019; Xenitidis et al., 2023). This research aims at further investigating these dynamics to identify the potential opportunities and challenges linked to wind energy-based projects in the Western Macedonia region.

1.2. Purpose of the Study

The major aim of this study was to explore the attitudes of the general public towards wind energy projects and the factors that shape the attitude in the Western Macedonia, Greece.

1.3. Research Objectives

The specific objectives of this study are:

(1) To assess the level of public support for wind energy projects in Western Macedonia
(2) To examine the perceived environmental and economic impacts of wind energy projects
(3) To evaluate the influence of visual and noise impacts on public acceptance
(4) To analyse the role of trust in government and developers in shaping public perception.

1.4. Research Hypotheses

The specific hypotheses of this study are:

(1) Hypothesis One (H_1): Public support for wind energy projects is positively associated with perceived economic benefits
(2) Hypothesis Two (H_2): Perceived environmental impacts negatively influence public acceptance of wind energy projects
(3) Hypothesis Three (H_3): Visual and noise impacts significantly reduce public acceptance of wind energy projects
(4) Hypothesis Four (H_4): Trust in government and developers positively influences public acceptance of wind energy projects.

2. LITERATURE REVIEW

2.1. Theoretical Review

This research used model which is relatively new known as Social License to Operate (SLO) that has been recently applied when assessing the acceptability and legitimacy of energy projects particularly those involving the use of renewable energy technologies such as wind power. The SLO framework also requires continuous approval from the community, not only the regulatory bodies, in order to attain the project implementation and sustainability (Minadakis and Vega-Araújo, 2024). It explores three key levels of acceptance: social acceptance and rejection where legitimacy, credibility and trust are some of the factors that determine the extent to which the communities will accept or decline a project. An SLO is not something like a regulatory license; it is a process that requires regular contact with stakeholders to keep alive (Demuijnck and Fasterling, 2016). The SLO approach is most appropriate in explaining the decision of the community members in wind energy projects because decision making is in relation to their concerns about the environmental, economic and social impacts of the projects. The two principles of legitimacy and credibility are based on legitimacy which is the extent by which a project conforms to the culture and norms of the relevant community and credibility which is the level of compliance with communication and promises made. The final stage of the diffusion process is acceptance, and this is reached when the community recognizes that the developers have their interests and the environment at heart (Koivurova et al., 2015; Prno and Scott Slocombe, 2012).

As earlier indicated, SLO framework has been applied in the context of renewable energy to establish factors that may act as antecedents to acceptance by the community. For instance, Leiren et al. (2020) examined the community acceptance of wind energy in the regions that have relatively less exposure to equivalent projects and noted that legitimacy concern which stems from the inability to meet anticipated standards was among some of the challenges. Similarly, Kleanthis et al. (2022) observed that credibility could be compromised if there are gaps in the delivery of projects or if such critical indices as environmental issues are not considered in the formation of an SLO in the renewable energy sector. Furthermore, SLO is rather helpful in grasping the fact that trust is established and developed through ongoing and genuine communication with the stakeholders since it stems from it (Ehrnström-Fuentes and Kröger, 2017). In their research, Enevoldsen and Sovacool (2016) opined that the hardest to come by and maintain is trust because it is insufficient for developers to engage with the communities; they must also engage the communities in decision-making processes. This was also supported by Katsaprakakis et al. (2022) who showed that when stakeholders used integrated planning to build trust for the wind energy projects in Crete, Greece, it helped to promote the projects. Thus, the SLO framework that focuses specifically on the aspects of legitimacy, credibility, and trust offers a comprehensive view to encompass the dynamic and ongoing nature of the public acceptance process in renewable energy projects (Hall et al., 2015; Prno and Slocombe, 2014). This further highlights the importance of stakeholder engagement and change management in the regard to maintaining the support of communities for wind energy projects (Jami and Walsh, 2014; Jami and Walsh, 2017).

2.2. Public Perception of Wind Energy Projects

Some wind energy projects have been affected by changes in the perception of the public based on environmental, economic and social aspects (Msigwa et al., 2022; Nazir et al., 2020). Djurisic et al. (2020), working in Montenegro also found that while there is a positive attitude towards RES because of environmental benefits, negative attitudes were formed due to noise, visual pollution, and effects on wildlife. This is in concordance with the study conducted by Georgopoulou et al. (2024), which established that in Greece, the perceived negative impacts of wind farms on birds and other systems were considered than the perceived environmental benefits of the use of renewable energy. Likewise, the economic effects of wind energy affect perception on how it positively impacts people's lives. Botsaris et al. (2021) also observed that in the case of Greece, chances of saving on energy and gaining higher energy sovereignty are viewed as the primary drivers of the public support of renewables, such as wind farms. This was further supported by Baltima (2021) who confirmed that in Crete, the prospects of employment creation and economic growth, linked to green hydrogen development, which is associated with wind energy projects, boosted public perception.

Nevertheless, the aesthetic and the acoustical impacts of wind turbines are still questionable. As highlighted by Loukogeorgaki et al. (2022), one of the main concerns of wind energy is that it is aesthetically unpleasant to the public where tourism is a key factor. Proposed measures included the risk that the building of wind turbines would detract from the scenery, thus decreasing tourism and house values. The same was echoed by the study conducted by Vlami et al. (2020) where they pointed out that one of the reasons that received less approval from the public in the protected island areas was the visual and aesthetic impact of wind farms. Another

study by Enevoldsen and Sovacool (2016) found that lack of information on the project as well as non-consultation of the public in decision making decisions lower acceptability levels and result in rejection of wind energy projects in France. However, Kafetzis et al. (2023) noted that in the western Macedonia region of Greece, because of effective communication by wind energy developers, the attitudes towards wind energy initiatives were more positive. This goes a long way in implying that efforts should be made to improve credibility and the level of openness in the process of gaining and maintaining public support for the wind projects (Brannstrom et al., 2022; Hussain et al., 2022).

2.3. Social Acceptance and Community Involvement

The acceptance level plays a significant role in the realization of the wind energy projects and depends on the level of participation and perceived fairness of costs and benefits (Klok et al., 2023; Knauf and Wüstenhagen, 2023; Leer Jørgensen et al., 2020). As highlighted by Leiren et al. (2020), the acceptability of projects in the community has been impacted by the perceived local opportunities in terms of employment, income generation, revenues, and energy savings. These factors are important in that they may influence the attitude of the community towards renewable energy projects especially in countries such as Greece where the economic factor emerges a very key factor (Kleanthis et al., 2022). This means that the extent to which the community is involved in the planning and decision-making process defines the acceptance level in the community. As evidenced by Loukogeorgaki et al. (2022), active participation of the local population in decision making of the zones and development of the offshore wind farms in Greece has enhanced the level of acceptance among the population. In this case, the support of the residents is higher when the residents are able to participate and be given a role to play in the projects. As argued by Botsaris et al. (2021), the residents were very categorical to the fact that they would require participation in the process to make the renewable energy community in Greece a reality.

On the other hand, if there is low community involvement then it results in rejection and opposition from the community. According to Enevoldsen and Sovacool (2016), strategies with top-down approach that do not involve the locals in France have been viewed as the most notorious because they result in a lot of public outcry, time consumption, and hurdles in the actualization of projects. This was further supported by Kafetzis et al. (2023) who noted that in Western Macedonia of Greece, projects which did not engage the local stakeholders faced significant problems of social acceptance. Another important factor is the perception of fairness in the distribution of the benefits and costs associated with wind energy projects. According to Katsaprakakis et al. (2022), studies have shown that social acceptance of wind energy in Crete, Greece, was relatively high when the communities perceived the benefits of the projects. This agrees with the study conducted by Martinidis et al. (2022), where the authors found out that in Western Macedonia, appeal to fairness and equality within the distribution of the benefits helped in achieving public acceptance. This study demonstrated that the more the communities feel that they are absorbing the social costs of environmental and aesthetical loss while reaping the economic gains of wind energy projects the more they are willing to accept the wind energy projects.

Moreover, social acceptance is linked with other areas of common interest, such as regional development and energy transition policies. Tranoulidis et al. (2022), stated that the shift from lignite to renewables especially through wind power was easier to accept when it was done in accordance to a master regional development plan that also captured the economic and social dimensions. This has advocated for integration of wind energy projects within the wider regional and community development plans in order to enhance their acceptance (Devine-Wright and Wiersma, 2020; Maleki-Dizaji et al., 2020).

2.4. Economic and Environmental Effects

The cost factors and environmental consequences of wind energy projects have therefore remarkably been retained as the main factors that define the acceptance of such projects. The common arguments given by those who support the economic aspect are job creation, cheap sources of energy, and projects funded in their respective regions. Baltima (2021) revealed that the Cretan region in Greece had a positive perception about the wind energy project because of the enhanced economic status and energy security. Similarly, Mandilas et al. (2023) identified that perceived benefits related to sustainable development and employment were noted to be pivotal for the enhancement of renewable energy in Greece. However, a major disadvantage that might go a long way in discouraging the acceptance of the solution is environmental concerns. Georgopoulou et al. (2024), state that the attitude of people in Greece towards wind power was negative due to concern over the effects of the wind turbines to birds, other animals, and the appearance of the wind turbines. This was supported by Karamountzou and Vagiona (2023) in their study which identified that there were some concerns in Greece regarding the sustainability and the impact of the current onshore wind farms to the natural environment and the wildlife.

The economic and environmental costs and benefits are other factors that have to be considered so as to get approval from the public. Koukakis (2024) therefore noted that the Greek and EU integration barriers for wind and solar technologies corresponded with the environmental impacts and perceived tradeoff between development and environment. This highlights the significance of assessing and managing the economic and environmental impacts of wind energy project development and deployment (Adeyeye et al., 2020; Rasoulinezhad, 2020). However, at the same time, another important factor that makes an impact on the acceptance of the wind energy projects is the long-term viability of the project for sustainable development. Likewise, Đurašković et al. (2021) highlighted that although people in the western Balkans have positive attitudes towards the use of renewable energy sources, their perception depends on the level of sustainable projects and compatibility of projects with large environmental objectives. In a similar vein, Nikas et al. (2019) noted that the project which have been seen to have a positive attitude towards environmental sustainability and energy security were more likely to be accepted by the Greek public. Thus, it is reasonable to state that the economic and environmental effects of wind energy projects are

interrelated, and the nature of both effects is fundamental for achieving social acceptance. The developers need to promote the economic benefits of wind power while at the same time taking an extra step to address the environmental issues that are likely to affect the perception of wind energy projects (Adeyeye et al., 2020; Peri and Tal, 2020).

2.5. Policy and Regulatory Frameworks

The policy and regulation framework that is applied on wind energy projects determines the perception of the people in society. Thus, for the public to embrace renewable energy, policy frameworks that associate renewable energy projects with the development goals and culture of communities should be established (Clausen and Rudolph, 2020; Hoicka et al., 2021; Lucas et al., 2021). As pointed by Andreou and Kontakos (2019), the policies that supported the promotion of the renewable energy in Cyprus together with other social and economic policies received more support from the public. Similarly, Kalogiannidis et al. (2024) found that in Greece, the integration of climate change measures into regional development plans helped to improve the acceptance of wind energy projects. It is also important to involve people and make as many as possible to participate in the process and this is the role of government and regulatory bodies. According to Enevoldsen and Sovacool (2016), the success of the French wind energy projects requires involvement of the public in the decisions made on the implementation processes. Similarly, Kafetzis et al. (2023) pointed out that the lack of effective communication to prevent the spread of information on wind energy and inadequate communication by the regulatory authorities were instrumental in the negative perception of the wind energy initiatives in Western Macedonia, Greece.

In addition, risk and uncertainty are also influenced by regulatory clarity and stability of policies that are crucial in enhancing investor confidence which results in public acceptance. Some of the issues that Western Balkan has been grappling with include policy instability, and regulatory risks as highlighted in the Frey (2024) which have impacted negatively on renewable energy including wind energy. In this regard, Katsaprakakis et al. (2022) opined that because of the policy uncertainty, policies must provide clear information to the public and investors for confidence in wind energy projects in the island of Crete, Greece.

Moreover, subsidies, tax exemptions, and grants for renewable energy projects are other policies, which enhance public acceptance. In the same way, Mezartasoglou et al. (2020) stated that the Greek government has supported the utilization of the renewable energy in the form of economic incentives including wind energy. These incentives do not only assist in reducing the burden placed on the developer but also the government stakeholders will be inclined to support renewable energy sources that are also likely to influence the public. Overall, the policy and regulatory framework is crucial in managing the perception of the public on wind energy projects. To eliminate the social concern and resistance towards RE initiatives and supportive policies, comprehensible and effective regulations, as well as open and participatory decision-making approaches are essential (Geekiyanage et al., 2020; Ryan et al., 2024; Zournatzidou et al., 2025). Therefore, the synchronization of the policies with the community cultural values and the continued support from the regulatory body will help towards enhancing the acceptance of wind energy project in the Western Macedonia, Greece and other similar regions.

3. METHODS AND MATERIALS

3.1. Research Design

This research used a survey design to explore the attitudes and acceptance level toward wind energy projects in Western Macedonia region of Greece. The study adopted a cross-sectional survey research design to ensure that the residents' attitudes, beliefs, and perceptions were captured at a given time. The cross-sectional approach was used because it enables the collection of data within a short time and is appropriate for examining the co-relational nature of the variables, perceived economic benefits, environmental effects, visual and noise considerations, and trust in government and developers. This approach allows for the determination of factors that affect the acceptance of wind energy projects by the public without having to use data collected over time. The survey format was chosen to provide a clear and well-organized structure for collecting data; the data was then statistically processed. This design is useful because it allows for the inclusion of large samples, meaning that the results are generalizable to the rest of the population of the region. Due to the emphasis on quantitative approach to the analysis, the study sought to offer factual and empirically based findings about the factors influencing or constraining the public acceptance of wind energy projects, which can be useful to policymakers and developers.

3.2. Study Area

The survey took place in the region of Western Macedonia in Greece (Figure 1) which is a major producer of renewable energy especially wind energy. This region has been identified for several wind energy projects because of its good wind characteristics and geographic features. In terms of population density, Western Macedonia exhibits both urban and rural settings with a diverse economy including farming, mining, and now renewable energy. The area has also been affected by the change from coal generated energy and therefore is an important area of focus in terms of public perception of cleaner forms of energy such as wind. This setting makes it possible to determine the extent of economic, environmental, and social factors that shape the public perception of wind energy on the local level. This region was chosen specifically as this area plays crucial role in Greece's energy transition and people living here have first-hand experience dealing with consequences of energy structures. In this way, by conducting the study on Western Macedonia, the authors intended to reveal the unique perceptions of the population which is directly influenced by the energy policy decisions, and which can be useful to support the further development of the wind energy projects in the similar Greek regions and other countries.

3.3. Target Population and Sample Size

This study aimed at residents of Western Macedonia with a particular emphasis on those affected by wind energy initiatives. Using a stratified random sampling technique, a sample size of 384

respondents was selected from a population of 10,000, following Yamane's formula (1973) which is presented in Equation 1 (Kalogiannidis et al., 2024; Singh and Masuku, 2014).

$$n = \frac{N}{1 + Ne^2} \quad (1)$$

Equation 1: Calculating the minimum sample.

Where:

n = sample size
N = population size (10,000)
e = level of significance (0.05)

$$n = \frac{10,000}{1 + 10,000(0.05)^2}$$

n = 384.

3.4. Sampling Technique

In an effort to ensure that a sample was representative of the population, a stratified random sampling technique was employed in an effort to capture all the demographic characteristics of the population in relation to wind energy projects including age, gender, education levels and geographical location. This was a purposive and stratified by geographic sub-regions of Western Macedonia that considered the respondents from both urban and rural areas and those who are directly and/or indirectly affected by wind energy projects. Regarding participants' selection, random sampling was used within each stratum, so that no eligible person was predetermined to participate more than any other person. This approach was useful in minimizing selection bias while enhancing the external validity of the study. The application of the selected sampling technique was relevant in ensuring that a number of people's perceptions towards wind energy were gathered to show the general acceptance levels in the region.

3.5. Data Collection Method

Questionnaires were administered through an online survey and face-to-face interviews to enhance the coverage of the research in the Western Macedonia region. This was done to ensure that the questionnaire is valid and clear after going through the literature on public perception of renewable energy, especially wind energy. They were closed questions to measure perceived economic benefits, perceived environmental impacts, visual and noise issues, and trust in government and developers. Closed questions, in the form of Likert scale questions, were employed to measure attitudes and perceptions, as they can be easily quantified.

Face-to-face interviews were administered at the community centers, local events, and other public places to ensure that participants with limited internet access were considered. To increase the response rate the survey was conducted in Greek language and the anonymity of the respondents was guaranteed. A combination of quantitative and qualitative data was used to increase response rates and to gain a broad cross-section of participants. The issues of ethics, such as informed consent and the voluntary nature of the participation of the research participants, were respected during the data collection.

3.6. Variables and Measures

To measure the acceptability of wind energy projects, several variables were brought into focus in the study. The dependent variable was defined as public acceptance of wind energy, and it was operationalized through several questions that aimed at establishing overall support for wind energy, support for living close to wind farms, and acceptability of wind projects in the region.

Perceived economic benefits, perceived environmental impacts, visual impacts, noise, and trust in government and developers were independent variables. Concerning economic impacts, questions were asked on employment, economic stimulation and local development, and financial returns. Perceived disruption to wildlife, changes in the landscape, and ecological impacts were identified as environmental consequences. Visual effects were assessed based on the perceived loss of aesthetics due to the wind turbines, and noise effects were determined from questions on noise annoyance and its effects on the quality of life. Perceived trust in government and developers was measured through questions regarding the perceived transparency, perceived fairness and perceived past implementation experiences. All the variables were measured by Likert scales for easy statistical analysis and to test the correlation of these factors and the level of acceptance by the public.

3.7. Data Analysis

The collected data were analyzed with the help of statistical software called the Statistical Package for the Social Sciences (SPSS, ver. 22). The descriptive data analysis technique in the form of mean, frequency, and percentage were employed in the study with regard to the demographic information of the respondents and their perception about wind energy projects.

To analyze the hypothesis, multiple regression analysis was used to determine the level of the perceived economic benefits, perceived environmental impacts, visual and noise impacts, trust in government and developers and the level of acceptance of wind energy project. The regression model also aimed at determining the nature and magnitude of these associations using standardized coefficients, known as Beta values, to compare the significance of each predictor. In the present study, the alpha level set for statistical significance was 0.05.

Furthermore, the overall fit of the regression model was also assessed using ANOVA. The regression model for predicting public acceptance of wind energy projects in Western Macedonia focuses on the perceived economic benefits, environmental effects, visual and noise impacts of wind energy projects, and trust in the government and developers. The dependent variable, therefore, is Public Acceptance (PA), which captures the community's attitude towards wind energy projects. The independent variables are Perceived Economic Benefits (EB), Perceived Environmental Impacts (EI), Visual and Noise Impacts (VNI), and Trust in Government and Developers (TGD) (Kalfas

et al., 2024; Kalogiannidis et al., 2023). The model is structured as Equation 2 shows.

$$Y = \beta_0 + \beta_1 EB + \beta_2 EI + \beta_3 VNI + \beta_4 TGD + \varepsilon \quad (2)$$

Equation 2: Multiple regression model to get the different anticipated values.

Here, β_0 represents the intercept, while β_1, β_2, β_3, and β_4 are coefficients that quantify the effect of each independent variable on public acceptance. The error term ϵ accounts for the variability not explained by the model. A positive coefficient (β_1) for Perceived Economic Benefits would support Hypothesis One, indicating that higher perceived economic benefits, such as job creation and local development, enhance public acceptance of wind projects. A negative coefficient (β_2) for Perceived Environmental Impacts would support Hypothesis Two, suggesting that concerns about environmental damage decrease acceptance. Similarly, a negative coefficient (β_3) for Visual and Noise Impacts would confirm Hypothesis Three, showing that visual and auditory disturbances reduce support. Lastly, a positive coefficient (β_4) for Trust in Government and Developers would support Hypothesis Four, highlighting that higher trust in these entities fosters greater acceptance of wind energy projects. The results will reveal the relative importance of these factors, guiding strategies to improve public acceptance of wind energy in the region.

3.8. Ethical Considerations

In the development of this research, the following ethical considerations were taken into account. Ethical clearance from the relevant institutional review board was sought before data collection could commence. The participants were asked to give their consent, and this was done in detail to explain the purpose of the study, procedures to be followed and that their participation was voluntary. The participants were informed that their responses would be anonymous, and the data collected would not include any personally identifiable information.

The data was kept secure and only made available to the research team and for the purpose of this study only. The study complied with the principles of beneficence, respect for persons, and justice to avoid causing harm to the participants. Additionally, the research conducted for this paper minimally prejudged cultural factors, with the survey completed in the participants' language and participants able to withdraw from the study at any one time with no repercussion. The values and ethical issues were incorporated into each phase of the research study to ensure the validity of the work.

4. RESULTS

This section includes the findings of the study after the identification of the sample respondents for the study.

4.1. Demographic Characteristics

The demographic profile of the 384 respondents is presented in Table 1.

The findings presented in Table 1 reveal gender distribution, according to which males constituted the larger share of the respondents (65.1%); 34.9% of the respondents were females (n = 134). This gender distribution indicates that there is an increased representation of male participants in the study population. As for the age, the majority of the participants belong to the 30-40 years age group, which includes 210 out of 384 or 54.7%. This is closely followed by the 41-50 years age group at 20.8% (80/384) and the below 30 years age group at 18.8% (72/384).

The least represented group is the one consisting of participants who are 50 years and above, representing 5.7% of the sample, where there are 22 participants out of 384. Regarding their staying in the region, 71.6% or 275 out of 384 of the respondents have been living in Western Macedonia for 10-20 years, which shows that a large number of the respondents are already settled in the region. The respondents with <10 years of residence were 40 (10.4% out of 384) while those with residence of more than 20 years were 69 (18.0% out of 384). This distribution means that the view points obtained are profoundly shaped by the long term residents, which is important for the perception of wind energy projects.

4.2. Descriptive Results

This section includes the findings of the study after the identification of the sample respondents for the study. The findings are presented based on the objectives of the study.

This study is to evaluate the level of public support regarding wind energy projects in Western Macedonia and the results are presented in Table 2.

The findings in Table 2 show that people in Western Macedonia are highly supportive of wind energy projects with an agreement rate of 52.9% and a strong agreement rate of 21.9%. Such a large pool of support suggests that wind energy is generally seen as a positive addition to the community. A large majority of the respondents (60.1%) identified wind energy as an important component of the regional energy mix in the future, which indicates that the public opinion on wind energy is consistent with the overall environmental and sustainability concerns. However, there are some information gaps as only 39.6% of respondents feel that

Table 1: Participants' demographic information (Residents of Western Macedonia)

Characteristic	Frequency	Percentage
Gender		
Male	250	65.1
Female	134	34.9
Age bracket		
Below 30 years	72	18.8
31-40 years	210	54.7
41-50 years	80	20.8
50 years and above	22	5.7
Years residing in region		
<10 years	40	10.4
11-20 years	275	71.6
More than 20 years	69	18.0
Total	384	100

Source: Survey (2024)

they are informed enough about the benefits of wind energy, while 15.6% of respondents disagreed with the statement.

This suggests that it is time to develop and implement better communication strategies to improve knowledge and participation among the public. Some concerns, however, remain, especially connected with the local effects of wind projects; 38.8% of respondents stated they would not like to have wind projects close to their homes what suggests that local opposition might occur despite the overall positive attitude. Lastly, 58.3% of the respondents agree that future generations will benefit from wind energy projects, which shows that the public is thinking of the long-term impact that wind energy projects will have on the environment and the economy. Overall, these results imply that more universally, acceptance and participation is high, however, efforts to specifically focus on certain issues and educate the public could go a long way in boosting acceptance and participation.

The results on the perceived environmental and economic impacts of wind energy projects are presented in Table 3.

As the findings in Table 3 reveal, the perception of the environmental and economic effects of wind energy projects in Western Macedonia can be regarded as mostly positive. A clear majority (59.4%) strongly or somewhat support the view that wind energy helps decrease the region's carbon footprint, which is a strong signal of perceived environmental advantages of wind energy. Even the economic effects are considered positive; 55.2% respondents agree that wind projects can create significant economic development in the local area, including job opportunities and economic boost, as 56.2% of the respondents agreed with this statement. Nevertheless, nearly 20% of the respondents are ambivalent to the economic gains, thereby implying variation in terms of perceived local economic effects, which may vary with the experience of some communities or the way different projects are being implemented. On the balance of the environmental advantage/disadvantage, opinion, 50.6% of respondents were in agreement that the advantages tipped the scale in its favor, while 21.4% were on the fence, depicting some element of skepticism or ignorance.

Respondents' perception of sustainability is in support of wind farms and their contribution towards environmental sustainability, with 60.1% of the respondents agreeing with this proposition. This strong endorsement also indicates that wind energy is not only viewed as an economic resource, but it is also viewed as critically important in terms of environment management in the region. In conclusion, positive effects on wind energy have great support from the public, but data also shows the areas that require more information or local involvement to overcome any existing doubts.

From Table 4, visual and noise effects are two of the main concerns that determine the acceptance of wind energy projects in Western Macedonia. A significantly large proportion (58.0%) of the participants are in agreement with the statement that wind turbines have a large impact on the visual environment, which is further supported by 27.1% strongly agreeing, signifying that the people of the community are concerned with the aesthetics.

Table 2: Attitudes regarding the wind power plants in Western Macedonia

Statement	%	SD	D	N	A	SA
I support the development of wind energy projects in my community.	%	3.1	6.5	15.6	52.9	21.9
Wind energy is an important part of the region's future energy strategy.	%	1.3	4.2	10.4	60.1	24.0
I feel informed about the benefits of wind energy.	%	5.2	15.6	22.1	39.6	17.5
I would oppose wind projects near my home due to potential drawbacks.	%	11.0	21.4	15.6	38.8	13.2
I believe wind energy projects will benefit future generations.	%	2.0	6.0	12.5	58.3	21.2

SD=Strongly disagree, D=Disagree, N=Neutral, A=Agree, and SA=Strongly agree
Source: Survey (2024)

Table 3: Perceived environmental and economic impacts of wind energy projects

Statement	%	SD	D	N	A	SA
Wind energy reduces the region's carbon footprint.	%	0.0	3.9	14.6	59.4	22.1
Wind projects bring significant economic benefits to the local area.	%	1.3	7.8	19.8	55.2	15.9
The environmental benefits of wind energy outweigh its costs.	%	0.0	6.5	21.4	50.6	21.5
Wind projects create jobs and stimulate the local economy.	%	2.0	8.0	14.5	56.2	19.3
The presence of wind farms contributes to environmental sustainability.	%	1.3	5.8	13.4	60.1	19.4

SD=Strongly disagree, D=Disagree, N=Neutral, A=Agree, and SA=Strongly agree
Source: Survey (2024)

Table 4: Visual and noise impacts in relation to public acceptance of wind energy projects

Statement	%	SD	D	N	A	SA
Wind turbines significantly alter the visual landscape.	%	0.0	2.6	12.3	58.0	27.1
The noise from wind turbines is disruptive to daily life.	%	0.0	11.0	13.5	50.0	25.5
Visual impacts of wind turbines are a major concern for me.	%	1.3	15.6	16.2	43.5	23.4
Noise from wind turbines affects my support for wind projects.	%	2.0	18.8	15.2	43.8	20.2
The presence of wind turbines degrades the natural beauty of the area.	%	3.1	14.6	11.9	49.7	20.7

SD=Strongly disagree, D=Disagree, N=Neutral, A=Agree, and SA=Strongly agree
Source: Survey (2024)

Such a perception could be a challenge to wind project developers particularly in areas that are perceived to have aesthetic value. Likewise, noise disruption is a significant factor; 50.0% agree with the statement that noise from wind turbines interferes with daily life, and 25.5% strongly agree, making noise a key factor that may potentially hinder public acceptance. These concerns are further supported by the fact that 43.5% of the respondents agreed that visual impacts are a major concern while 23.4% of the respondents strongly agreed. This implies that visual impacts are not mere cosmetic matters and are strongly perceived by a large segment of society.

Further, 43.8% of respondents agree that noise impacts influence their support towards wind projects implying a clear correlation between perceived noise pollution and support for wind projects. Finally, half as much as the respondents (49.7%) imagine that having wind turbines spoils the look of the area whereas 20.7% of the respondents are strongly sure. This degradation of perceived natural aesthetics could lead to increased resistance or demand for mitigation measures. These results indicate that despite the overall positive attitudes toward wind energy, managing the visual and noise impacts through proper selection of locations, aesthetic design or public involvement might be essential for further strengthening and stabilizing the acceptance.

The results on the implications of Trust on Government and Developers in Addressing Perception are presented in Table 5.

The results in Table 5 show that the role of trust in both the government and the developers is an important factor influencing the perception and acceptance of wind energy projects in Western Macedonia. The results revealed a somewhat higher level of trust in the government, with 43.5% agreeing and 16.3% strongly agreeing with the statement that they trust the government to handle wind energy projects responsibly. Nevertheless, a significant percentage of the respondents (24.0%) are still undecided and/or lack sufficient information about the issue in question. This is why it is crucial for the government to be transparent and constantly share information with the population to keep it informed. Concerning the trust in developers, the figure seems lower, as 38.0% of respondents express their agreement with the statement "Developers give clear and understandable information about wind projects," while 20.3% of respondents disagree with this statement.

This implies that an effort to increase the level of transparency and communication from the side of developers might be very important in increasing the perception from the side of the public. Additionally, only 40.6% of the participants agreed that the government will be able to respond to the concerns that the community will have regarding projects while a significant number of 25.0% of the participants were indifferent towards the notion, implying that some members of the community may feel out of touch or skeptical about the government. Trust in developers to take environmental consequences of projects into account is also moderate, with 37.0% agreeing. Communication from the government is seen as one of the major factors that can positively influence the community support for wind projects; 52.2% of the respondents agreed with it to show that the government should engage in an active and clear dialogue with the community.

These findings underpin the need for the government and developers to work on trust promotion activities so as to ensure that members of the public have a positive attitude towards wind energy projects in the region through enhanced and effective communication on the projects.

4.3. Regression Analysis

This section brings detailed findings of the regression analysis and evaluates each hypothesis based on the coefficients found out. The results are presented in Table 6.

The regression model has an R-squared value of 0.658, indicating that 65.8% of the variability in public acceptance of wind energy projects can be explained by the independent variables included in the model: perceived economic benefits, perceived environmental effects, visual and noise effects, and perceived trust in government and developers. The Adjusted R-squared value of 0.649 indicates that even after controlling for the number of predictors, it can be concluded that the chosen variables have a substantial impact on the degree of public acceptance.

A one-way analysis of variance was then performed to confirm the appropriateness of the linear regression model as demonstrated in Table 7.

The analysis of variance test shows that there is relationship between the independent variables and the level of acceptance towards wind energy projects and the F-statistic of 75.321 at 0.013, which is a significant $P < 0.05$. This suggests that the regression model fit the data well and that the independent variables taken together have an effect on the level of public acceptance of wind energy projects.

Table 8 shows the regression coefficients, which quantify the significance of each predictor in affecting public perception of wind energy projects.

Table 5: Trust on government and developers and its impact on public perception

Statement	%	SD	D	N	A	SA
I trust the government to manage wind energy projects responsibly.	%	4.2	12.0	24.0	43.5	16.3
Developers provide transparent information about wind projects.	%	5.8	20.3	23.4	38.0	12.5
I believe the government will address community concerns about projects.	%	6.0	13.5	25.0	40.6	14.9
I trust developers to consider the environmental impact of projects	%	6.8	20.1	25.9	37.0	10.2
Effective communication by the government improves my support for wind projects.	%	1.3	5.9	20.8	52.2	19.8

SD=Strongly disagree, D=Disagree, N=Neutral, A=Agree, and SA=Strongly agree
Source: Survey (2024)

The coefficient for perceived economic benefits is 0.244 with the standardized Beta of 0.384 and a t-value of 4.357 (P < 0.001). This positive and significant relationship means that when perceived economic benefits are high, there will also be a high level of support for wind energy projects.

Based on Hypothesis One, the high Beta value points to a significant influence. This finding underscores the need to focus on the positive economic impacts, including employment generation and local economic development, as key factors influencing public acceptance of wind energy projects. The coefficient for perceived environmental impacts is −0.116, the standardized Beta is −0.118, while the t-value is −1.812 (P = 0.047).

This negative and significant correlation validates Hypothesis Two; thus, negative attitudes towards the impacts of wind energy projects on the environment like habitat destruction or alterations to the scenery diminish public acceptance of wind energy projects. This evidence shows that the consideration of environmental issues and the emphasis on measures that could be taken to address such issues are important in gaining the support and approval of the people. Hypotheses 3 is supported by the negative coefficients for visual impacts (−0.172) and noise concerns (−0.145) with significant Beta values of −0.210 and −0.132, respectively. The t-values of Hypothesis Three are as follows: for visual impacts (−3.510, P = 0.001) and noise concerns (−2.339, P = 0.020), which are significant.

These findings confirm that visual and noise disturbances have a serious negative influence on the public acceptance, thus, the reduction of these effects or better public perception of the problems could be the major strategy towards acceptance. The coefficient for trust in government and developers is 0.182 with a standardized Beta of 0.153 and t-value of 2.984 (t = 2.984, P = 0.003). Hypothesis four is thus supported and the positive and significant correlation between trust in government and developers and acceptance of wind energy projects supports this hypothesis.

This result underscores the significance of clear and open communication, stakeholder outreach, and the authenticity of the project promoters in garnering public confidence and support. The regression analysis shows that perception of economic benefits, trust in government and developer support all significantly enhance public acceptance of wind energy projects while perception of environmental, visual and noise impact all significantly decrease acceptance.

Table 6: Model summary

R	R-square	Adjusted R-square	Standard error of the estimate
0.712	0.658	0.649	0.10432

Predictors: (Constant), Perceived economic benefits, perceived environmental effects, visual effect, noise effect, perceived trust in government/developers. Dependent Variable: Public perception of wind energy projects

Table 7: ANOVA analysis

Model	Sum of squares	df	Mean square	F	Significant
Regression	82.031	5	20.508	75.321	0.013
Residual	42.099	379	0.111		
Total	124.130	384			

Dependent Variable: Public perception of wind energy projects, Predictors: (Constant), Perceived economic benefits, perceived environmental effects, visual effect, noise effect, perceived trust in government/developers

5. DISCUSSION

The findings of this study are significant and may offer useful information about the factors that affect the perception and acceptance of wind energy projects in the region of Western Macedonia in Greece. The results support the importance of economic gains, environmental effects, aesthetics, and noise as well as the public confidence in government and developers regarding wind power projects. The findings confirmed that perceived economic benefits are a significant positive factor influencing the acceptance of wind energy projects among the public, thus supporting H1. This finding supports prior research that notes that economic self-interests, including employment generation, local development, and financial gains, underpin support for renewable energy projects (Hanger-Kopp et al., 2019; Shaban et al., 2023).

In Western Macedonia, where the shift from lignite mining to renewable sources of energy has social and economic impacts, employment opportunities and economic development play a critical role in securing social acceptance (Kafetzis et al., 2023; Katsaprakakis et al., 2022). The positive perception of economic benefits indicates that stressing on the direct as well as indirect economic returns of wind energy projects as an effective approach to enhance the acceptance levels in the regions of energy transformation (Baltima, 2021; Farmaki et al., 2021; Tsoutsos et al., 2009; Zournatzidou et al., 2025).

In general, the public has a positive attitude towards wind energy, however, perceived environmental impact have a negative effect on

Table 8: Regression analysis

Model	Unstandardized coefficients		Standardized coefficients	t	Significant
	B	Standard error	Beta		
(Constant)	0.512	0.127		4.035	0.512
Perceived Economic Benefits	0.244	0.056	0.384	4.357	0.244
Perceived Environmental Impacts	−0.116	0.064	−0.118	−1.812	−0.116
Visual Impacts	−0.172	0.049	−0.210	−3.510	−0.172
Noise Concerns	−0.145	0.062	−0.132	−2.339	−0.145
Trust in Government and Developers	0.182	0.061	0.153	2.984	0.182

Dependent Variable: Public perception of wind energy projects

Figure 1: Map showing region of Western Macedonia in Greece

acceptance as the coefficient for perceived environmental impact is negative and highly significant in the regression equation. This finding supports the Hypothesis Two and resonates with the issues mentioned in the literature regarding the ecological consequences of wind turbines, including the impact on wildlife and landscape alterations (Georgopoulou et al., 2024; Karamountzou and Vagiona, 2023).

In Greece, one of the major challenges that have hindered the acceptance of wind resources include the effect of wind farms on bird's populations and natural ecosystems (Koukakis, 2024; Leiren et al., 2020)(Kalfas et al., 2021). These concerns imply that project developers should factor environmental impact assessments and mitigation measures to the existing ecological risks. Furthermore, enhancing public awareness of these measures can help reduce anxiety and increase confidence (Enevoldsen and Sovacool, 2016; Koukouzas et al., 2021).

The findings also demonstrated that visual and noise impacts had a negative impact on public acceptance, meaning Hypothesis Three was supported. A high level of concern towards these impacts means the aesthetic and auditory nuisances of the wind turbines and these are always said to be some of the disadvantages of wind energy projects (Loukogeorgaki et al., 2022; Vlami et al., 2020).

Concerning Western Macedonia, change of the natural environment and noise generated by wind turbines are the main issues that are well understood to impact the perceptions of the society (Krystalidis, 2022; Ruddat, 2022). The findings of this study mean that it is possible to increase the acceptance level among the community by choosing the right locations and using less sight and noise pollution, incorporating new ideas in technology as well as engaging the community in the decision-making process. In addition, participation of the local communities during the planning and siting stages can help in the management of these effects and enhance acceptance (Botsaris et al., 2021; Hassan et al., 2024; Loukogeorgaki et al., 2022).

The fourth hypothesis was also supported which stated that trust in government and developers has a direct correlation with the acceptance level among the public. Lastly, this conclusion underscores the role of credibility, openness, and communication to shape public opinion (Enevoldsen and Sovacool, 2016; Kleanthis et al., 2022).

In the region of Western Macedonia, problems such as the opacity of information and the participation of both the authorities and the developers were mentioned as the means to regain the trust of the population in wind energy (Kafetzis et al., 2023; Katsaprakakis et al., 2022). It is in these conditions that people are likely to support projects that are considered to be fair, transparent and that reflect the general values in the society (Demesouka et al., 2024; Tranoulidis et al., 2022).

According to the conclusions of the study, it is crucial to improve confidence by communicating with the stakeholders consistently, addressing the concerns of the community and meeting the obligations to achieve and maintain public acceptance of wind energy projects (Hanger-Kopp et al., 2019; Loukogeorgaki et al., 2022).

The following is a breakdown of policy implications that can be inferred from the study. First, the economic incentives that should be offered by policymakers are those that will have a direct positive impact upon the people in the regions where the wind energy projects are to be developed, for instance, employment and revenue generation, so as to increase support for the projects in those regions (Baltima, 2021; Mezartasoglou et al., 2020).

Second, the environmental requirements should be intensified to respond to ecological issues; these should include compulsory environmental assessments with the integration of a reporting system with full public disclosure to gain the trust of the society (Georgopoulou et al., 2024; Koukakis, 2024). Third, visual and noise should be minimized through enhanced turbine design, location selection and engagement of the community in the decision making process (Loukogeorgaki et al., 2022; Vlami et al., 2020). Lastly, the promotion of trust between different stakeholders through the sharing of information, engagement of all the stakeholders and the governance of the renewable energy projects should be a key component of all renewable energy projects (Enevoldsen and Sovacool, 2016; Kleanthis et al., 2022).

By effectively tackling these factors, stakeholders can help to ensure a more efficient transition to sustainable energy and contribute to Greece's broader climate and energy objectives (Andreou and Kontakos, 2019; Xenitidis et al., 2023).

6. CONCLUSION

This study established the key success factors that relate to the public acceptance of wind energy projects in the Western

Macedonia region of Greece. From this study it is clear that perceived economic utility, which encompasses employment creation and local economic development, is a crucial factor in the perception that the public has towards wind energy projects. This goes to show that for renewable energy acceptance, there is a need to ensure that these projects are economically beneficial to the local people. However, the study also revealed that environmental issues, especially those to do with wildlife and scenery greatly lower the level of acceptability hence the importance of proper environmental planning and compensation.

Criticisms that were regarded as barriers to acceptance included visual and noise effects, which refer to the effects of the aesthetic look and sound of wind turbines. This means that to facilitate increased acceptance of wind energy projects, the developers have to ensure that they reduce these effects by selecting proper locations, using better technologies and engaging the community well. Meeting these concerns not only enhances the public's perception of the issue but also increases the level of ownership by the local people. The level of trust in the government and developers can be considered as the key factor that influences the overall perception of the public.

The analysis identified clear communication, active engaging of stakeholders, and the ability to address community concerns as critical for trust building and sustenance. This underscores the importance of this paper which focuses on the disclosure practices of government bodies and developers in the development of wind energy projects: This involves the pursuit of high standards of transparency, fairness and inclusiveness in all the stages of the project development. In sum, the study shows that there is a need to address the economic, environmental, social, and institutional factors if the wind energy projects are to be successful in Western Macedonia. In this way, stakeholders can not only improve acceptability but also support the country's energy transition and climate objectives in Greece.

6.1. Recommendations

Based on the guidelines provided in this study, the stakeholders in Western Macedonia should focus on pro Wind energy projects economic factors that will have a positive impact on the community, such as employment generation and revenue sharing. Environmental issues should be resolved after careful evaluation of the impact of the decision on the environment and reporting.

Besides, measures that would help reduce visual and noise pollution such as better designs of turbines and the choice of locations to install the turbines should be employed. Last but not least, it is crucial to share the information with the public and engage them in dialogue to ensure long-term support for wind energy projects.

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