



## Barriers to the Use of Renewable Energy Sources

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# Barriers to the use of renewable energy sources

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**Abstract:** The article discusses the main barriers to the use of renewable energy sources among entrepreneurs. It presents the results of a survey of 717 Polish small and medium-sized enterprises operating in the tourism sector. The subject of the study was the determinants of investment in renewable energy sources (RES). The research was carried out in two groups; those using RES and those not using RES. The aim of the article was to identify the main barriers that cause the lack of use of RES and the lack of intention to use these sources in the future. The study used statistical tests, factor analysis and econometric modelling. The analysis was carried out at a significance level of  $\alpha=0.05$ .

**Keywords:** renewable energy sources (RES); small and medium-sized enterprises; barriers

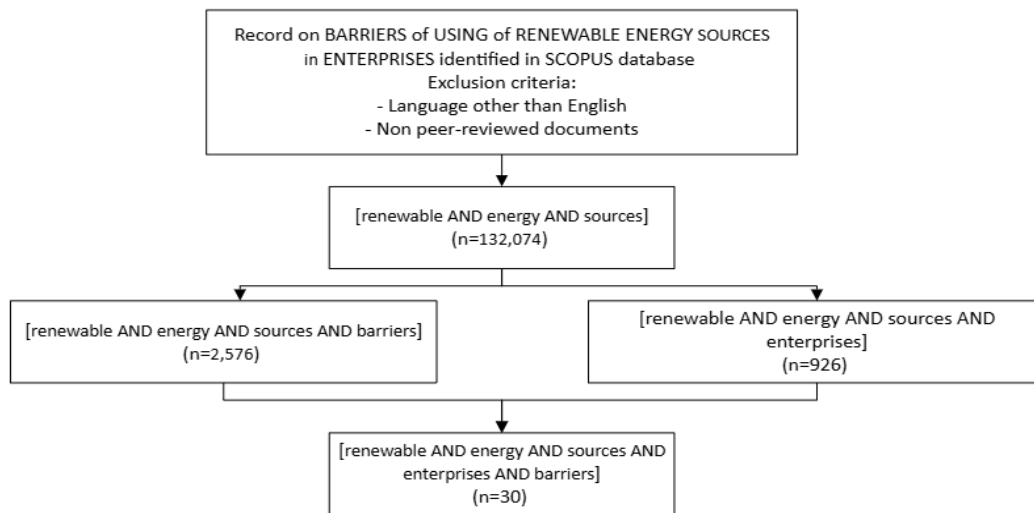
**JEL Classification:** C5; O3; Q2

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## 1. Introduction

Renewable energy sources (RES) have huge potential. They are based on the forces of nature, are not exhaustible and do not pollute the environment. They are derived from natural processes and resources, are sustainable and have minimal environmental impact. They are an excellent 'green' alternative to depleting and polluting fossil fuels. Their use brings a range of benefits to the economy and to those who use them. However, there are barriers to investing in RES (Sobocińska, 2022; Kudurs et al., 2020; Prem Anand Jayaprabha et al., 2024; Tomaszewski & Sekściński, 2020). The study was based on the available literature on the subject and on extensive own research among small and medium-sized enterprises operating in the Polish tourism sector. It focused on the conditions for investing in renewable energy sources, and the respondents included both entrepreneurs who use renewable energy sources and those who have not decided to use them.

Due to the broad understanding of the relationship between using of renewable energy sources by enterprises and the barriers in its implementation, it was decided to conduct a systematic literature review. In the first stage of the review, it was decided to select a bibliographic database that would allow a detailed analysis of scientific publications. The SCOPUS database was chosen for this purpose. In the second stage, the keywords considered and the conjunctions linking the phrases were developed. This resulted in combinations presented on the Figure 1.



**Figure 1.** Selection of sources of literature review  
Source: Authors' own elaboration

Based on the identified literature, it was possible to identify the most commonly identified factors holding companies back from making the energy transition decision. Research by Kudurs et al. (2020) suggests that limiting the use of RES in companies is related to other investment priorities, long payback periods and constraints due to existing infrastructure. Long payback periods are also highlighted by other studies (Prem Anand Jayaprabha et al., 2024). These studies address the issue of storing energy generated during periods of sunshine (the study looked at solar energy) for use during periods without access to sunlight. This requires additional investment in renewable energy infrastructure. Despite EU subsidies and compliance with environmental requirements, the company's financial contribution is a factor that can be an obstacle to implementation at company level (Florkowski & Rakowska, 2022). Similar issues, albeit in the context of individual RES installations (at household level), are highlighted in the study by Karasmanaki et al. (2024). Investment costs are the main barrier to RES investment, and cost barriers slow down investment and reduce the rate of deployment. Qamar et al. come to similar conclusions, indicating that perceived price, perceived level of competition and energy cost intensity of businesses are barriers to RES adoption and diffusion (2022). Among the internal, company-specific factors, the main barriers to the implementation of RES were found to include: (1) poor environmental concerns on the part of company personnel, expressed in terms of fear of air pollution resulting from energy consumption; (2) low awareness and knowledge of renewable energy due to previous bad experiences, or (3) assessment of the total cost of renewable energy production due to the fact that producing green energy can involve additional costs or high initial outlay (Lyakurwa, 2023). Internal factors such as fierce market competition, limited company financial resources, risk aversion or the complexity of the technology were responsible for the lack of company investment in sustainable energy technologies. (Meijer et al., 2019). Importantly, factors such as loss of time or institutional inertia of the firm were rated as less important barriers in this regard. Among the available publications, only one dealt with the tourism-related industry (Sardianou & Kostakis, 2019). This study analysed hotels in Crete. According to hoteliers, economic,

institutional and human factors were the main barriers to investing in RES. These included budgetary barriers: (1) lack of financing or (2) high investment risk. These two were identified as the most important barriers to the adoption of RES in hotels. The second category of barriers were bureaucratic barriers related to the adoption of relevant investments. In addition, the study also identified physical limitations (50%), the level of education of staff (70%), or the lack of knowledge of know-how in the implementation of renewable energy sources (60%) (Sardianou & Kostakis, 2019). The administrative and bureaucratic barriers mentioned here, which lead to a lack of investment in and implementation of RES technologies in the operations of small and medium-sized enterprises, are also indicated by the Celic & Lenz study (2022). These studies indicate that an unclear system of bodies responsible for RES issues, lack of information, difficult application procedures for investments or overly complicated forms of their control are responsible for the shortcomings in the implementation of RES in enterprises. The barriers identified can also be grouped into the general category of lack of stable regulation, which is a result of the changing and evolving nature of RES regulation. These are mostly external, systemic and developmental barriers (Bednarek et al. 2023). The lack of a stable policy to promote renewable energy sources, including an energy market monopoly or the lack of a coherent sustainable development policy for air protection, and the lack of mechanisms to support the reduction of the energy intensity of the economy have been identified as barriers to the implementation of RES at the level of individual users (Wojciechowska-Solis & Soroka, 2018). Due to their systemic nature, they can also be considered as business factors. Similar barriers, i.e. the cost of investment, the lack of adequate subsidies and complex legal frameworks, the price of electricity, the low capacity of electricity grids, the length of the investment process, the need for additional investments (e.g. roof retrofitting), are identified by experts (My, 2024).

An important issue raised when analysing barriers to RES deployment is the impact of the deployment itself, which contributes to the competitiveness of companies (Cong & Uyen, 2020). Maintaining a company's intention to implement RES turns out to be a key factor at the level of internal factors. However, it is important that the energy and economic efficiency of the projects envisaged for implementation are satisfactory both for the companies and for the agencies intermediating their funding (Prokhorova et al., 20-23; Sen & Ganguly, 2017). In the case of external factors, the role of a well-functioning RES system is emphasised, including access to RES operators. If there are none, or not enough, even the willingness of companies to implement RES will not translate into actual implementation for infrastructural reasons. In fact, the lack of responsiveness of the RES supply chain is identified as a key barrier to RES deployment in companies, as are bureaucracy and constraints in deployment planning (Mason-Jones et al., 2022).

It is therefore necessary to develop appropriate measures at the level of administrative and legislative solutions to encourage companies to implement RES in their activities. Furthermore, companies should have access to information on available RES technologies and financial instruments, as well as the possibility to receive advice on the implementation of these technologies. (Kudurs et al., 2020). This issue is also highlighted by the Celic & Lenz

study (2022), which calls for the creation of an optimal policy with an innovative financial instrument dedicated to companies wishing to invest in RES.

### 3. Methodology

The aim of the research was to find out what barriers make entrepreneurs in the Polish tourism industry reluctant to invest in renewable energy sources, and what factors could influence a positive decision to invest in renewable energy sources in the longer term. The analysis is based on data obtained from a diagnostic survey conducted using a questionnaire among companies operating in the tourism industry in Poland. A total of 1196 entrepreneurs participated in the survey, of which 140 entrepreneurs used RES (12% of the total group) and 1056 entrepreneurs did not use any such technology (88%). The group analysed in this study are entrepreneurs who do not use RES and do not plan to use these technologies in the next 3 years. The total size of this group was 717 entrepreneurs (representing 60% of the total group surveyed and 68% of the group not using RES in their business). The study used statistical tests, factor analysis and econometric modelling. The analysis was performed at a significance level of  $\alpha=0.05$ .

### 4. Results

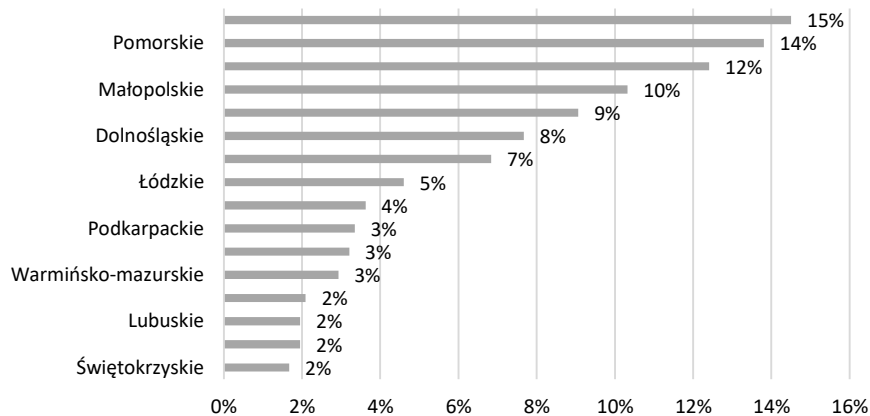
The characteristics of the enterprises surveyed are shown in Table 1.

**Table 1.** Characteristics of the surveyed entrepreneurs who not using RES

Specification		N	%
Type of business	Feeding	381	53
	Accommodation	336	47
Type of facility	Preparing and delivering food for external recipients (catering)	24	3
	Restaurants and other permanent catering establishments	357	50
	Tourist accommodation facilities and short-term accommodation	204	28
	Other accommodation	32	4
	Hotels and similar accommodation facilities	100	14
Ownership of premises	Yes		26
	No, we have our own premises		74
No. of employees	to 9	603	84
	from 10 to 49	108	15
	from 50 to 249	6	1
How long has the company been in the market	min, max	0.5; 73	
	mean	13	
	median	12	
	std.dev	8,5	

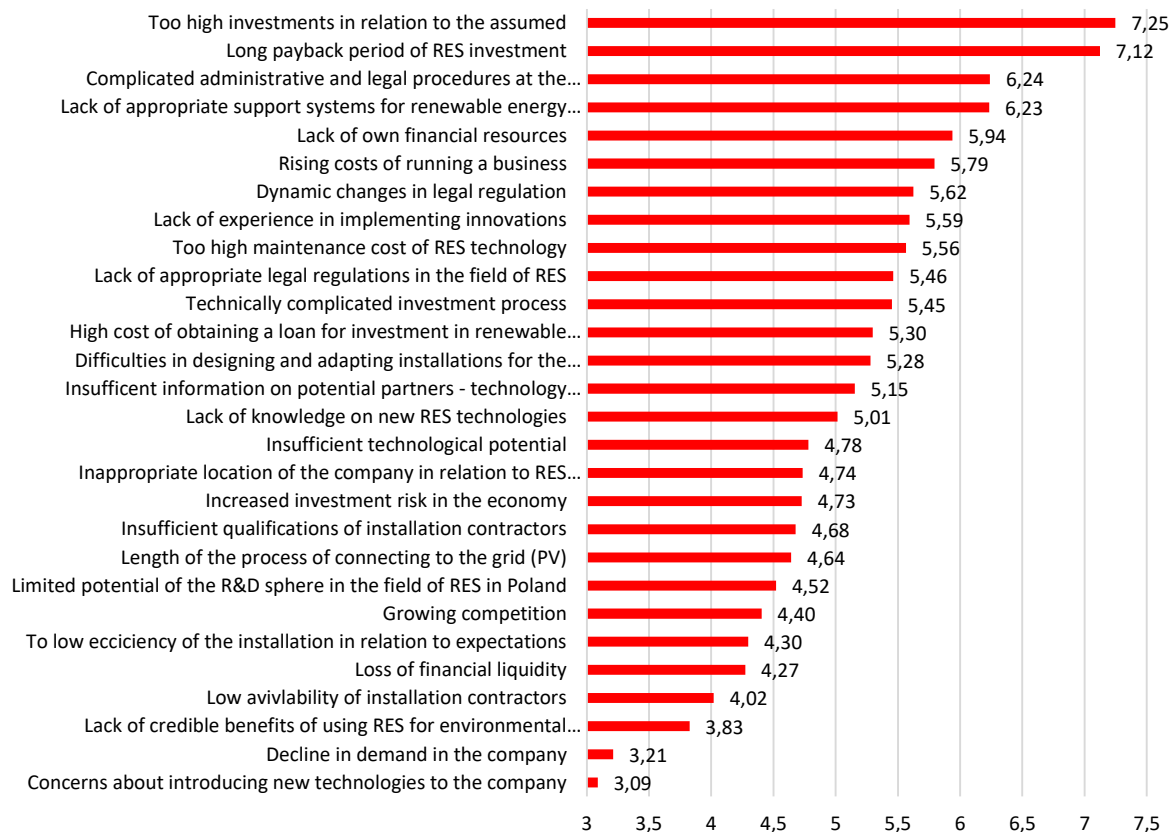
Source: Own study based on completed research

Most respondents operated a food business (53%), with half owning restaurants or other fixed food outlets. The vast majority - 74% - did not own the premises in which they operated. As many as 84% of respondents were micro-enterprises, employing up to 9 people. The average duration of entrepreneurship is around 13 years. The shortest period for running an enterprise was six months and the longest was 73 years. Most enterprises were located in Mazowieckie Province (15%) and Pomorskie Province (14%). The fewest, 2% each, were located in Podlaskie Province, Lubuskie Province, Opolskie Province and Świętokrzyskie Province (Figure 2.).



**Figure 2.** Province in which the surveyed enterprises operate, broken down by RES users and non-users  
Source: Own study based on completed research

One of the aims of the research was to find out what the main barriers are that prevent tourism entrepreneurs from investing in renewable energy. What prevents them from planning such investments in the near future. The barriers were ranked on a scale from 1 - least impact to 10 - most impact. The ranking of the barriers is shown in Figure 3.



**Figure 3.** Ranking of importance of barriers to RES investment abandonment  
Source: Own study based on completed research

Two barriers to investment in RES were rated above 7 points and thus had the greatest influence on entrepreneurs' reluctance to invest in RES. These were: investment costs that were too high in relation to the expected ones - the highest rated with an average of 7.25 points, and the long payback period of investments in RES - with an average of 7.12 points.

The next two barriers with a score above 6 points are: complicated administrative and legal procedures at the authorisation stage - 6.24 points, and lack of adequate support systems for RES investments - 6.23 points. Only in fifth place was the lack of sufficient own funds to finance the investment (5.94 points), and in sixth place was the increasing cost of doing business (5.79 points). This suggests that it is not financial barriers that most deter entrepreneurs from investing in renewable energy, but rather the length of the payback period and the belief that investment costs will be higher than expected.

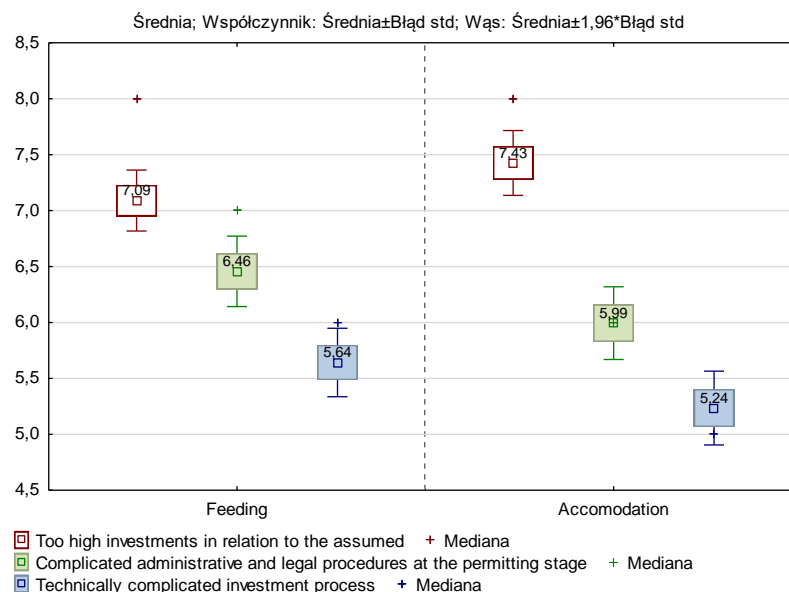
The research investigated whether there were differences in the perception of barriers among tourism entrepreneurs depending on the type of business they operated - whether it was catering or accommodation, whether they owned or rented, and whether the size of the business determined the occurrence of specific barriers to investment in RES. Non-parametric tests of significance, Mann-Whitney U test and Kruskal-Wallis ANOVA were used for the study. The results are presented in Tables 2, 3 and 4. The analyses carried out show that the type of activity influenced the assessment of the following three barriers limiting RES investments: too high investments in relation to the assumed targets  $p < \alpha$  ( $p=0.0404$ ), complicated administrative and legal procedures at the permit stage  $p < \alpha$  ( $p=0.0202$ ) and technologically complicated investment process  $p < \alpha$  ( $p=0.0478$ ) (Table 2).

**Table 2.** U Manna-Whitney test - type of activity vs. assessment of RES investment barriers

Barriers	p-value
Too high investments in relation to the assumed	0,0404*
Complicated administrative and legal procedures at the permitting stage	0,0202*
Technically complicated investment process	0,0478*

Source: Own study based on completed research

Too high costs in relation to the RES to be installed are feared by those in the hotel sector (mean score 7.43), while complicated administrative and legal procedures at the licensing stage (6.46) and a technically complicated investment process (5.64) are more limiting for those in the catering sector (Figure 4).



**Figure 4.** Barriers to investment in RES in relation to the conducted business activity

Source: Own study based on completed research

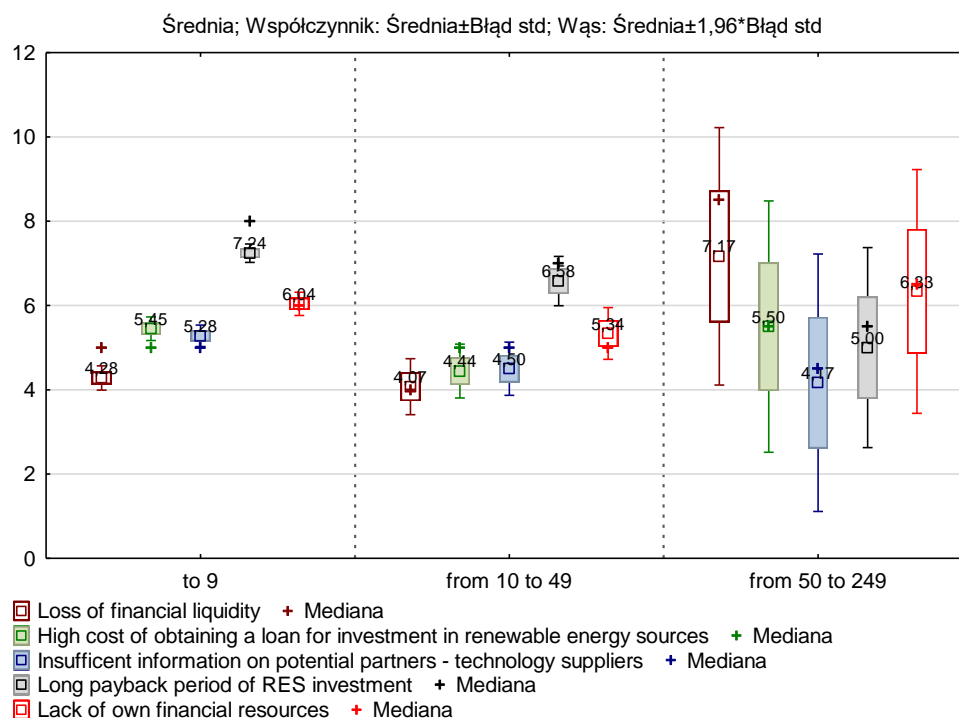
For enterprise size, there were differences in the assessment of the following five barriers: loss of liquidity  $p < \alpha$  ( $p=0.0357$ ), high cost of obtaining a loan to invest in RES  $p < \alpha$  ( $p=0.0260$ ), insufficient information about potential partners  $p < \alpha$  ( $p=0.0896$ ), long payback period for RES investments  $p < \alpha$  ( $p=0.0264$ ) and lack of funds to invest in RES  $p < \alpha$  ( $p=0,0083$ ) (Table 3).

**Table 3.** Kruskal-Wallis ANOVA – size of enterprise vs. assessment of RES investment barriers

Barriers	p-value
Loss of financial liquidity	0,0357*
High cost of obtaining a loan for investment in renewable energy sources	0,0260*
Insufficient information on potential partners - technology suppliers	0,0896*
Long payback period of RES investment	0,0264*
Lack of own financial resources	0,0083**

Source: Own study based on completed research

Loss of financial liquidity was most feared by entrepreneurs of the largest enterprises with between 50 and 249 employees - the average score for this barrier was 7.17 points. Large enterprises were also concerned about the high cost of borrowing for RES investments - average score 5.50 points - and the lack of financing sources - 6.33 points. Lack of or insufficient information on potential partners and technology suppliers, with an average score of 5.28, was a concern for entrepreneurs in micro-enterprises employing up to 9 persons, as was the long payback period for RES investments, with an average score of 7.24. (Figure 5).



**Figure 5.** Average scores for each barrier in groups based on enterprise size

Source: Own study based on completed research

The last criterion used in the research was whether (or not) the respondents had their own premises where their business was carried out. Having own premises was related to the



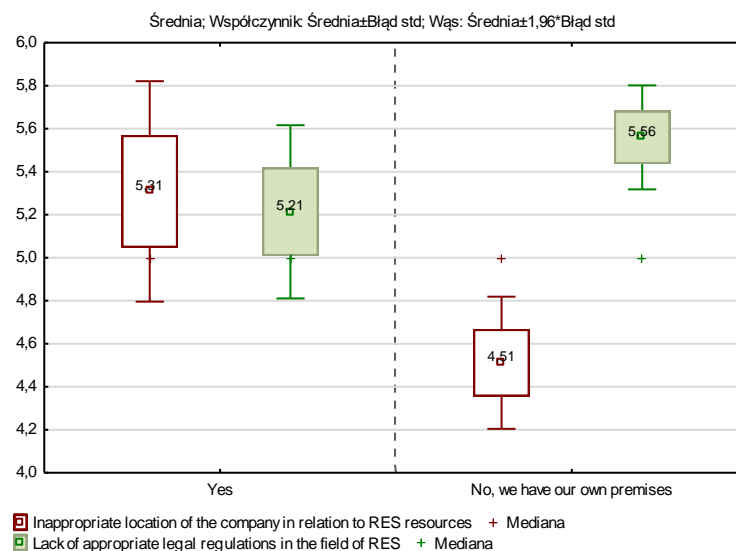
assessment of two barriers - inappropriate business location in relation to RES resources  $p < \alpha$  ( $p=0.0098$ ) and lack of adequate support systems for RES  $p < \alpha$  ( $p=0,0466$ ) (Table 4).

**Table 4.** Kruskal-Wallis ANOVA - ownership of premises vs. assessment of RES investment barriers

Barriers	p-value
Inappropriate location of the company in relation to RES resources	0,0098**
Lack of appropriate support systems for renewable energy sources	0,0466*

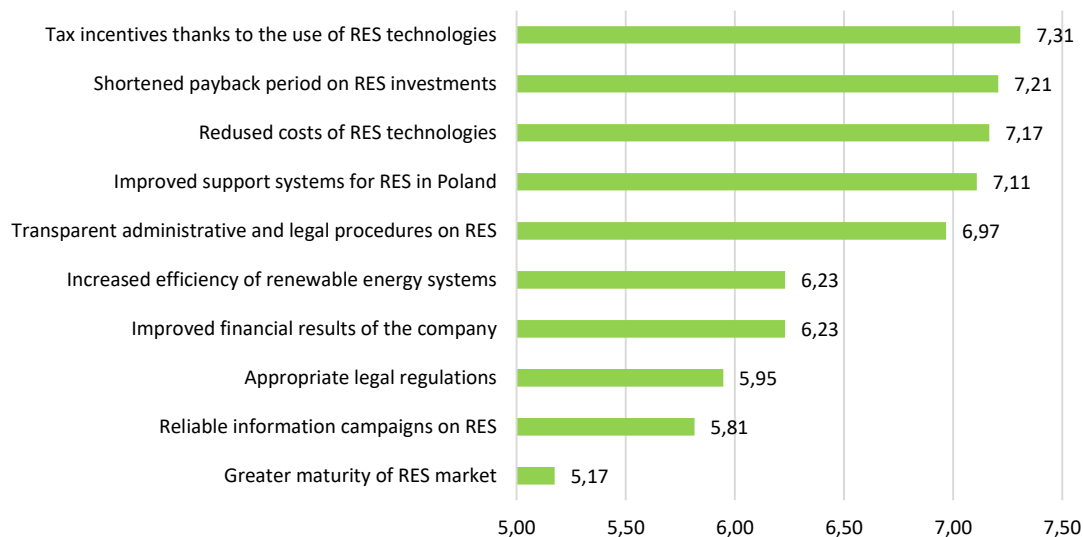
Source: Own study based on completed research.

Inadequate business location in relation to RES was more feared by entrepreneurs who had their own premises in which to operate - the average score for this barrier was 5.31, while lack of adequate legislation in the field of RES was feared by entrepreneurs who did not have their own premises and operated in rented premises - the average score was 5.56 (Figure 6).



**Figure 6.** Average scores for each barrier in groups based on ownership of premises  
Source: Own study based on completed research

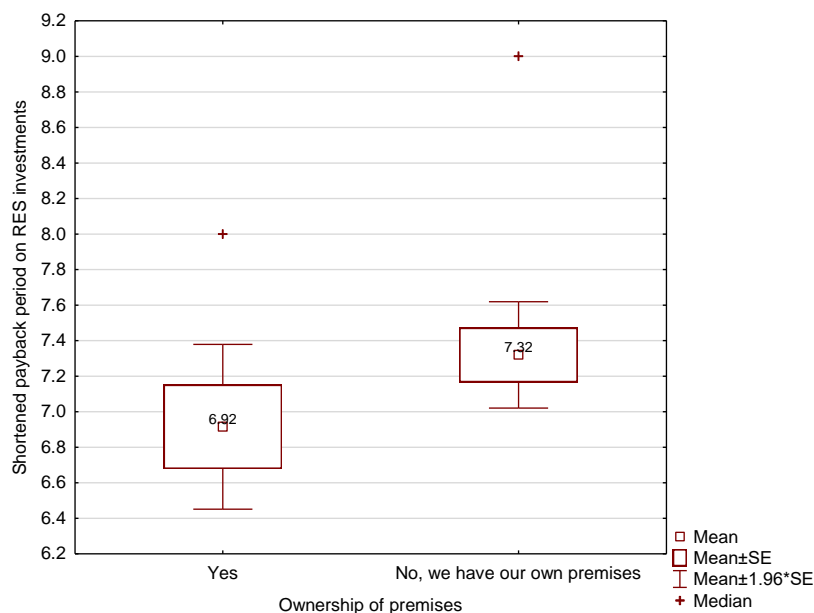
The respondents were entrepreneurs who had not invested in RES and had no intention of doing so. They were therefore asked what factors would persuade them to make a decision to invest in RES. The highest scores were given by the entrepreneurs surveyed to tax incentives for the use of RES technologies - average score 7.31 points - and to shortening the payback period of investments - average score 7.21 points. Reducing the cost of RES technologies came in third, with an average score of 7.11, and improving the support systems for RES in Poland came in fourth, with an average score of 7.11. On average, entrepreneurs rated transparent administrative and legal procedures for RES with 6.97 points (Figure 7).



**Figure 7.** Ranking of factors that could influence a positive decision on RES investments

Source: Own study based on completed research

The research looked at whether the factors that could encourage investment in renewable energy were related to the size of the business, the type of business and whether they had their own premises where the business was carried out. The research shows that neither the size of the enterprise nor the type of enterprise is related to the assessment of factors that would lead entrepreneurs to decide to invest in RES. Only „reduced payback period for RES investments” - was related to whether the entrepreneur owned his own premises  $p < \alpha$  ( $p = 0.0356$ ). Those entrepreneurs who did not have their own premises rated the shorter payback period significantly higher - mean 7.32, median even 9 points (Figure 8).

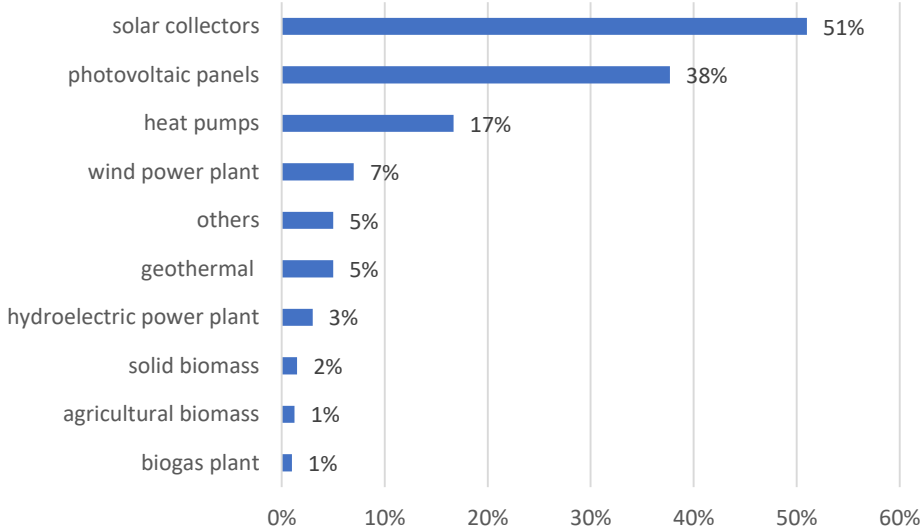


**Figure 8.** Average rating for reduced payback time for RES investments by whether entrepreneurs have their own business premises

Source: Own study based on completed research

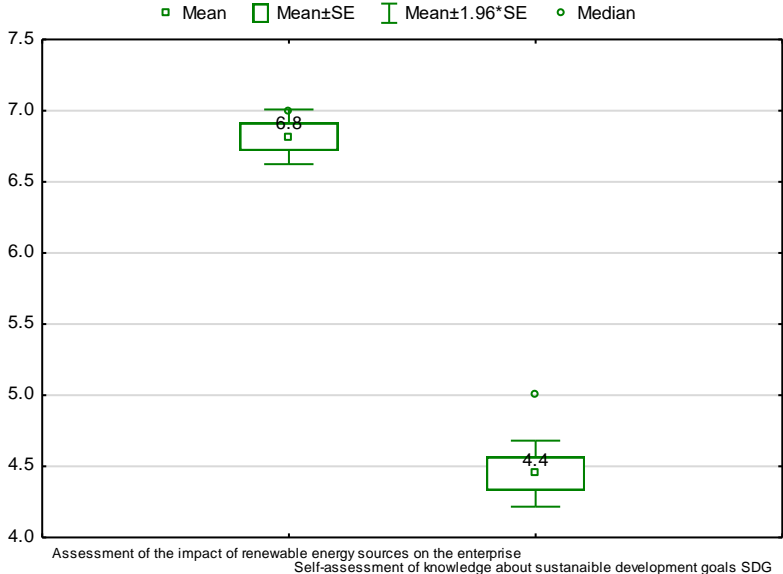
If conditions were to change, some of the entrepreneurs said they would like to invest in renewable energy sources. They were therefore asked in which technology they would be

most likely to invest. More than 50% said solar panels, 38% would invest in photovoltaics and 17% in heat pumps. Biomass was the least popular, with only 1% of respondents saying they would be willing to invest in it.



**Figure 9.** Technology that may be of interest to entrepreneurs if certain conditions are met  
 Source: Own study based on completed research

The entrepreneurs surveyed were also asked whether they were familiar with the Sustainable Development Goals (the UN's list of overarching development goals for 2015).



**Figure 10.** Self-assessment of knowledge of SDG sustainability targets, and assessment of the impact of renewable energy sources on the company  
 Source: Own study based on completed research

Only 35% of respondents said they were familiar with the Sustainable Development Goals, and they rated their knowledge of the subject at an average of only 4.4 on a scale of 1 to 10.

## 5. Discussion

The discussion of the results is limited due to the lack of studies directly related to the tourism sector. Nevertheless, it was decided to compare the main barriers with the available literature discussed in the introduction. The main barrier diagnosed in this study related to the investment costs being too high in relation to the expected ones. This finding is similar to that of Karasmanaki et al. (2024) or Lyakurwa (2023). Similarly, the second main factor, the long payback period for RES investments, was confirmed in the studies by Kudurs et al. (2020) and Prem Anand Jayaprabha et al. (2024). The complicated administrative and legal procedures at the permitting stage identified in the presented studies have also been highlighted in previous studies (Celic & Lenz, 2022; Mason-Jones et al., 2022; Sardianou & Kostakis, 2019). Similarly, the lack of adequate support schemes for RES investments, which was identified as the fourth most important barrier, has also been mentioned previously in the literature (Celic & Lenz, 2022). The lack of sufficient equity to finance investments or the rising cost of doing business, although not identified as critical, was also highlighted in a study by Sardianou & Kostakis (2019). Lack of or insufficient information about potential partners and technology suppliers, which was identified as a barrier in microenterprises, was also mentioned in studies by Kudurs et al. (2020), Celic & Lenz (2022) or Sardianou & Kostakis (2019). Significantly, the barrier of inappropriate business location in relation to RES, feared by entrepreneurs with their own premises, was also mentioned in the study by Prem Anand Jayaprabha et al. (2024). On the other hand, the lack of appropriate regulation in the field of RES, which was feared by entrepreneurs who did not have their own premises, was indicated by Bednarek et al. (2023). This means that the results obtained in the present research are consistent with previous results conducted for different economies and different sectors, although they are largely consistent with the results conducted by Sardianou & Kostakis (2019) for the hotel sector.

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**Conflict of interest:** none

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