

SUBSIDIES AND BUSINESS COMPETITIVENESS IN POLAND'S RENEWABLE ENERGY MARKET

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Purpose: The aim of this article is to present the role of subsidies as a factor of competitiveness for businesses in the renewable energy sources (RES) market.

Design/methodology/approach: First, a review of available subsidies in Poland for individual customers was conducted. Next, based on the survey, the sources of financing for the purchase of RES by households in Poland were determined. Furthermore, an evaluation of various factors encouraging energy transformation was carried out, and the role of subsidies for the purchase of RES as a factor influencing the decision to transform a household was defined.

Findings: Research showed that higher government subsidies are the most important factor encouraging individual customers to invest in RES. Most respondents financed their RES purchases with personal funds, while subsidies and grants were the second most common option. The range of subsidies for purchasing and installing RES infrastructure in Poland for individual customers is extensive. Companies offering support in the subsidy application process can boost their market appeal and contribute to the broader adoption of RES in Poland.

Research limitations/implications: It is important to note that the sample size of individuals with installed RES was relatively small. Additionally, the considerations were limited to individual customers and they were excluding enterprises which are also important recipients in the RES market. Therefore, future research can expand on these considerations by focusing on the analysis of subsidies for enterprises to better understand how they influence firms' investment decisions. They could also conduct efficiency analyses of various subsidy programs to identify those that yield the best results and are most cost-effective.

Originality/value: The paper explores the dual impact of RES subsidies on reducing costs for consumers and enhancing market attractiveness for companies. By analyzing consumer financing sources and preferences, the study highlights the critical role of financial incentives in promoting energy transformation and increasing the adoption of RES technologies.

Keywords: competitiveness, renewable energy sources, subsidies, energy transition.

Category of the paper: research paper.

1. Introduction

Electricity plays a crucial role in the modern world, serving as an essential commodity for the functioning of nearly all aspects of daily and industrial life. It is the foundation for the operation of many devices, from simple household appliances to advanced technological systems. Although generated from a variety of sources, there is a shift from traditional fossil fuels towards alternative energy sources in the context of striving for sustainable development.

Renewable energy sources (RES) currently constitute the main alternative to fossil fuels and are recognized as a cornerstone in the fight against climate change. Their implementation in national energy systems not only meets the guidelines of global agreements, such as UN conventions, the European Union's energy and climate policy, or national energy strategies, but also represents a rational action supported by economic considerations (Tomaszewski, Sekściński, 2020). Generating electricity from RES is now a promising option that helps reduce high dependence on imported energy carriers (Karakosta et al., 2013).

The continuous tightening of emission standards results from processes occurring in the global economy, as well as those related to climate and technology (Kielierz, 2018). Nevertheless, the Polish energy sector still largely relies on coal. However, the future of Poland's energy sector seems closely linked to the RES development, due to the high potential of RES associated with Poland's geographical location (Seroka, 2022). Leading companies in the Polish energy sector have already adopted strategies involving significant investments in RES (Kubiczek, Przedworska, 2024).

The shift towards a cleaner and more sustainable environment by increasing the share of RES in electricity generation is mainly driven by the involvement of households (Kubiczek et al., 2023). In Poland, the lack of sufficient household engagement stems, among other things, from insufficient ecological awareness and government policies that reinforce the historically coal-centric nature of the economy. As a result, despite the significant EU and state funds earmarked for RES subsidies, they remain underutilized.

The purchase and installation of RES is costly, and the lack of financing options is a significant barrier to the energy transition. To accelerate this process, the role of subsidies must be increased (Krawczyńska et al., 2024). From the perspective of businesses, price is one of the key factors of competitiveness, and assistance in obtaining subsidies can become an essential element of market competition. The subsidy system plays an important role in the energy transition in Poland (Cop, 2023). The purpose of this article is to present the role of subsidies as a factor of competitiveness for businesses in the RES market. To achieve this goal, the following research questions were posed: What subsidies are available for the purchase of RES in Poland for individual customers? What percentage of people have used subsidies for the purchase of RES among Poles undergoing energy transformation? How are subsidies for the purchase of RES perceived as a factor influencing the decision to transform a household?

The article includes a review of available subsidies in Poland for individual customers and presents the results of own research on the sources of financing for the purchase of RES by households in Poland. It compares the evaluation of various factors encouraging energy transformation and defines the role of subsidies for the purchase of RES as a factor influencing the decision to transform a household.

2. Subsidies as an instrument for increasing the competitiveness of enterprises

Poland still heavily relies on coal as an energy source, and the energy transition process is still poorly advanced. Despite the decrease in coal's share in the energy mix to 63% in 2023, coal still dominates not only in the power sector but also in the entire economy. The high costs of a coal-based economy stem from the increasing dependence on imported fossil fuels and the rising prices of emission allowances. Poland also has the most expensive energy in the European Union, which affects the competitiveness of its industry. There is a need to accelerate the energy transition to reduce emissions and increase the country's energy independence (Michalik, Zieliński, 2024).

A greater amount of alternative energy carriers to coal can result in a decrease in wholesale energy prices, which will contribute to reducing the operating costs of enterprises, increasing their competitiveness, and lowering the cost of living for households. Alternative energy generation technologies, based on local resources, have a beneficial impact on the economies of individual countries. By utilizing resources available in a given region, they help maintain resilience to external shocks related to energy security. This way, countries can become independent from energy imports and minimize the risks associated with global changes in energy commodity prices (Mammadov et al., 2022).

Unfortunately, the cost of installing photovoltaic systems remains high. Profitability analyses of investments in RES for individual customers show that even with a 50% subsidy, the return on investment will occur only after 17 or more years (Seklecki et al., 2024). Although the purchase and installation of RES infrastructure are costly, research by Szara (2024) indicates that this market is highly competitive, leading to excessive marketing activities. Among the respondents, 78.5% received at least several offers for RES installations, while only 7% did not receive any offers. These activities aim to encourage investments in RES, promoting these energy sources among individual customers and supporting energy transformation from a macroeconomic perspective.

In Poland, the sale and installation of RES are handled by companies of various sizes, from small one-person businesses to the four largest energy producers in the country. The largest companies offer a comprehensive service that includes not only the sale of devices

(e.g., photovoltaic panels) but also the design, installation, configuration, and servicing of the entire system. Administrative support is also crucial: companies assist customers in handling formalities related to subsidies and grid connection applications. This means that the customer receives a full package of services, and the company manages all the aspects related to RES.

Research by Mazzucato and Semieniuk (2018) highlights the possibility of RES financing from both public (state banks, state-owned enterprises, other public corporations, and government agencies) and private sources (energy companies, private utility companies, industry, commercial banks, institutional investors, and charitable organizations). This is particularly important as it supports the process of energy transformation. Abolhosseini and Heshmati (2014) note that many countries use tax incentives as a fiscal measure to promote the deployment of RES. Certain types of investments, especially those crucial for national interest, such as offshore wind energy in Poland, have special support mechanisms aimed at new technologies (Graczyk et al., 2020). In Poland, support mechanisms for RES can be divided into four groups: (i) financial (guarantees, preferential loans, subsidies, thermomodernization bonus), (ii) market-based (green certificates system, RES auction system), (iii) taxation (VAT rebate, excise tax relief, thermomodernization rebate, investment rebate for farmers), and (iv) regulatory (system of guaranteed tariffs, subsidies to FIP market price, system of net metering, system of net billing, PPA agreements) (Mazurek-Czarnecka et al., 2022).

3. Importance and overview of subsidies in the RES sector in Poland

Poland, as an EU member, has received substantial funds and support for RES projects, which could significantly accelerate the process of decarbonization and modernization of the energy sector (Kubiczek, Przedworska, 2024). Despite this, studies have shown that the transformation process in Poland is progressing much slower than in most EU countries (Krawczyńska et al., 2024).

For many businesses, combating climate change by increasing the efficiency of electricity use and investing in RES are measures aimed at enhancing their competitiveness (Kosior, 2024). Experts recommend that investments in RES projects should focus on funding direct users, such as households, small and medium-sized enterprises, and small-scale projects that contribute to the development of local communities (Oji et al., 2016).

Narodowy Fundusz Ochrony Środowiska i Gospodarki Wodnej (NFOŚiGW, eng. The National Fund for Environmental Protection and Water Management) plays the most significant role in subsidizing the purchase and installation of RES infrastructure in Poland. Established in 1989 during Poland's political transformation, NFOŚiGW serves as the main financial institution supporting environmental protection and water management in the country. Another important institution allocating funds for RES subsidies is the Bank Gospodarstwa

Krajowego (BGK), the only state-owned bank in Poland, fully owned by the State Treasury, whose objectives include supporting governmental socio-economic programs and local self-government and regional development programs. The results of the review of available programs through which individual customers can benefit from subsidies are presented in Table 1.

Table 1.
Subsidies for RES under support programs in Poland

Program name (funding institution)	Details
Mój prąd (NFOŚiGW)	<p>All expenses related to the purchase and installation of the PV micro-installation and additional equipment, as well as the connection of the PV micro-installation to the grid and the commissioning of additional equipment are eligible.</p> <p>The amount of subsidy (up to 50% of eligible costs no more than):</p> <ol style="list-style-type: none"> 1. photovoltaic micro-installation: PLN 6000 (only group 1 and 2 Applicants); 2. photovoltaic micro-installation + additional device: PLN 7000 or PLN ,000 depending on the group of beneficiaries; 3. additional equipment: <ul style="list-style-type: none"> - Heat storage: PLN 5000; - Ground heat pumps - ground/water, water/water heat pumps: PLN 28,500; - Air/water heat pump with improved energy efficiency class: PLN 19,400; - Air/water heat pump: PLN 12,600; - Air/air heat pumps: PLN 4400; - Electricity storage: PLN 16,000; - HEMS/EMS energy management system: PLN 3000; - Solar hot water collectors: PLN 3500.
Moje ciepło (NFOŚiGW from the Modernization Fund)	<p>Supporting the purchase and installation of heat pumps for new single-family buildings will contribute to reducing low emissions resulting from heating single-family homes with inefficient fossil fuel heat sources, in addition to increasing the share of RES in final energy consumption and promoting RES.</p> <ul style="list-style-type: none"> - Ground source pumps: Percentage of eligible costs: Up to 30%. Percentage share of eligible costs for individuals with a Large Family Card¹: Up to 45%. Maximum subsidy amount: PLN 21,000. - Air pumps (air-to-air type in a central system): Percentage of eligible costs: up to 30%. Percentage share of eligible costs for individuals with a Large Family Card: up to 45%. Maximum amount of subsidy: PLN 7000. - Air pumps (air-to-water type): Percentage share of eligible costs: up to 30%. Percentage share of eligible costs for individuals with a Large Family Card: Up to 45%. Maximum subsidy amount: PLN 7000.
Ciepłe mieszkanie (NFOŚiGW through the participating municipalities)	<p>The purpose of the program is to improve air quality and reduce particulate matter and greenhouse gas emissions by replacing heat sources and improving energy efficiency in units located in multi-family residential buildings.</p> <p>For final beneficiaries eligible for the basic level of subsidy (i.e., with an annual income not exceeding PLN 135,000): - up to 30% of the actually incurred eligible costs of the end-beneficiary's project, not more than PLN 16,500 per dwelling.</p> <p>For final beneficiaries eligible for an increased level of subsidy: - up to 60% of the actually incurred eligible costs of the project implemented by the final beneficiary, not more than PLN 27,500 per dwelling unit. For final beneficiaries eligible for the highest level of subsidy: - up to 90% of the actually incurred eligible costs of the project implemented by the final beneficiary, not more than PLN 41,000 per dwelling unit. An additional 5% for a unit in a multi-family building located in a locality on the list of the most polluted municipalities, up to PLN 19,000, PLN 29,500, and PLN 43,900, respectively. In turn, communities up to 60% of the actually incurred eligible costs of the project implemented by the final beneficiary, not more than from PLN 150,000 to PLN 375,000, depending on the scope of the project implemented.</p>

Cont. table 1.

<p>Stop smog (NFOŚiGW through the participating municipalities)</p>	<p>The “Stop Smog” program deals with low-emission measures implemented by municipalities in areas where so-called “anti-smog” resolutions are in force. Under this program, municipalities, inter-municipal associations, counties and a metropolitan association in the Silesian province can apply for subsidies for the elimination or replacement of heat sources with low-emission ones, as well as thermal modernization in single-family residential buildings of the least affluent. The ultimate beneficiaries of the program are those who cannot afford to replace their stove and insulate their homes. The program specifies that the beneficiaries in this case are those whose average monthly income per household member does not exceed 175% of the amount of the lowest pension in a single-person household and 125% of this amount in a multi-person household. Funding of up to 100% of the cost of the project. The average cost in a single building/location cannot exceed PLN 53,000.</p>
<p>Ulga termomodernizacyjna (state budget)</p>	<p>The tax credit can be used if incurs expenses for thermal modernization of a single-family house. Whereby thermal modernization consists of: an improvement where the demand for energy supplied for heating and heating of domestic water and heating to residential buildings is reduced; an improvement where primary energy losses in local district heating networks and the local heat sources supplying them are reduced, if the residential buildings to which energy is supplied from these networks meet the energy-saving requirements of the Construction Law, or measures have been taken to reduce the consumption of energy supplied to these buildings; making a technical connection to a centralized heat source, in connection with the elimination of a local heat source, resulting in a reduction in the cost of obtaining heat supplied to residential buildings; total or partial conversion of energy sources to renewable sources or the use of high-efficiency cogeneration. The maximum amount of the deduction is PLN 53,000 to be claimed within 6 years counting from the end of the tax year in which the first expense was incurred.</p>
<p>Premia termomodernizacyjna (Bank Gospodarstwa Krajowego)</p>	<p>The thermomodernization bonus is available to the investor for the implementation of the thermomodernization project and constitutes repayment of the loan taken by the investor. It is intended for investors using a loan (support does not apply to investors implementing a thermomodernization project exclusively with their own funds). The amount of the loan is at least 50% of the cost of the thermomodernization project and is no less than the amount of the premium. The amount of the thermomodernization bonus is:</p> <ul style="list-style-type: none"> - 26 percent of the cost of the thermomodernization project; - 31 percent of the total cost of the thermo-modernization project together with a RES project involving the purchase, installation, construction or modernization of a renewable energy source installation (the cost of the RES installation must constitute at least 10 percent of the total cost of thermo-modernization and RES installation); - additional support in the amount of 50% of the cost of strengthening a large-panel building - for the implementation of thermal modernization of buildings from the so-called “large-panel” with their strengthening. <p>Thermomodernization grant is 10% of the net investment cost and increases support for deep and comprehensive thermomodernization of a multifamily building.</p>

Note 1. Large Family Card (pol. Karta Dużej Rodziny) – A system of discounts and additional entitlements for families of 3+. Note 2. The review was carried out from July 1st to July 20th, 2024.

Source: own study based on data from government websites and particular programmes.

The review shows that individual customers in Poland have numerous opportunities to obtain funding for the purchase and installation of RES infrastructure. The state creates incentives for energy transformation. However, the number of these opportunities and programs can confuse consumers due to the diversity of requirements and application procedures. Including assistance in applying for subsidies by businesses can thus be a valuable addition to

their offerings, making it easier for consumers to access funds and simultaneously accelerating the energy transformation process.

4. Methodology of primary research

The evaluation of the role of subsidies as a factor in the competitiveness of businesses in the RES market in Poland was conducted from the consumers' perspective. Adopting this standpoint allowed for a better specification of consumer expectations and behaviors. This provides essential information enabling the determination of the dimensions of value created by businesses in practical terms.

The data used in the analyses were collected through primary research on the determinants of energy transformation, conducted by the CAWI technique on using Ogólnopolski Panel Ariadna in December 2023, using a questionnaire as the research tool. The study involved 1781 respondents selected by quota sampling – their characteristics reflected the socio-demographic profile of adult Poles in terms of gender, age, education, and place of residence. After verifying the responses based on control questions, 1642 responses were deemed suitable for analysis. The respondents were divided into two groups. The first group consisted of those who had installed devices enabling the use of RES, while the second group did not have such devices. The group sizes were 407 and 1235 people, respectively.

Respondents received a set of questions tailored to their group membership. From the perspective of this article, it is essential to analyze the responses to two issues. For the first group, which already had installed RES devices, the questions focused on identifying the sources of financing for the purchase of RES, allowing for the verification of the actual use of government subsidies. For the second group, which did not have such devices, the focus was on assessing the factors that could increase the willingness to purchase RES installations, with particular emphasis on the role of government subsidies.

Through the analysis of responses from the first group, it was determined to what extent government subsidies were used in financing RES installations. Conversely, the analysis of responses from the second group helped identify whether government subsidies could encourage the adoption of RES, thereby becoming a significant factor in choosing a particular offer.

5. Results

In the era of increasing ecological awareness and the need to reduce greenhouse gas emissions, more people are choosing to invest in renewable energy infrastructure. To better understand how these investments are financed, respondents who had purchased RES installations were asked about the sources of their financing. Figure 1 illustrates the financing sources used by the respondents when purchasing renewable energy infrastructure.

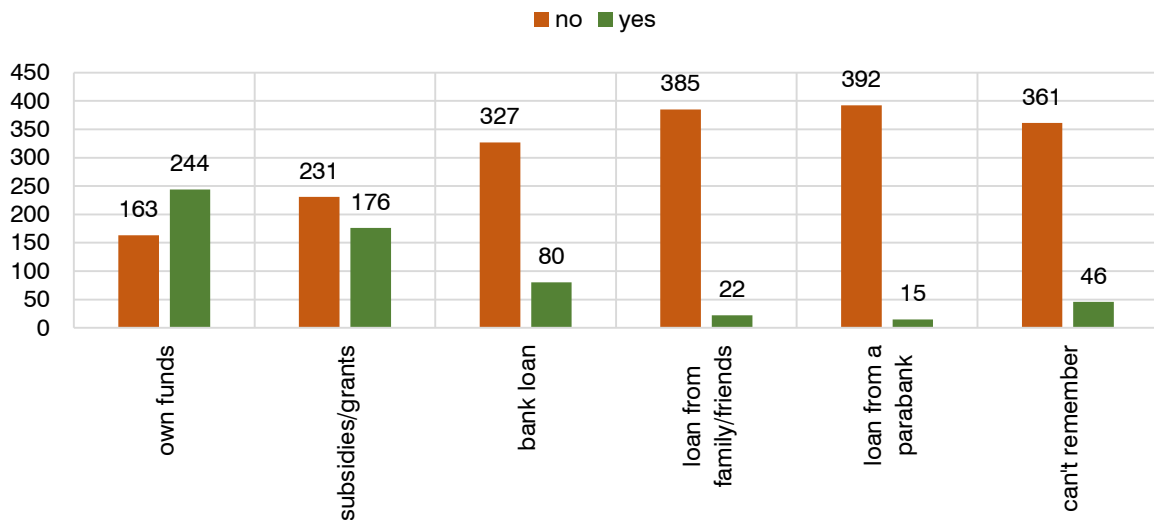


Figure 1. Use of specific funding sources when purchasing RES infrastructure.

Source: own study.

The vast majority of people used their own funds when purchasing RES infrastructure. The second most frequently indicated option was the use of subsidies and grants. Notably, 45% of respondents relied entirely on funding programs from local, government, or EU sources. Financing RES infrastructure through obligations such as bank loans or credits was much less common.

The next step was to compare the factors that could increase the willingness to purchase and install RES infrastructure among those who have not yet used this type of energy. The average ratings of these factors are presented in Figure 2.

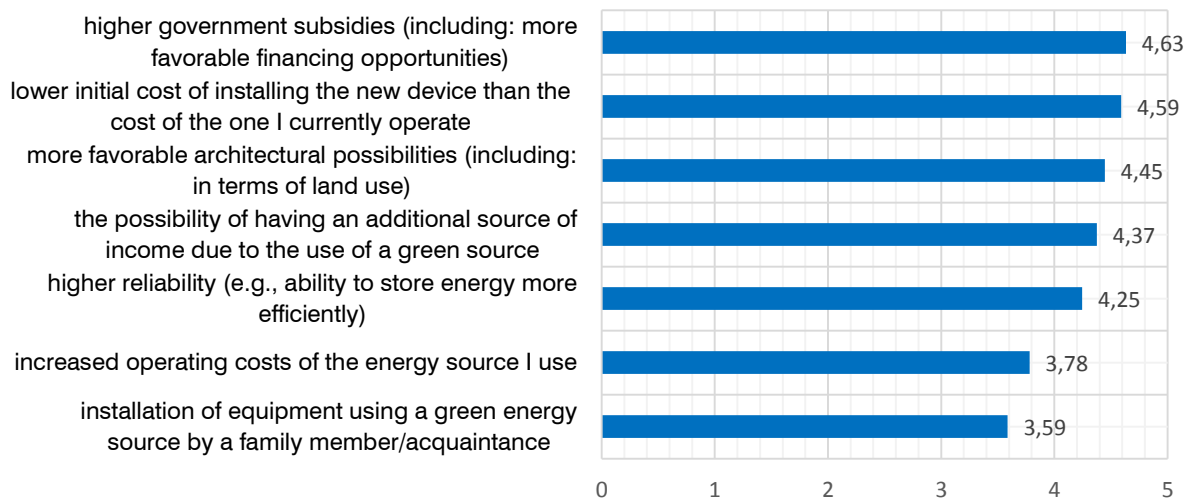


Figure 2. Average rating of individual factors encouraging transformation.

Source: own study.

The most important factor that would encourage respondents to undergo energy transformation is higher government subsidies. The amount and availability of these subsidies play a crucial role in the decision to invest in RES, as they can significantly reduce initial costs and increase the profitability of such ventures. This suggests that increasing the role of subsidies would likely positively impact the competitiveness of companies involved in the sale and installation of RES.

The second most important factor turned out to be the low initial cost of installation, which also reflects price as a fundamental determinant of consumer purchase decisions. The least significant factors were those related to the increase in the cost of the currently used energy source and the imitation effect, expressed as following the installation of devices by someone from the family or friends. Comparing the factors encouraging transformation suggests that higher subsidies are a significant factor. Therefore, the next step was to focus on and analyze the distribution of responses regarding the role of increased subsidies, as presented in Figure 3.

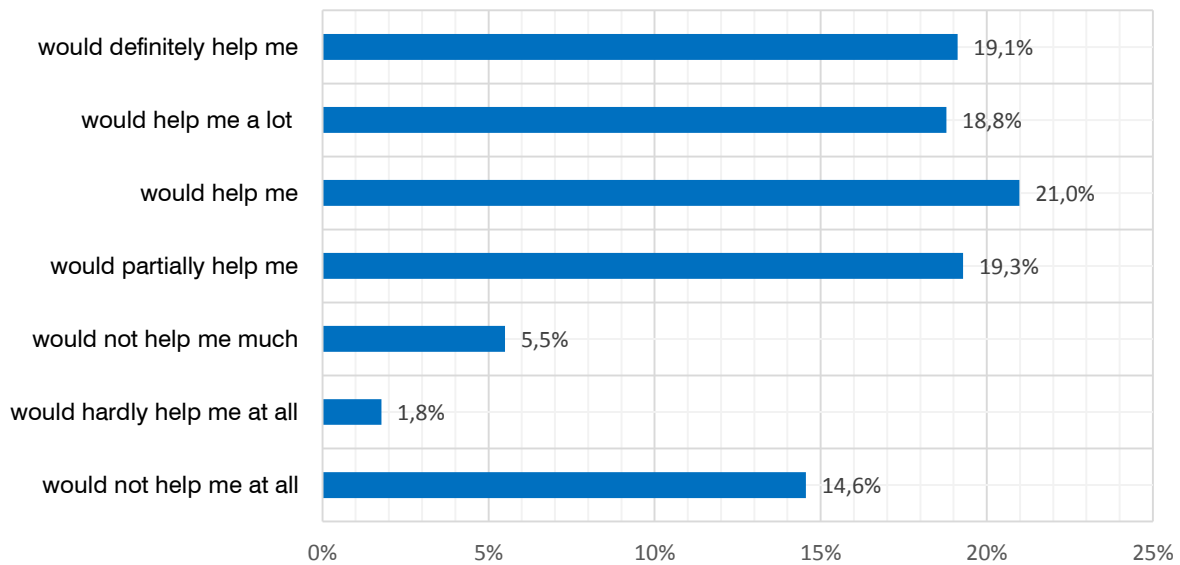


Figure 3. Higher subsidies as drivers of energy transition.

Source: own study.

Nearly 60% of respondents believe that higher subsidies would definitely help them decide to invest in RES. Another 20% think that higher subsidies would help only partially. Slightly over 20% of respondents feel that higher subsidies would have little to no impact on their decision. These respondents may be more skeptical about adopting RES.

These results indicate that for many respondents, assistance in obtaining subsidies from companies could be a crucial factor encouraging them to take advantage of their offerings and install RES. This means that companies offering support in the subsidy application process can increase their attractiveness in the market and simultaneously contribute to the broader implementation of RES.

6. Discussion

The increasing energy prices have intensified the importance of the energy transition, not only due to rising costs but also because of the continued dependence on fossil fuels. Mammadov et al. (2022) highlight that a significant use of RES in energy production can mitigate vulnerability to global shocks. In addition, Michalik and Zieliński (2024) stress that the urgency of enhancing Poland's energy independence—particularly in light of the war in Ukraine—should serve as a catalyst for accelerating the energy transition.

As Kubiczek et al. (2023) argue, the transformation of the energy sector at the household level forms the foundation for a broader national energy transition. Mazurek-Czarnecka et al. (2022) also emphasize that Poland offers a wide range of support instruments to facilitate this

shift. A comprehensive review of the available financial assistance for household energy transitions in Poland confirms the existence of diverse forms of funding.

Nevertheless, our research indicates that Poles primarily finance the purchase and installation of renewable energy infrastructure from their own savings, with fewer than half of the respondents utilizing local, governmental, or EU funding programs. This is a notable finding, given the high costs associated with acquiring and installing RES systems. The research further reveals that the availability of subsidies plays a critical role in promoting the energy transition, and increasing the amount of financial support could significantly boost this process. A large proportion of respondents indicated that higher subsidies would be a key motivator for them to undertake the energy transition, while also making it much easier to implement. This aligns with the postulates of Krawczyńska et al. (2024), who support the continued expansion of RES funding programs in Poland.

It is also important to note that respondents did not see the installations of RES by family or friends as a significant motivator for their own energy transitions. This suggests that the effect of social imitation is minimal in this context. This observation could provide a valuable direction for future research, particularly in examining the role of social factors in influencing investment decisions in renewable energy sources.

7. Conclusions

The range of available subsidies for the purchase and installation of RES infrastructure in Poland for individual customers is very broad. Individual customers can take advantage of many types of subsidies, which effectively reduce the costs they have to bear when deciding to use RES. However, the multitude of available options can cause difficulties in effective application, creating an opportunity for companies involved in the sale and installation of RES to include assistance in obtaining subsidies as part of their offerings.

The conducted research showed that the most important factor encouraging individual customers to invest in RES is higher government subsidies. Most respondents financed the purchase of RES infrastructure with their own funds, with subsidies and grants being the second most frequently indicated option. Bank loans or credits were used much less frequently. These findings underscore the crucial role of subsidies in increasing the competitiveness of companies in the RES market and in the process of energy transformation. Companies offering support in the subsidy application process can enhance their market attractiveness while contributing to the broader implementation of RES in Poland.

8. Practical implications

The article holds significant practical value for both individual customers and companies operating in the renewable energy sector. It not only outlines the available forms of financial support but also highlights the crucial role that subsidies and grants play in the decision-making process for investing in RES. For businesses in the RES industry, the article serves as a valuable source of insight into customer needs and emphasizes the importance of offering comprehensive services, including assistance with securing subsidies. By doing so, companies can enhance their competitiveness and build a market advantage while also contributing to the broader implementation of RES in Poland. Therefore, the article provides practical guidance on how to better tailor offerings to customer expectations and how to more effectively support the energy transition process.

9. Limitations of the study and directions for further research

Among the limitations of the study, it is important to note that the sample size of individuals with installed RES was relatively small. This is because the number of people who made such installations in Poland is not significant. Additionally, the considerations were limited to individual customers, excluding enterprises, which are also important recipients in the RES market.

Therefore, future research can expand on these considerations by focusing on the analysis of subsidies for enterprises to better understand how they influence firms' investment decisions. They could also conduct efficiency analyses of various subsidy programs to identify those that yield the best results and are most cost-effective. Consequently, such studies should also indicate which aspects of subsidy programs need modification to better meet the needs and expectations of potential beneficiaries.

Another important direction for future research could involve investigating whether the imitation effect significantly influences the adoption of RES technologies in the context of energy transformation. While the imitation effect—where individuals are influenced by the actions of others—has been observed in various sectors, the findings from our study suggest that this effect may not play a substantial role in the decision-making process of individual customers investing in RES. Therefore, it would be valuable to further explore whether social influence and peer behavior have a meaningful impact on RES adoption, or if other factors, such as financial incentives and personal environmental awareness, are more decisive.

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