

Overview of social attitudes and applications towards the use of crowdfunding in renewable energy

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Abstract: **Background:** Crowdfunding has become a popular method for raising funds for various projects, including those related to renewable energy sources.

Research objectives: This paper aims to present crowdfunding and the social attitudes of the Poles towards its use in renewable energy sources.

Research design and methods: The first section discusses the theoretical assumptions of crowdfunding and presents the possibilities of using this form of financing in the renewable energy sector in Poland and worldwide. The second section of the paper is devoted to presenting the results of my research on the attitudes of Polish society towards renewable energy sources and the use of crowdfunding in the energy transition in Poland and worldwide. The paper uses literature analysis, criticism, comparative analysis, desk research, and a survey method.

Results: Crowdfunding is used extensively in various projects in the area of renewable energy sources. There is social support for this type of activity (especially in the age groups 18–29 and 30–44 years) and a growing awareness and openness to support initiatives in the area of renewable energy sources.

Conclusions: Based on the analysis, it was concluded that crowdfunding allows local actors to optimize their share of the economic benefits of solar energy projects, including solar energy, and to participate in the energy transition at the same time.

Keywords: crowdfunding, sharing economy, renewable energy

JEL Codes: B55, G29, Q2

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“Renewable energy is becoming increasingly cheaper.
The use of wind and solar energy is practically free.
New models for doing business will emerge in the future.
Energy will become democratized.”
(Rifkin, 2011, p. 140)

1. Introduction

The power industry is based on many different sources, mainly fossil. In Poland, this is primarily coal. However, energy materials such as coal, oil, and natural gas are exhaustible. Renewable energy sources can safeguard the security of the state and its citizens in the event of natural disasters or hybrid wars. They, therefore, build the security of both present and future

generations. This is why it is so important to gradually transform the energy sector towards the use of renewable energy sources, as noted by the authors (Mędrzycki, 2019, pp. 6–16; Nowiński, 2021, pp. 42–46; Zablocki, 2013, pp. 29–43). The current energy crisis, exacerbated by Russia's attack on Ukraine, has highlighted the need for European Union countries to reduce their dependence on Russian fossil fuels and to diversify and secure the EU's energy supply by pushing for greener alternatives, such as renewable energy sources (Tokarski, 2022, pp. 10–16). At the same time, the EU wants to be at the forefront of the green transition to tackle the climate crisis by, among other things, increasing the energy efficiency of public infrastructure, enhancing biologically active areas in urban and functional areas, strengthening the protection of water resources, including the adaptation of urban areas to climate change, or reducing noise and improving air quality. New business models are emerging in the energy market, which can be defined as "the content, structure, and governance of transactions designed to create value through the exploitation of business opportunities" (Amit & Zott, 2001, p. 511) and are a means to bring new technologies, such as renewable energy sources, to market (Chesbrough, 2002, pp. 529–555; Zott et al., 2011, pp. 1019–1042). Many of these models are based on direct energy user participation in energy production: for example, citizens owning shares in photovoltaic installations (Huijben & Verbong, 2013, pp. 362–370). In Western European countries such as among others, France, the Netherlands, Germany, and the United Kingdom, but also in Sweden or the United States, crowdfunding has been used successfully for several years to finance investments in renewable energy sources (Huijben & Verbong, 2013, pp. 362–370). This is a form of funding various types of projects by the community that is or will be structured around these projects (Cézanne et al., 2021, pp. 9–11). The project is then financed through a large number of small, one-off contributions made by people interested in the project (Schwienbacher et al., 2010, pp. 369–390). In Poland, such solutions are not yet popular, although current legislation allows for similar crowdfunding campaigns (Stasik, 2018, pp. 54–62). On the other hand, the number of facilities and the installed capacity of renewable energy sources in our country is growing every year. This paper aims to present crowdfunding and the social attitudes of the Poles towards its use in renewable energy sources. The article describes the issue of crowdfunding, which involves a wide spectrum of people, enabling them to participate in the funding of projects they find valuable or interesting which fits in with the issue of the journal *Social Entrepreneurship Review*, where we find multifaceted, multidimensional analyses of social entrepreneurship in many different contexts (Tkacz, 2016, pp. 20–37; Broniszewski, 2016, pp. 38–47; Jonek-Kowalska, 2020, pp. 78–99, and others). The paper consists of two sections. The first section discusses the theoretical assumptions of crowdfunding and presents the possibilities of using this form of financing in the renewable energy sector in Poland and worldwide. The second section of the paper is devoted to presenting the results of my research on the attitudes of Polish society towards renewable energy sources and the use of crowdfunding in the energy transition in Poland and worldwide. The paper uses the methods of literature analysis and criticism, comparative analysis, document research, and diagnostic survey.

2. Literature review and theoretical background

2.1. Crowdfunding

According to Hervé and Schwienbacher (2018, pp. 1514–1530), one innovative phenomenon that is challenging the norms of finance is "crowdfunding". As another author notes, crowdfunding is not new, but the advent and use of social media have tremendously boosted

crowdfunding (Harrison, 2013, pp. 283–287). The phenomenon of crowdfunding is so popular that the number of definitions on the subject continues to grow, together with the number of books. Definitions come from different sources and distribute the emphasis differently. Steinberg (2012, pp. 12–31), for example, defines the phenomenon as asking the general public for start-up capital for a new venture. Wick adds to the above definition that crowdfunding occurs when a large number of people (the crowd) financially support a project in the form of relatively small amounts of money in exchange for a reward in the form of a donation or possibly in exchange for shares in the venture (Wick, 2013, pp. 5–8). De Buysere's definition, on the other hand, draws attention to the use of the Internet throughout the process and the initiators' use of their social media outreach (De Buysere et al., 2012, pp. 9–12). Crowdfunding is still a relatively recent phenomenon that we can define in our own way while retaining its constant elements. Support from the community is always financial. A collection is carried out via the Internet, specifically via a crowdfunding platform. Supporters receive various rewards for their contributions (so-called payback). The action is mainly placed in a specific time frame. The start and end date of the collection are known. The funding campaign is open, meaning anyone can donate from anywhere and in any amount (Witoszek, 2016, p. 108). In addition, we know by whom the money is being raised, for what purpose the amount of money to be ultimately raised, and whether the goal will be met (Ziobrowska, 2016, pp. 285–287). In addition, an important aspect of implementing a venture on crowdfunding portals is to ensure the quality of the new product or service (Bi et al., 2017, pp. 10–18), to spread the word about the project on social media, and to ensure that the various milestones of the project are met promptly (Mollick, 2014, pp. 133–150). Bottom-up initiatives in crowdfunding can include, for example, cultural, social, artistic, educational, technological, charitable, and many other projects (Sobol, 2014, pp. 137–146). Schwienbacher and Larralde (2010, pp. 369–390) have identified the basic business models of crowdfunding, which include donation-based crowdfunding and passive and active crowd investment. Donation-based crowdfunding has long been a well-known and still very popular way of funding, in which individuals or organisations raise money from a large number of people, known as donors, to support a specific charitable cause, community project, charity, or other philanthropic initiative and expect nothing in return (Hansmann, 1987, pp. 27–42; Nyssens et al., 2006). However, with the development of crowdfunding initiatives and platforms, "crowd" resources for donations have become highly competitive and, therefore, scarce. In a passive form of crowdfunding, investors receive some form of reward, such as personalised products or services, honorary recognition, or other forms of revenue sharing. However, the interaction between the company and its community investors is limited to the reward function. Active crowdfunding, on the other hand, assumes that investors not only provide money but also, in the best way of crowdsourcing, are involved in an ongoing dialogue with the company, helping, for example, to design new features, test products, suggest paths for the company and provide network reach and individual expertise. To this day, new divisions of crowdfunding models and strategies are emerging. Many are taking a hybrid form and are being used to support innovative, green projects.

2.2. Crowdfunding and renewable energy sources

Crowdfunding can be seen as a bottom-up tool for the delivery of sustainable development. Indeed, more and more often, in the context of social and economic bottom-up initiatives for local and global energy demand coverage, there is a discussion of civic micro- and macro-energy (Wasilewski et al., 2015, pp. 45–57). We can speak here of a trend of so-called energy

democracy, which combines technological energy transformation with strengthening democracy and public participation. This notion is related to decentralising energy systems using energy efficiency and renewable energy for ownership transition in the power industry (Morris & Jungjohann, 2016, pp. 379–412). With new green technologies available on the market, such a transition is possible with new actors: individual users – prosumers, energy co-operatives, and community power plants – replacing centralised, corporate power plants (Okraszewska, 2016, pp. 40–41). Energy democracy is increasingly moving towards the financing of renewable energy sources by local communities via crowdfunding, which, as mentioned earlier, involves financing projects through one-off (mostly very small) contributions made by citizens (Dylağ et al., 2019, pp. 11, 97–111). Crowdfunding can provide additional legitimacy to renewable energy projects since, as noted by Lehner (2013, pp. 289–311), the selection process by the crowd is perceived as per se democratic. Crowdfunding in support of renewable energy innovation can support both energy services for the needs of an individual user or household and entire installations offering energy services for community or business needs, integrated or not with the electricity grid (Stasik, 2018, pp. 54–62). Equity crowdfunding can be applied to business projects such as erecting a solar farm. As a result, participants – in exchange for their financial support – can receive, for example, the right to participate in a company, which also entails the prospect of sharing in its profits. By contrast, participation in non-share crowdfunding rewards participants with, for example, prizes in kind or services or simply by donating a product whose manufacture was made possible by the collection. An important advantage of such activities is that an attractive source of regular passive income can be created. The fact that the investment is undertaken as a group makes it more cost-effective compared to individual actions. A project to invest in renewable energy sources in the crowdfunding model requires establishing a special purpose entity that pursues a single objective, such as constructing a wind or photovoltaic solar farm. Investors take shares in the company, allowing them to be actively involved in key decisions. As citizen participation is essential in creating local acceptance for developing renewable energy projects, crowdfunding can be an extremely effective tool. This alternative way of financing enables Renewable Energy Systems (RES) developers to get early funding and authenticate their projects at the same time (Gomez, 2018, pp. 4–36). Some of the most popular crowdfunding platforms in the world for funding renewable energy projects include Solar Mosaic, Abundance Investment, Bettervest, Ecoligo, and Trine which are presented in Table 1.

Table 1. Crowdfunding platforms to finance renewable energy projects

| Platform name | Country (seat) | Area of operation |
|----------------------|----------------|--|
| Solar Mosaic | USA | Direct financing of PV projects |
| Abundance Investment | United Kingdom | Direct financing of wind, solar, and biomass projects |
| Bettervest | Germany | Direct financing of renewable energy projects in Africa and the Middle East |
| Ecoligo | Germany | Direct financing of photovoltaic investments |
| Trine | Sweden | Direct financing of solar pump installations, water pumps, solar panels, and biomass |

Source: Own compilation based on data provided by crowdfunding platforms: Solar Mosaic, Abundance Investment, Bettervest, Ecoligo, and Trine.

Solar Mosaic is a US-based crowdfunding platform enabling investors to fund photovoltaic projects directly. In this way, Solar Mosaic allows it to finance small residential solar installations and larger commercial projects. Solar Mosaic reported in 2019 that it had surpassed the USD 1 billion threshold in investment in renewable energy projects, including those in solar (Mosaic, 2023). Another crowdfunding platform shown in Table 1 is Abundance Investment. It is a pioneer in the crowdfunding industry in the UK and has raised over GBP 100 million since 2012 (Abundanceinvestment, 2023). Bettervest, on the other hand, is a German crowdfunding platform that enables financing renewable energy projects in Africa and the Middle East. The platform focuses on projects that aim to improve the living conditions of people in these regions by providing energy from renewable sources (Better Invest, 2023). Ecoligo is a crowdfunding platform based in Berlin that enables investment in photovoltaic projects in developing countries. Through Ecoligo, entrepreneurs and property owners can invest in photovoltaic installations whilst investors receive an annual return on their capital (Ecoligo, 2023). The last one presented in the table is Trine, a Swedish crowdfunding platform that focuses on renewable energy projects in developing countries. Investors can invest in solar water pump installations, solar panels, or biomass projects. The Trine platform allows direct funding for projects that aim to improve people's lives in poor countries (Trine, 2023). The number of renewable energy crowdfunding platforms in the world is constantly evolving. There are now several such platforms in different countries, and their number continuously grows. There is no precise number of renewable energy crowdfunding platforms worldwide, but we can estimate that there are at least dozens of them. Many of these platforms operate in Europe, but some operate in other parts of the world, including Asia, Africa, and North and South America. Table 2 shows a sample of crowdfunding projects that have been implemented in the area of renewable energy sources in recent years.

One of the most recent examples of the effectiveness of crowdfunding in the area of financing renewable energy projects comes from the United Kingdom, where a 5 MW photovoltaic farm was connected to the grid in Merston, West Sussex, which residents entirely own.

Table 2. Selected crowdfunding projects supporting the development of renewable energy sources

| Entity/Country | Funds raised | Purpose |
|--|---|--|
| UrbaSolar Axpo Group, company (Switzerland, France) | In 2021, EUR 7.5 million was raised through 25 crowdfunding campaigns. | They are used to fund different types of PV systems: ground-mounted power plants, rooftop installations, canopies over car parks, or greenhouses. |
| Baywind Energy, an energy cooperative that owns wind turbines (United Kingdom) | During 1996–1997, it raised GBP 1.2 million to purchase two turbines, and in 1998, it raised GBP 670,000 to purchase an additional turbine. | Profits from energy resold externally Baywind invests in environmental initiatives. |
| Local online platform Ethex (Merston, United Kingdom) | In 2016, the money needed – GBP 1.2 million – was raised in just three weeks. | It was agreed that the proceeds from the energy production would be split between the shareholders, but some of it would go to local community projects. |
| Windcentrale (Netherlands) | In 2013, more than EUR 1.3 million was raised in a campaign lasting just 13 hours. | In 2013, 1,700 households in the Netherlands bought a wind power plant. |

| Entity/Country | Funds raised | Purpose |
|---|---|--|
| Photovoltaic farms by Berg Holding (Poland) | In 2021, more than PLN 1 million had already been raised a quarter after the launch. In the end, PLN 4.05 million was raised from almost 1,000 community investors. | The funds will be used, among other things, to build a 1 MW installation in Nagoszyn. |
| Italian energy group Enel Green Power (Italy) | Crowdfunding platform established in 2021. | An online crowdfunding platform was launched for a project called Scelta Rinnovabile to enable Italian citizens to participate in ongoing investments. |

Source: Own compilation based on data provided by crowdfunding.

They managed to raise the necessary funds through a crowdfunding campaign. The stake was sold via the local online platform Ethex. The money needed – GBP 1.2 million – was raised in just three weeks. The income from the energy produced on the PV farm will be distributed to shareholders, but some of it will go to local community projects (Ethex, 2013). In contrast, the Dutch carried out one of the largest, if not the largest, crowdfunding campaigns related to renewable energy sources. In 2013, 1,700 households in the Netherlands bought a wind power plant. The campaign, which lasted just 13 hours, raised more than EUR 1.3 million, a new world crowdfunding record (Vasileiadou et al., 2016, pp. 142–155). As part of the crowdfunding, the value of the Vestas V80 wind power plant operating in the Dutch town of Culemborg, which has a capacity of 2 MW, was divided into 6,648 shares. Each share is worth EUR 200 and corresponds to an energy production of approximately 500 kWh/year. The Italian energy group Enel, one of the largest investors in the global renewables market, is also a forward-looking project. It has launched a crowdfunding platform where it will offer Italian citizens to sell shares in new investments. Priority will be given to residents of the regions where the various projects will be developed. They will also gain the right to a higher dividend than other shareholders. Enel Green Power, which to date has already made investments in renewable energy sources of around 50 GW, has launched an online crowdfunding platform as part of a project called Scelta Rinnovabile, which aims to enable Italian citizens to participate in the investments being made (Enel Green Power, 2023).

In Poland, crowdfunding in energy is still a new market. Table 3 shows the platforms enabling financing renewable energy source projects in Poland.

Table 3. Platforms for financing renewable energy source projects in Poland

| Platform name | Minimum investment amount | Area of operation |
|----------------|---------------------------|---|
| Ecobazaar.pl | PLN 50 | Investing in green and sustainable development projects, including, for example, photovoltaic installations, wind power plants, or green heat sources. |
| Enerfunding.pl | PLN 100 | Investing in solar, wind, or biomass projects. |
| Crowdfundme.pl | PLN 100 | It enables the financing of projects from a variety of sectors, including but not limited to renewable energy. |
| Crowdway.pl | PLN 100 | It enables the financing of renewable energy projects, including photovoltaic installations, hydrogen cells, and wind power plants, to name just a few. |

Source: Own compilation based on data from crowdfunding platforms.

The first platform shown in the table is Ecobazaar.pl, which enables investment in ecology and sustainable development projects, including, among others, photovoltaic installations, wind power plants, or ecological heat sources. Investors can invest in projects for as little as PLN 50 (Eco Bazaar, 2023). Another platform is Enerfunding.pl, which focuses on projects related to renewable energy sources, including solar, wind, or biomass projects. Investors can invest in projects for as little as PLN 100 (Enerfund, 2023). Crowdfundme.co.uk is a platform enabling financing projects in various sectors, including, i.a., those related to renewable energy. Projects related to photovoltaic installations, heat pumps, or wind power plants on the platform can be found. Investors can start investing from as little as PLN 100 (Crowdfundme, 2023). The last of the platforms presented in the table is Crowdway.pl, which is a platform focused on financing projects related to renewable energy, including, among others, photovoltaic installations, hydrogen cells, or wind power plants. Investors can invest in projects from as little as a few hundred PLN. Apart from the crowdfunding platforms discussed in the table, in Poland, there is a website with projects financed using crowdfunding at the address polakpotrafi.pl. If you enter the keyword "RES" into the search engine, quite a lot of information is displayed, but none of it mentions a specific idea to build a wind farm, photovoltaic power plant, biogas plant, etc. We could only find the founders of the EKO Projekt Foundation, which aims to educate the public on RES and create new "green" jobs. However, only a few people expressed interest in the idea (Polakpotrafi, 2023).

Local initiatives such as collecting funds for installing photovoltaic panels on school roofs (Pomagam.pl, n.d.), and sports hall roofs (Polakpotrafi, 2023) are increasingly common in less widespread collections. These projects show that crowdfunding can effectively finance RES projects while involving local communities in energy production processes. Crowdfunding offers a range of opportunities for renewable energy projects. In addition to harnessing users' financial resources and transforming the energy consumer into an energy financier and producer (prosumer), crowdfunding can attract new types of customers, such as those interested in experimenting with new online tools. Furthermore, as Wheat notes crowdfunding can facilitate public support for renewable energy, which can translate into political support (Wheat, 2013, pp. 71–72). Crowdfunding helps entrepreneurs grow their organisations by providing a platform to attract early-stage venture capital funds and expand existing investments (Lam & Law, 2016, pp. 11–20; Bonzanini et al., 2016, pp. 429–444; Kaufman et al., 2021, pp. 143–149). In addition, crowdfunding helps to reduce and share risk among investors and removes the safeguards associated with the traditional banking system. In addition, crowdfunding facilitates investment in smaller projects that investors often neglect. Finally, crowdfunding reduces intimidation and encourages local communities to manage REPs (Bonzanini et al., 2016, pp. 429–444; Kaufman et al., 2021, pp. 143–149).

3. Research method and material

A survey with a sample size of 500 respondents was carried out between October 2022 and January 2023. A quantitative survey was chosen as an additional piece of work to understand the number of respondents advocating a particular position on the use of crowdfunding in the energy transition. A pilot study was carried out beforehand. A survey questionnaire was used, made available electronically on the survio.com platform, requiring respondents to have internet access. Surveys were posted in online forums. It was, therefore, not a randomised research sample. Not everyone was likely to be in the research sample. The study is exploratory. In the

initial phases of the study, the aim is to gather general information and orientation on the topic. Purposive sampling can help obtain a variety of perspectives. Limitations regarding the sample's representativeness or the research context may affect how well the survey results can be generalised to the population or situations outside the survey. However, they are only a supplement to the theory and overview section. Future research will be conducted with a larger sample.

The survey questionnaire included a filter question: *Do you know what renewable energy sources are?* Most respondents indicated an affirmative answer (445 people) and participated in the further survey. Data analysis was carried out using cross-tabulations, collating responses from different questions. In this way, it is easy to see how the respondents answered not only to this one question but also to other issues.

4. Results and Discussion

Men were predominant over women among survey participants, with 58% of respondents being men. All respondents were Polish citizens. The largest number of respondents were aged 30–44, making up 42% of the total. The remaining respondents were between 18 and 29 years of age (28%) and 45–59 years of age (20.2%). The smallest group of respondents was over 60 years of age (8%) and under 18 years of age (1.8%). Most people resided in the Lower Silesian Voivodeship (34%), as well as the Opolskie Voivodeship (27%) and the Silesian Voivodeship (19.6%). People living in the Lubuskie and Lubelskie Voivodeships were the least numerous voivodeships in Poland (they accounted for 1% of the total, respectively). Representatives from the other voivodeships averaged 6–8 people per voivodeship. Most respondents had secondary education (37%) and a university degree (36.2%). More than one in five respondents (22.2%) had incomplete higher education. On the other hand, 4.6% of respondents admitted to having basic (primary) and basic vocational education. Respondents most often described their material situation as average, i.e. they declared that their household budget allows them to cover all expenses, but they cannot afford to spend more (48%). One in four respondents (25%) admitted that their budget allows them to cover all expenses, but unfortunately, they are not able to save. Around 14.2% of those surveyed felt that they were unable to meet even their immediate needs. Those who described their financial situation as relatively very good accounted for 12.8% of the total – people who can afford to cover all their expenses and have money to accumulate savings. Respondents were then asked whether they thought Poland should develop renewable energy sources such as wind and solar farms and hydroelectric power plants. As many as 74.8% of respondents (200 women and 133 men) indicated that due to the energy crisis, Poland should develop renewable energy sources: wind and solar farms, in addition to hydroelectric power plants. Respondents were then asked whether they agreed with the statement that using renewable energy sources positively impacts the economy, human health, climate, and the environment. The distribution of respondents' answers is shown in percentage in Figure 1. As can be seen, as many as 361 people (81%) marked the answer: "strongly agree", 43 persons (10%) marked the answer "rather agree", 10 persons (2%) marked the answer "neither agree nor disagree", 28 persons (6%) marked the answer "rather disagree" and only 3 persons (1%) "strongly disagreed" with the statement.

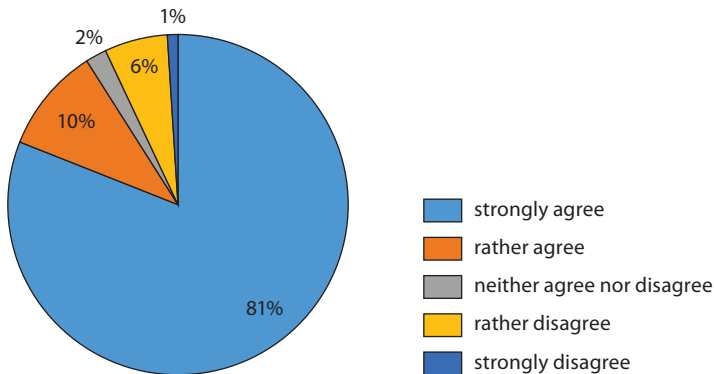


Figure 1. Respondents' opinions on the positive impact of renewable energy sources on the economy, human health, climate, and the environment

Note: $N = 445$, those who knew what renewable energy sources were remained in the sample.

Source: Own compilation.

The responses confirmed that consumers are increasingly aware that renewable energy production positively impacts many areas of life and demonstrates that the modern world needs more and more energy sources. Population growth, the high rate of economic development, and advances in the creation and use of new technologies mean the demand for energy is constantly growing. The majority of survey participants cited the following among the main advantages of introducing renewable energy sources on a wider scale: free and virtually infinite energy (295 people), reduced bills (125 people), solution to an uncertain geopolitical situation (107 people), independence (97 people) streamlining of energy expenditure (91 people), investment in the future (103 people), high efficiency (87 people), ecological solution with a positive impact on climate/environment (77 people), health benefit (57 people). Under "other", the following was entered: reduction of surplus food or uncultivated plants (1 person), reduction of waste (4 people), and long-term guarantee (2 people). Respondents could indicate more than one answer. The results are shown in Figure 2.

The survey results indicate that respondents perceive renewable energy sources as practically inexhaustible and cheaper (free), as their resources are naturally replenished. Considering renewable energy sources for private use (especially photovoltaic installations) – the entire investment is practically limited to the one-time purchase and installation of solar panels with the entire system. When analysing renewable energy sources for commercial use (wind, hydro, geothermal energy), some costs are involved. However, these are still significantly more affordable than those for non-renewable energy sources. On the other hand, among the disadvantages of introducing renewable energy sources on a wider scale the following were indicated: high initial costs (185 people), the long payback period for the investment in renewable energy sources (143 people), limited availability (100 people), and the fewest respondents indicated the harmfulness of some renewable energy sources, e.g., geothermal energy, the use of which can emit harmful gases into the atmosphere or pollute deep water (23 people) in addition to interference with the landscape and natural environment (8 people). Other disadvantages included: the need to understand how modern technology works (1 person), and the need for a sufficiently large space (3 people). Only 10 people did not indicate any disadvantage. Respondents were also asked whether they would like the number of facilities and installed

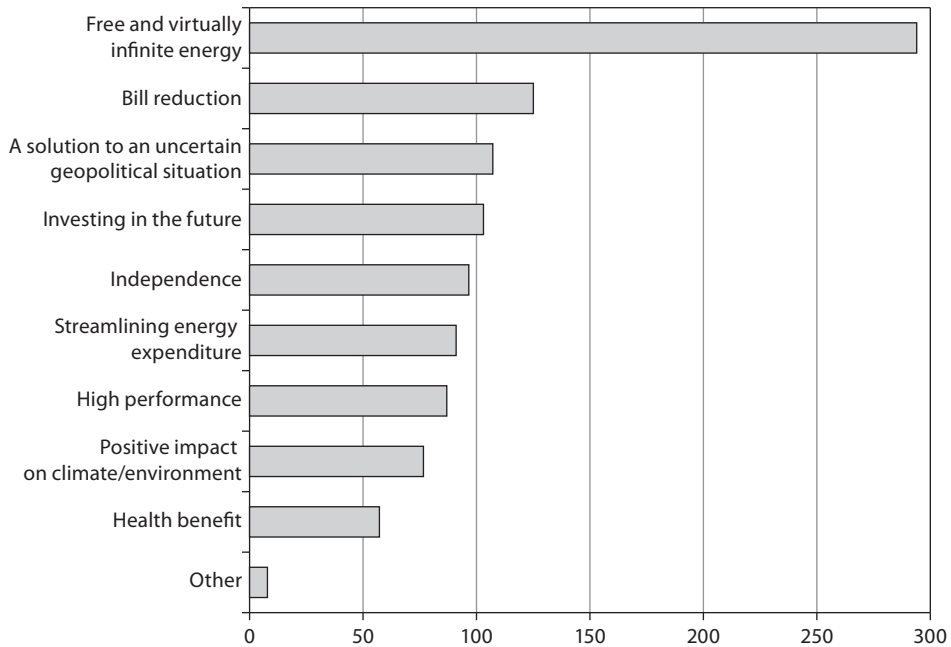


Figure 2. Respondents' opinions on the advantages of renewable energy sources

Note: $N = 445$, those who knew what renewable energy sources were remained in the sample.

Source: Own compilation.

capacity for renewable energy sources to increase in Poland. Nearly 205 people said “definitely yes”, 101 people said “probably yes”, 105 were “not sure”, no one answered “probably no”, and 34 people answered “definitely no”. The majority of respondents, if given the option, would decide to sell and (or) share the surplus of self-generated energy (e.g., from the use of photovoltaic panels) with neighbours – this was 295 people, 98 people had no opinion, and 52 people replied that they would not decide to do so, justifying it among others by a lack of trust in neighbours or uncertainty about the profitability of such an investment. 445 respondents were also asked about their knowledge of the concept of crowdfunding. 145 people did not know what crowdfunding was about. These were 77 women and 68 men, respectively. On the other hand, 300 people (103 women and 197 men) indicated that they knew what crowdfunding was about and they were the ones who took part in the further survey. When asked whether they thought crowdfunding could positively impact the development of renewable energy sources in Poland, most people answered: “not sure” – 150 people (89 men and 61 women). The remaining individuals considered: “probably yes” (87 men and 12 women), “definitely yes” (20 men and 24 women), “probably no” (1 man and 4 women), and “definitely no” (2 women). The results are shown in Figure 3.

Among those who perceive benefits or are uncertain about the use of crowdfunding in the introduction of renewable energy sources, the following advantages of such a solution were identified: acceleration of the energy transition (113 men and 50 women), optimisation of costs (109 men and 26 women), innovation of the solution (70 women and 42 men), speed of investment (54 men and 43 women), possibility to earn/return on investment (40 men and

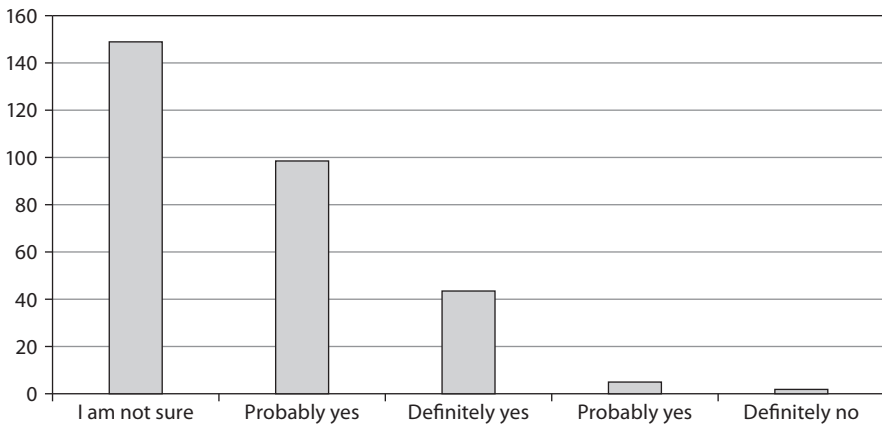


Figure 3. Respondents' opinion on the positive impact of crowdfunding on the development of renewable energy sources in Poland

Note: $N = 300$, there are people in the sample who know what crowdfunding is.

Source: Own compilation.

3 women), support of the idea of sharing resources in the economy (11 men and 11 women), independence from state policy (7 men and 4 women), possibility to be a prosumer (4 women). The results are shown in Figure 4.

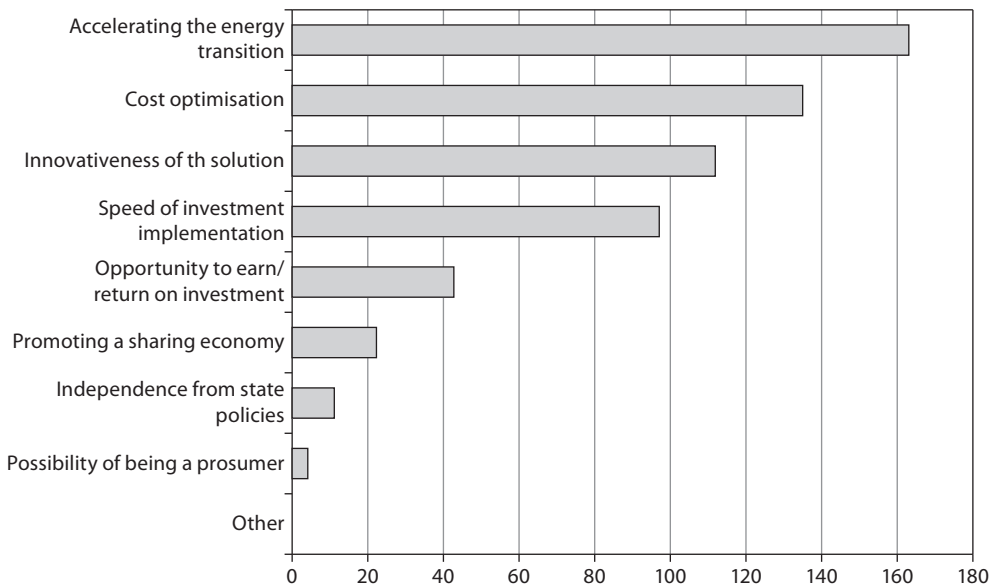


Figure 4. Respondents' opinions on the advantages of using crowdfunding to support renewable energy sources in Poland

Note: $N = 293$.

Source: Own compilation.

The seven people who did not indicate any advantages were from the 60+ age group. 4 people were women and three people were men. They were people with basic (3 people) or basic vocational (4 people) education.

Unfortunately, most respondents (288) were unaware of any specific crowdfunding projects that had raised funding to use renewable energy sources. Only 8 people (3 women and 5 men in the age bracket 18–29 and 30–44 years) pointed to the Photovoltaic Farms campaign and 4 people (4 men in the age bracket 30–44 years) to the action in the United Kingdom, where a 5 MW photovoltaic farm was connected to the grid in Merston, West Sussex, in June, which is entirely owned by residents. Barriers against the use of crowdfunding in the area of renewables included: lack of proper education and information on the subject (210 people – 100 women and 110 men), lack of money (205 people – 87 women and 118 men), unclear regulations (176 people – 89 women and 87 men), lack of projects to invest in (98 people – 13 women and 85 men), no need for using renewable energy sources (56 people – 24 women and 32 men), lack of trust (18 people – 9 women and 9 men). Other options included: lack of popularity in Poland (2 men), lack of a suitable platform for investment (1 man), and lack of real results of such investments (1 man). The results are shown in Figure 5.

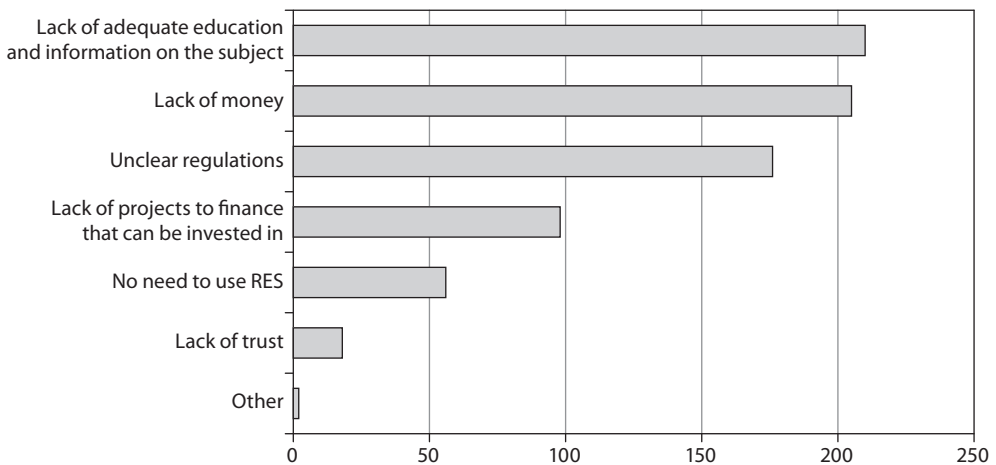


Figure 5. Respondents' opinion on barriers to the use of crowdfunding in supporting the development of renewable energy sources

Note: $N = 300$, all respondents indicated at least one barrier.

Source: Own compilation.

The final question of the survey questionnaire invited respondents to answer whether they would like to participate as a funder in a crowdfunding campaign supporting renewable energy sources. The vast majority answered: "rather yes" (210 people, mainly men aged 18–29). Answers followed this: "definitely yes" – 31 people (mainly men in the age group 18–29), "rather no" – 59 people (mainly men in the age group under 60). This demonstrates public support (primarily by men) for this type of action and a growing awareness and openness to supporting initiatives in the area of renewable energy sources. The results are shown in Table 4.

Table 4. Respondents' willingness to support renewable energy crowdfunding projects

| Answer | Age and gender | | | | | | | | | |
|-----------------------|----------------|----|-------|----|-------|----|-------|---|-----|---|
| | <18 | | 18–29 | | 30–44 | | 45–59 | | >60 | |
| | M | W | M | W | M | W | M | W | M | W |
| <i>Definitely yes</i> | 4 | 5 | 10 | 3 | 5 | – | 3 | 1 | – | – |
| <i>Rather yes</i> | 41 | 18 | 78 | 34 | 18 | 10 | 7 | 4 | – | – |
| <i>Not sure</i> | – | – | – | – | – | – | – | – | – | – |
| <i>Rather no</i> | 6 | 3 | 4 | 8 | 2 | 9 | 4 | 3 | 15 | 5 |
| <i>Definitely no</i> | – | – | – | – | – | – | – | – | – | – |
| Total | 51 | 26 | 92 | 45 | 25 | 19 | 14 | 8 | 15 | 5 |

Note: $N = 300$. The abbreviation "M" indicates the male group, and the abbreviation "W" the female group.

Source: Own compilation.

The survey can help raise general public awareness of crowdfunding, its benefits and barriers, and its potential use in the area of energy transition. A survey of public attitudes can help project proponents understand which aspects of their project are most compelling to potential investors and which are least so. They can adapt their communication and strategy to better appeal to public expectations.

5. Conclusions

When summarising the literature and document analysis and our research results, we can conclude that crowdfunding can be a good way to finance projects in the area of renewable energy sources. This is because there is public support for this type of activity and a growing awareness and openness to support initiatives in the area of renewable energy sources. People participating in crowdfunding can contribute to the construction of renewable energy installations while benefiting from the investment. In addition to regaining initial capital, they can earn a fixed annual return over the project's life while the developer frees up funds for future projects. Crowdfunding various green initiatives helps increase public interest in green energy and promotes its development. In this way, investments in renewable energy become more accessible to a wide range of people, helping to accelerate the energy transition. The author's conclusions are compatible with those of other authors cited in the text. The article can contribute to a better understanding of the role of crowdfunding in the energy transition and identify effective strategies for its development and use. Companies can take advantage of the trend of increasing public awareness in this area to build a positive image and greater support for their projects. Energy companies and developers can consider this option to raise capital for projects, especially if traditional funding sources are difficult to access. It is also recommended that educational programs be developed to help the public understand the risks and benefits of this form of investment.

The article does not exhaust the entire subject matter. In the future, the research sample will be expanded, and new crowdfunding projects in this area will be analysed. The lack of a single central platform or database that records all these transactions makes it difficult to gather a complete picture of the phenomenon's scale, particularly about renewables.

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Appendix. Questionnaire survey

1. *Do you know what renewable energy sources are? (Filter question)*
 - A. Yes
 - B. No (refer to metric)
2. *Do you think that Poland should develop renewable energy sources such as wind and solar farms and hydroelectric power plants?*

- A. Yes
 - B. No
 - C. I have no opinion
3. *Do you agree with the statement that the use of renewable energy sources has a positive impact on the economy, human health, the climate, and the environment?*
- A. Strongly agree
 - B. Rather agree
 - C. Neither agree nor disagree
 - D. Rather disagree
 - E. Strongly disagree
4. *What do you see as the main advantages of introducing renewable energy sources on a wider scale?*
- A. Free and virtually infinite energy
 - B. Reducing bills
 - C. A solution to an uncertain geopolitical situation
 - D. Independence
 - E. Rationalising energy expenditure
 - F. Investing in the future
 - G. High performance
 - H. Green solution with a positive impact on climate/environment
 - I. Health benefit
 - J. Other ... (which)
 - K. I do not see the advantages.
5. *What do you see as the disadvantages of introducing renewable energy sources on a wider scale?*
- A. High initial costs
 - B. Long payback period for investment in renewable energy sources
 - C. Limited availability
 - D. The harmfulness of some RES, e.g. geothermal energy, the use of which can result in the emission of harmful gases into the atmosphere or the pollution of deep water
 - E. Interference with landscape and environment
 - F. Other ... (which)
 - G. I do not see any flaws.
6. *Would you like to see an increase in the number of facilities and installed capacity for renewable energy sources in Poland?*
- A. Definitely yes
 - B. Probably yes
 - C. Not sure
 - D. Probably not
 - E. Definitely no.
7. *If you were in a position to do so, would you choose to sell and/or share surplus self-generated energy (e.g. from the use of photovoltaic panels) with your neighbours?*
- A. Yes
 - B. No (justify)
 - C. I have no opinion.

8. *Do you know what crowdfunding is all about?*
 - A. Yes
 - B. No (refer to metric)
9. *Do you think crowdfunding can have a positive impact on the development of renewable energy sources in Poland?*
 - A. Definitely yes
 - B. Probably yes
 - C. Not sure
 - D. Probably not
 - E. Definitely no.
10. *What advantages do you see in using crowdfunding to support renewables?*
 - A. Accelerating the energy transition
 - B. Cost optimization
 - C. Innovation of the solution
 - D. Speed of investment
 - E. Opportunity to earn/return on investment
 - F. Promoting resource sharing in the economy
 - G. Independence from state policy
 - H. The possibility of being a prosumer
 - I. Other... (which)
11. *Do you know of specific crowdfunding projects that have raised funding for the use of renewable energy sources? If yes, indicate examples.*
 - A. Yes ...
 - B. No.
12. *What barriers do you see against the use of crowdfunding in the area of renewables?*
 - A. Lack of adequate education and information on the subject
 - B. Lack of money
 - C. Unclear regulations
 - D. Lack of projects in which to invest
 - E. No need for renewable energy sources
 - F. Lack of confidence that the project will succeed
 - G. Other ... (which)
13. *Would you like to participate in a crowdfunding campaign supporting renewable energy sources as a funder shortly?*
 - A. Definitely yes
 - B. Rather yes
 - C. Not sure
 - D. Rather not
 - E. Definitely no.

Metrics

14. *Gender:*
 - A. Female
 - B. Male
 - C. Other
 - D. I do not wish to specify

15. *Age:*

- A. Under 18 years
- B. 18 years – 29 years
- C. 30 years – 44 years
- D. 45 years – 59 years
- E. Over 60 years

16. *Region of residence:*

- A. Dolnośląskie
- B. Kujawsko-Pomorskie
- C. Lubelskie
- D. Lubuskie
- E. Łódzkie
- F. Małopolskie
- G. Mazowieckie
- H. Opolskie
- I. Podkarpackie
- J. Podlaskie
- K. Pomorskie
- L. Śląskie
- M. Świętokrzyskie
- N. Warmińsko-Mazurskie
- O. Wielkopolskie
- P. Zachodniopomorskie

17. *Education:*

- A. Basic
- B. Basic vocational education
- C. Medium (secondary education)
- D. Incomplete higher
- E. Higher

18. *Material situation:*

- A. I can afford to cover all my expenses and I have savings to build up from.
- B. The household budget allows for current expenses, but I cannot afford larger, often unplanned expenses.
- C. The budget allows for all expenses, but unfortunately I am not able to save.
- D. I am unable to meet even the most urgent needs.

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Conflict of Interest

The author declare that the research was conducted without any commercial or financial relationships that could be construed as a potential conflict of interest.

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