

Article

The Role of Energy Cooperatives in Ensuring the Energy and Economic Security of Polish Municipalities

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Abstract: In recent years, negative phenomena of an external and internal nature have been observed that threaten the security of Polish municipalities. The increase in energy prices had a negative impact on the situations of consumers and companies. Strengthening energy security can be achieved through the development of an energy community based on renewable energy. The aim of the article is to demonstrate that energy cooperatives have a negligible impact on the energy and economic security of Polish municipalities. The article is based on literature studies and analysis of data obtained from the National Center for Agricultural Support and the Central Statistical Office, as well as our own qualitative research. Based on the research, three hypotheses were formulated: Firstly, energy cooperatives participate to a limited extent in building local energy security. Secondly, cooperatives should be treated as a complement to coal power plants. Thirdly, only the involvement of municipal authorities in the energy cooperatives can strengthen local energy security. The research shows that there has been a quantitative development of energy cooperatives, but this has not significantly improved local energy security. Only the active participation of local authorities is a condition for strengthening the role of energy cooperatives in ensuring economic and energy security.

Keywords: economic security; energy cooperatives; energy community; energy security



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1. Introduction

In recent years, there has been an accumulation of negative phenomena that threatened the energy and economic security of Polish municipalities. First of all, the COVID-19 pandemic disrupted the functioning of supply chains, which led to market imbalances and price increases. At the same time, the expansionary (demand-stimulating) budget policy and the expansive monetary policy of the central bank intensified this process.

The increase in inflation and economic slowdown was also supported by the increase in prices of raw materials, especially oil and natural gas, caused by the war in Ukraine and the sanctions imposed on Russia. At the same time, OPEC countries continued their policy of limiting the supply of crude oil. The persistence of the above situation has had a negative impact on energy and economic security, both nationally and locally.

At the same time, the observed economic phenomena pose serious threats in the social sphere. An increase in inflation results in a reduction in the real income of society, which in turn leads to reduced consumption and an increase in poverty. High inflation has negative effects, and not only on the poorest social groups. It also favors the pauperization of the middle classes, who are the pillar of the functioning of the market economy and liberal democracy.

A particularly dangerous phenomenon, both for entrepreneurs and consumers, is the observed increase in electricity prices. The reasons for the above phenomenon are varied. One of them is the climate policy of the European Union (EU), which aims to decarbonize and even replace fossil fuels with renewable energy sources.

Although the direction of changes proposed by the EU is correct, the pace of their implementation raises concerns from Poland's perspective related to the negative experiences of economic transformation in the 1990s.

As a result, in Polish conditions it is important to combine energy transformation with economic security. This requires, among other things, activating grassroots activities aimed at developing distributed energy based on renewable energy sources (RES). This should be achieved through the development of energy cooperatives, the most economically effective form of energy community. The aim of the article is to demonstrate that currently energy cooperatives do not enhance energy and economic security because they have low energy production capabilities, which results from the small scale of their operations.

2. The Concept of Economic and Energy Security

Safety is one of the basic values in society. It can be understood in a positive sense as a desired level of certainty and in a negative sense as protection against a threat [1]. Nowadays, the concept of "security" should be understood broadly. Apart from the military, technical and political aspects, the security problem also covers the economic and social sphere [2].

Socio-economic security can be identified with broadly understood economic security, which is a component of general security and can be defined as the absence of both internal and external economic threats.

It is strictly dependent on energy security. The lack of stable energy supplies at a reasonable price limits the development of companies, discourages investors, threatens production and increases costs, and also negatively affects economic prosperity. Energy security is a multidimensional concept. It covers many different elements that are necessary to maintain the ability of the power system to ensure uninterrupted supplies of fuels and energy in the required quantities in the short and long term, including covering unplanned fluctuations in demand as well as maintaining stable and economically acceptable prices. This ensures that energy security is influenced by political, economic and infrastructural factors that affect the possibility of uninterrupted supplies of raw materials and various energy carriers. For this reason, energy security should be considered in the context of a given country's external and internal relations. From an external perspective, the interactions between geographic attributes (spatial location, size, topography, borders, climate, and resource distribution) and international political power must be considered. This is confirmed by the competition between great powers for access to strategic locations and natural resources [3]. The fight for domination and influence on the worldwide political stage is less and less oriented towards military power and more and more towards strategic and economic development, putting "energy diplomacy" at the center of events [4]. In importing countries, ensuring security requires, first of all, reducing dependence on imported energy sources [5]. The current geopolitical context shows how important it is to limit energy imports [6].

Therefore, security should also be analyzed from the point of view of threats arising from global antagonism of power, the socio-political instability of many energy-producing countries and acts of sabotage against energy supply chains, which are often expressed in physical form or through cyberattacks on critical infrastructure (energy storage facilities, refineries, transmission grids) [7]. Energy security can also be significantly improved not only by making a country independent of external sources of supply but also through energy saving and efficiency measures, as reducing energy intensity will reduce the economy's dependence on energy imports [8].

Energy security also needs to be considered in the long and short term. In the long term, ensuring energy security requires the diversification of fuels, limiting of imports and promotion of renewable energy sources, and in the short term it is primarily about meeting current demand. One of the important criteria for energy security is price. Security not only means ensuring supply but also the possibility of access for users, which in turn depends on the price. Price is one of the main elements in this group, which is the executive

element of energy supply, determining the level of affordability of energy for power supply. According to Gitelman et al., energy prices are affordable as long as they do not cause serious disruptions to normal social and economic activities [9]. Therefore, the concept of energy security also includes various social aspects, such as the standard of living and the availability of electricity and heating, as well as health aspects [10].

Gitelman et al. define energy security as the state of protection of citizens and the economy against the threat of failure to meet rational energy needs; to ensure acceptable quality and price under normal conditions and in extraordinary circumstances; and to ensure protection against disruptions to the stability and continuity of fuel and energy supplies [9].

In the light of Art. 194 TFEU, energy security is an element of the EU's common energy policy, covering many important areas of regulation of the power system. These include, above all, ensuring the functioning of the energy market, the security of energy supply in the EU, energy efficiency, the development of renewable energy sources and supporting interconnections between networks.

The International Energy Agency defines energy security as the continued availability of energy sources at an affordable price. In the long term, it includes investments enabling the supply of energy in the amounts necessary to maintain the expected economic growth, taking into account environmental protection requirements [11]. In the short term, however, it is the ability to eliminate imbalances in the energy market resulting from changes on the supply or demand side, which involves the risk of interruption of supplies by producers or distributors [12].

When defining energy security, we cannot ignore environmental challenges that have profound consequences for energy security. We should not limit ourselves only to achieving carbon neutrality, but should strive to provide citizens with energy and fuel at an acceptable price.

3. Energy Prices in Poland

In the first and second decades of the 21st century, Poland was considered a country with a relatively high level of energy security due to the domestic resources of hard coal and lignite, on which power plants are based, and the possibility of importing gas and oil in quantities to supplement domestic production.

In 2019, the demand for hard coal amounted to approximately 69 million tons and was mostly covered by domestic mining [13]. In turn, the demand for natural gas in 2019 amounted to 18.6 billion m³, with domestic production covering approximately 22% of the demand [14]. It was different in the case of crude oil, as domestic production allows for approximately 4% of the demand of 27 million tons annually [14]. It is worth pointing out that Poland has been trying to diversify the directions of oil and gas supplies for many years, in order to become independent from purchases of raw materials from Russia. For example, in 1996, Poland imported crude oil only from Russia. In 2017, Russian oil imports amounted to 77% and in 2019 this figure was 63% [15].

The outbreak of war in Ukraine threatened Poland's energy security. There is a threat of destabilization of supplies resulting from the sanctions imposed by the EU on Russia. However, changing the direction of crude oil imports allowed supplies to be stabilized. In the first quarter of 2023, the main importer of oil to Poland was Saudi Arabia, which accounted for 48% of imports to our country. Other suppliers of crude oil to Poland include Norway, Great Britain, the United States and Nigeria [16].

Currently, a significant problem affecting energy security in Poland is high energy prices resulting from the use of fossil fuels in professional energy and heating. In the years 2021–2024, the price for 1 kWh in the G11 tariff (the most frequently used tariff for households) in Poland increased from PLN 0.63 to PLN 1.39 (Figure 1).

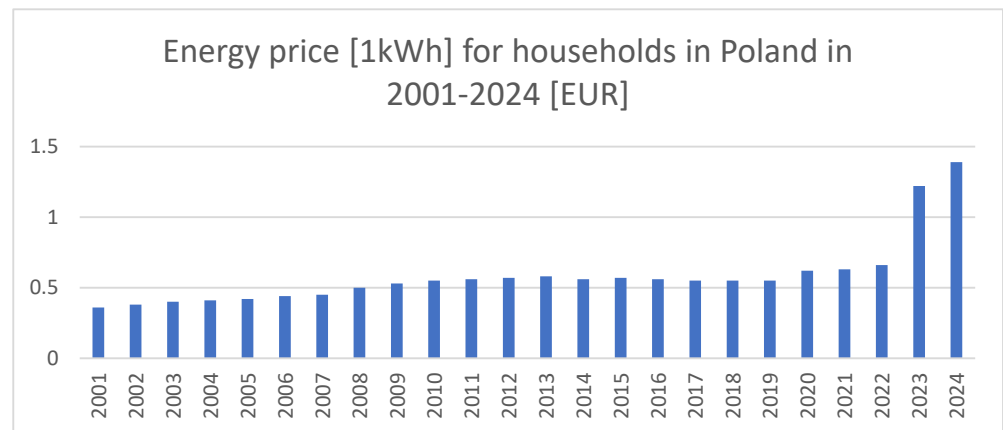


Figure 1. Energy price [1 kWh] for households in Poland in 2001-2024 [EUR], data from Portal of Energy Prices in Poland, Source: <http://cena-pradu.pl/tabela.html> (accessed on 27 December 2023).

The state's economic policy tools to date to ensure energy security focused on the expansion of liquefied gas (LNG) storage facilities, subsidies for PV panels for households, heat pumps, energy storage facilities, and solar collectors (a total of PLN 2,634,000,000 was allocated for this purpose) [17]. Economic growth, ongoing digitalization, the expansion of large agglomerations and changes in transport mean that the demand for electricity is constantly growing and prices are constantly rising. In 2019, the price per 1 MWh was PLN 245.44 (EUR 57); in 2023, it was PLN 759.29. (EUR 178) (Figure 2). Despite such a high price, households did not experience such a significant burden due to the price freezing in 2023 at PLN 412/MWh (EUR 96). Currently, from July 2024, the maximum price for households will be PLN 500/MWh (EUR 117). In 2023, electricity consumption in Poland was 167,518 GWh and production was 163,629 GWh [18]. Domestic production is lower than consumption, and Poland is a net importer (in 2023, energy imports amounted to 4.1 TWh). The dynamic increase in prices and the inability to meet the demand by domestic power plants and other energy sources indicate that it is necessary to build nuclear power plants to ensure stable energy supplies, but also to optimize renewable energy sources and promote various social initiatives. Global electricity demand is forecast to grow at a rate of 2.1% annually through 2040, with demand increasing by 13,000 terawatt hours (TWh) in 2040 compared to today [19].

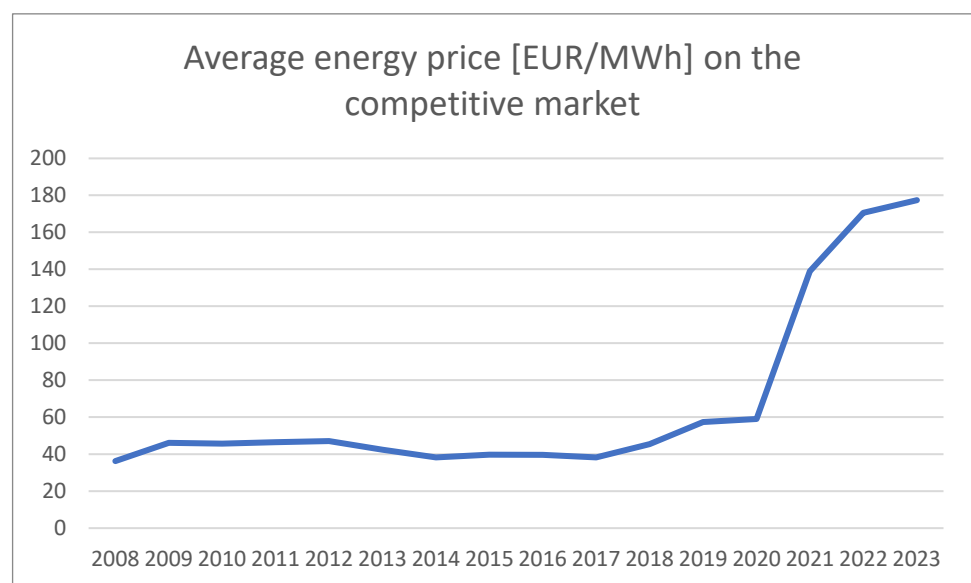


Figure 2. Average energy price [EUR/MWh] on the competitive market, data from the Energy Regulatory Office. Source: own study.

One of the main reasons for the rapid and significant increase in energy prices is, among others, the need to purchase ETS for utility power plants based on fossil fuels. Today, the energy system in Poland is based on them. Currently, Poland is one of the EU countries that generates the most energy from fossil sources. Figure 3 shows the level of energy production from renewable and fossil sources in Poland and other countries of Central and Eastern Europe in 2020 and 2022. In Poland, the share of fossil fuels in energy production decreased by 19.3% during this period, and yet Poland still generates the most energy based on fossil raw materials. For comparison, in the Czech Republic the share of minerals in energy production in 2022 was 51.2%, in Hungary 34.2%, in Romania 37.8%, in Bulgaria 48.7% and in Slovakia 17.6% (Figure 3).

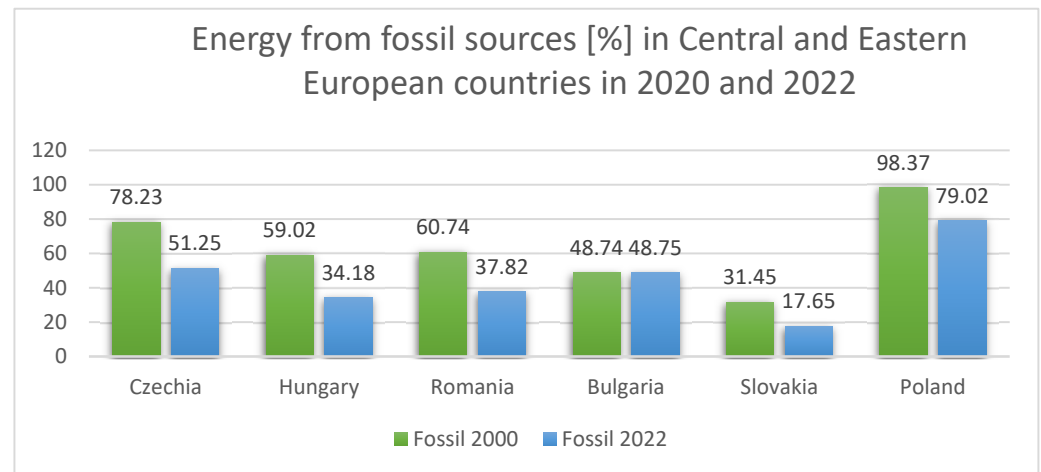


Figure 3. Energy from fossil sources [%] in Central and Eastern European countries in 2020 and 2022. Source: own elaboration base on *The European Electricity Review*, Ember, 2023. <https://ember-climate.org/insights/research/european-electricity-review-2023/> (accessed on 27 December 2023).

Stabilizing energy prices requires changing the energy mix. In accordance with Directive 2018/2001 [20], by 2030, the share of renewable energy in the energy mix is to be 32%, and the reduction in CO₂ emissions is to be at least 55% (compared to the level in 1990) [21]. This forces us to accelerate the development of opportunities to generate energy from renewable sources. So far, PV panels and heat pumps have been developing dynamically in Poland. Wind energy also has huge potential, but unfortunately its development is much too slow [22]. The share of energy from renewable sources in gross final energy consumption in 2021 was 15.6% [23].

Therefore, changing the energy system and basing it on low-emission sources is inevitable. This, in turn, requires the development of local, participatory forms of investment in renewable energy. At the local level, energy security is to be ensured by, among other: Citizen Energy Communities (CEC), energy clusters and cooperatives.

4. Materials and Methods

This article is based on literature studies and data obtained from the National Center for Agricultural Support (KOWR) and the Central Statistical Office in Poland (GUS). The research results were compared with results of other research conducted both in Poland and in selected European Union countries. The analysis covered all energy cooperatives operating in Poland, officially included in the “List of energy cooperatives” kept by the Director of the National Agricultural Support Center.

Currently, there are 33 energy cooperatives in Poland, and their areas of operation cover 13 voivodeships and 52 communes. This means that statistically, there is a cooperative in every second voivodeship and in every fiftieth commune. A detailed list of energy cooperatives is included in the Table S1.

At the same time, the article uses the results of previous in-depth research conducted in the first two energy cooperatives registered in Poland, i.e., the Eisall Energy Cooperative in Raszyn and the Nasza Energia Energy Cooperative in Mszana.

The research was conducted using the method of expert interviews. In both cases, the selection of respondents was purposeful; they were presidents of energy cooperatives who founded the cooperatives and had the greatest knowledge of the research subject. It was also considered that thanks to their professional knowledge and familiarity with the realities, they would be able to indicate the most important barriers to the development of energy cooperatives and propose realistic forecasts for their development.

The interviews were direct, using an interview questionnaire containing 14 open-ended questions. The aim of the questions was to deepen knowledge about the conditions of operation of energy cooperatives, and especially the barriers that hinder their development. A detailed list is included in Table 1.

Table 1. Interview questions.

Question No.	Question
1	Who was the initiator of the Cooperative?
2	How many members does the Cooperative currently have?
3	Are the members of your cooperative natural persons or legal entities?
4	What convinced them to join?
5	What benefits do the Cooperative and its members gain?
6	Are there any barriers to recruiting new members?
7	What are the general barriers (obstacles) to the further development of the Cooperative?
8	Does the Cooperative Board expect any legislative changes or have an idea for such changes?
9	What are the development prospects?
10	How does a 0.6 energy return factor affect profitability?
11	Does the cooperative generate a profit?
12	What financial support from central authorities or local government bodies did your Cooperative receive?
13	What is the installed capacity?
14	How many needs are covered by the cooperative (the statutory 70%)?

Source: own elaboration.

The methodology adopted in the article allowed the following hypotheses to be formulated:

H1. *Currently, energy cooperatives participate to a limited extent in building local energy and economic security.*

H2. *Cooperatives should be treated as a complement to the so-called professional energy, not its alternative.*

H3. *Only the involvement of municipal authorities in the operation of energy cooperatives can lead to the strengthening of local energy and economic security.*

5. Results

An energy cooperative is defined in the Act on Renewable Energy Sources (Article 2(33)(a)) [24] as an association of cooperatives whose aim is to produce energy (electricity, biogas or heat) in renewable energy installations and at the same time balance the energy demand exclusively for the needs of the cooperative and its members. This means that the cooperative cannot generate electricity from sources other than renewable sources (solar, wind, water (hydroelectric plants) and biogas). When defining an energy cooperative, its participatory nature should be emphasized. It can even be said that such a cooperative is an organizational and business model in which citizens jointly run projects

involving the production, distribution, sale and storage of energy and heat from renewable energy sources.

At the same time, the RES Act contains restrictions on the establishment and operation of an energy cooperative. Firstly, a cooperative can only be established in a rural or urban–rural commune. Secondly, only natural persons and municipalities with a specific territorial scope can obtain member status. Another significant limitation to the development of the cooperative is the inability to sell energy to entities outside the group of members. It should be noted that the legislator provided preferences for the operation of cooperatives, which may be an important factor motivating the cooperation of various entities within the cooperative [10]. In the light of the Act on Renewable Energy Sources (Article 38(e)) [24], a renewable energy cooperative is exempt from the following fees:

- Fees to the obligated seller;
- Distribution fees (these depend on the amount of energy collected by consumers and producers belonging to the cooperative);
- Capacity, cogeneration and renewable energy fees on the amount of energy produced and consumed by cooperative members (customers);
- Excise tax if the total power of the installations installed in the cooperative does not exceed 1 MW.

The above preferences give energy cooperatives an advantage over other forms of energy community, e.g., clusters. Therefore, it can be concluded that these entities may become important links in the bottom-up energy transformation in Poland. According to the research conducted, there are 33 energy cooperatives in Poland with a total of 101 members. Cooperatives are dominated by entities with up to four members. The only exceptions are two cooperatives located in the Silesian Voivodeship, i.e., Energy Cooperative Jaworze (15 members) and Energy Cooperative—Nasza Energia (14 members). Details are provided in Table 2.

Table 2. Summary of key information about energy cooperatives.

Name of the Cooperative	Number of Members	Number of Energy Consumption Points	Type of Installation	Number of Installations	Installed Power (MW)
EISALL Energy Cooperative	4	5	PV installation	2	0.020
“Energy Cooperative—Nasza Energia”	14	15	PV installation	15	0.118
Energy Cooperative of the Rural Commune of Hrubieszów, Trzeszczany, Werbkowice	1	12	PV installation	12	0.06552
Spółdzielnia Energetyczna Stawiski	3	7	PV installation	7	0.15902
Niepołomska Spółdzielnia Energetyczna	3	6	PV installation	4	0.037942
Spółdzielnia Energetyczna Gminy Wiejskiej Dołhobyczów, Mircze i Gminy Miejsko-wiejskiej Tyszowce	1	9	PV installation	9	0.0324
Spółdzielnia Energetyczna Gminy Wiejskiej Białopole, Horodło, Uchanie	1	5	PV installation	5	0.018
Spółdzielnia Energetyczna Skawina—SES	3	5	PV installation	4	0.059535
Spółdzielnia Energetyczna EKO WIELPLAST	4	4	PV installation	2	0.051
Wierzchosławicka Spółdzielnia Energetyczna	3	5	PV installation	2	0.02434
Pawłowska Spółdzielnia Energetyczna	3	3	PV installation	2	0.07287
Spółdzielnia Energetyczna Czerwonak	3	5	PV installation	2	0.0261
Spółdzielnia Energetyczna Michałowo	3	4	PV installation	9	0.20056
Spółdzielnia Socjalna Sąsiedzi	2	12	PV installation	1	0.021150
Spółdzielnia Energetyczna “Energia Optymalna”	1	1	PV installation	1	0.004125
Spółdzielnia Energetyczna Zielona Gmina	3	9	PV installation	5	0.1277
Spółdzielnia Energetyczna Sudecka Energia	3	3	PV installation	2	0.03088

Table 2. Cont.

Name of the Cooperative	Number of Members	Number of Energy Consumption Points	Type of Installation	Number of Installations	Installed Power (MW)
Spółdzielnia Energetyczna BIODAR w Ustroniu Morskim	3	83	PV installation	4	1.07253
Spółdzielnia Nyska Elektrownia Społeczna z siedzibą w Nysie	1	1	PV installation	1	0.0495
Łądecka Spółdzielnia Energetyczna	3	102	PV installation	1	0.99954
Spółdzielnia Energetyczna Nowa Słupia	3	9	PV installation	9	0.1112
Spółdzielnia Energetyczna “OZE POKÓJ”	1	1	PV installation	1	0.0220
Spółdzielnia Energetyczna Psary	3	7	PV installation	7	0.07626
Spółdzielnia Energetyczna Jaworze	15	17	PV installation	6	0.06256
Spółdzielnia Energetyczna Pucka Energia	2	2	PV installation with energy storage	1	0.01853
Spółdzielnia Energetyczna “L.I. Energia”	4	4	PV installation	4	0.249
Spółdzielnia Energetyczna Eko-Słupno	2	2	PV installation	2	0.0128
Spółdzielnia Energetyczna “Zielona Energia”	1	1	PV installation	1	0.01
“Spółdzielnia Energetyczna Meander”	1	1	PV installation	1	0.035
Spółdzielnia Energetyczna, “ECOVOLT”	3	3	PV installation	2	1.0398
“Spółdzielnia Energetyczna EKOENERGIA SUCHOWOLA”	2	2	PV installation	2	0.15
Spółdzielnia Energetyczna Olkusz—Srebrne Miasto	1	4	PV installation	4	0.10695
Spółdzielnia Energetyczna OZELION	1	1	PV installation	1	0.009735
Together	101	350	-	131	5.0945470

Source: study based on the National Agriculture Support Center (KOWR) data.

It is also worth emphasizing that the location of energy cooperatives varies spatially. Cooperatives operate in 13 Polish voivodeships (Lower Silesia, Kuyavian-Pomeranian Voivodeship, Lublin Voivodeship, Lesser Poland Voivodeship, Masovian Voivodeship, Opole Voivodeship, Podlasie Voivodeship, Pomeranian Voivodeship, Silesian Voivodeship, Świętokrzyskie Voivodeship, Warmian-Masurian Voivodeship, Greater Poland Voivodeship, West Pomeranian Voivodeship). The largest number of energy cooperatives operate in the Lesser Poland Voivodeship (seven cooperatives) and the Silesian Voivodeship (five cooperatives). At the same time, in three voivodeships (Lubusz, Łódź and Podkarpackie), the analyzed entities do not operate.

In total, energy cooperatives are able to produce just under 5.1 MW. For comparison, the total capacity of energy sources installed in Poland in 2022 was 60,422.7 MW [25]. The above data show that energy cooperatives produce approximately 0.008% of total electricity in Poland. It should also be noted that the scope of operation of energy cooperatives is limited (Figure 4). Currently, they operate in 52 communes out of 2175 urban–rural and rural communes in Poland [26]. This leads to the conclusion that only 2.4% of communes where such cooperatives can operate actually do so. To sum up, on a national scale, the importance of energy cooperatives as entities strengthening energy security, and thus also economic security, is negligible.

Map 1: Municipalities that are members of renewable energy cooperatives.

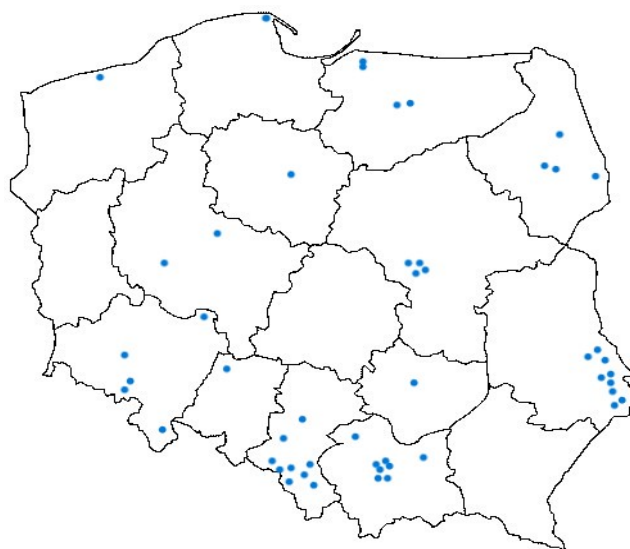


Figure 4. Source: own elaboration.

The above results, among other sources, from the fact that due to strong financial barriers, energy cooperatives focus their activities on generating electricity from photovoltaic installations. The interviews confirmed the existence of strong barriers, including financial ones, which hinder the possibility of large investments. The presidents of the surveyed cooperatives emphasized that cooperatives that incurred expenses for PV installations usually do not have the funds for energy storage. Only one cooperative (Spółdzielnia Energetyczna Pucka Energia) also runs an energy storage facility. Unfortunately, energy cooperatives do not invest in the construction of wind or biogas power plants. It should be emphasized that the development of biogas plants in rural areas would not only help to reduce energy poverty in these areas, but would also be a complementary good for agriculture, and thus strengthen their economic potential.

Basing the business on photovoltaic installations results in limited possibilities of electricity production. The only exceptions are three cooperatives, i.e., Spółdzielnia Energetyczna BIODAR in Ustronie Morskie, Spółdzielnia Energetyczna “ECOVOLT” and Łądecka Spółdzielnia Energetyczna. The installed capacity in these cooperatives is approximately 1.07 MW, 1.04 MW and 1.00 MW, respectively. It is worth emphasizing that both in the case of the BIODAR Energy Cooperative and the Łądecka Energy Cooperative, the shareholders are local government units, which increases the investment possibilities of the cooperative. Thanks to the involvement of municipalities, these cooperatives were able to move away from micro-installations and invest in photovoltaic farms.

In other cases, the installed power is low. As a result, a total of 133 installations are used by 350 collection points. It can be seen that the number of installations is often equal to the number of collection points. This leads to the conclusion that the installations are dominated by micro-installations supplying power to single facilities.

The key role of municipalities in the functioning of energy cooperatives is well illustrated by the example of the already-mentioned Łądek Energy Cooperative. The energy produced by cooperatives is used by, among others, the commune office, the school, kindergarten, rural community centers, local cultural institutions, Spa House and playgrounds. According to the commune’s data, its annual savings from participation in an energy cooperative may range from EUR 117,370 to EUR 176,056 [27]. Additionally, the implementation of the second stage of the investment should result in an increase in installed capacity to 7.7 MW, thanks to which the commune plans, among other things, to install heat pumps and infrared panels in approximately 400 municipal and social apartments. The example of the Łądecka Energy Cooperative confirms hypothesis H3. Without the involvement of local authorities, energy cooperatives will not produce electricity on a scale that will allow

for the effective building of energy and economic security. One of the key conditions is the development of direct networks, which is emphasized by Wróbel, Sołtysik and Rogus [28].

6. Discussion

Moving on to the discussion of the research results, it is necessary to mention the research limitations resulting from the short period of operation of energy cooperatives in Poland. Therefore, not all problems have been identified yet. It can be expected that in the future, other obstacles will appear that limit the development of cooperatives.

In world literature, many authors perceive energy cooperatives as a tool for sustainable economic development combined with ensuring local energy security. They see their potential in the development of local communities and the benefits for residents [29–34].

For example, German experience shows that the development of energy cooperatives not only improved the living conditions of residents, but also influenced the development of innovative technologies and created lasting jobs. Additionally, the activities of energy cooperatives, including in covering energy needs and generating additional income, has become an important factor in counteracting energy poverty [35].

Some researchers have analyzed the barriers to the possibility of generating energy from renewable sources, which mainly include regulatory, economic and market restrictions, and faulty economic and technological strategies (lack of know-how, poor infrastructure development) [36]. Juszczak drew attention to social barriers, such as reluctance regarding wind farms that generate noise or biogas plants around which there is an unpleasant smell, insects and even rodents that harm local residents. However, these are general barriers regarding broadly understood renewable energy, and in this context we should agree with the authors. However, in the case of cooperatives, the barriers are different, resulting from the specificity of this form of economic cooperation and administrative and legal conditions. The research shows that in Polish conditions, energy cooperatives develop slowly and provide little energy and economic security to local socio-economic systems. It is true that the financial preferences granted to cooperatives increased their number from 2 in 2021 to 33 in 2024. However, both their number and the territorial scope of their operation are highly unsatisfactory. Additionally, it should be emphasized that quantitative changes had little impact on the increase in local energy and economic security. This is due to the fact that energy cooperatives have a small number of members and, at the same time, a small scale of energy production. It can even be said that the vast majority of cooperatives produce energy consumed by single collection points.

This situation may result from numerous barriers that, despite legislative changes, still hinder the development of energy cooperatives. These barriers have their sources both in general problems related to the functioning of renewable energy in Poland, and in detailed legal solutions regulating the mode of establishment and operation of energy cooperatives. It should be emphasized, however, that this situation is not unique to Poland. Problems such as the capital intensity of investments, limited opportunities to obtain capital, restrictions in access to the energy market, the privileged position of large market entities and difficulties in acquiring real estate on which renewable energy installations would be located have also been noticed in other European countries [37,38].

First of all, the development of energy cooperatives is slowed down by barriers related to high investment costs, especially since the operating model of cooperatives adopted in Poland is based on settlements in the prosumer system, which means that entities with capital are not interested in these projects [39]. As a consequence, the energy cooperatives existing in Poland are weak in terms of capital and usually undertake investments requiring relatively low investment outlays. This leads to a situation in which energy is produced only from photovoltaic installations, and is usually of low power (micro-installations), and there is a lack of investment in the construction of wind farms or biomass power plants.

In this situation, a real solution is for engagement in energy cooperatives by local governments, which would take over the responsibilities of investors. The above statement is confirmed by research conducted in the Łądek-Zdrój commune, where the Łądek Energy

Cooperative operates. Unfortunately, the case described in this article is the exception, not the rule. As shown by previous research conducted among Lower Silesian communes, local government units are most often not interested in large capital-intensive investments, limiting themselves to activities with a small spatial scope and low economic importance (the electricity produced is primarily used to meet the needs of municipal units) [40].

However, it should be emphasized that the above situation is not unique to Poland. German research shows that in Germany, as well, as many as 80% of cooperatives are PV cooperatives, and only 5% are biogas cooperatives [40].

The involvement of municipalities in the creation and operation of cooperatives should not be limited only to financial issues. Activities related to spatial planning are also important. Meister, Schmid, Seidl and Klagge noted that in both Germany and Switzerland, municipalities are largely responsible for planning and approval procedures for renewable energy facilities (large-scale or greenfield) and can—within narrow legal limits—support cooperatives through administrative procedures [38]. Swiss cooperatives (41%) and German cooperatives (34%) indicated support from municipalities in quick approval procedures. In both countries, the most common form of municipal support is the provision of roof space or land, followed by support in planning and permitting procedures, and in the purchase of electricity at prices that cover costs.

In Poland, municipalities can also influence the development of renewable energy sources through proper spatial planning and by providing areas for the location of wind farms, photovoltaic farms or biogas plants. Research conducted by Kostecka-Jurczyk, Marak and Struś shows that current provisions of local spatial development plans often limit the development of renewable energy sources. Therefore, they do not support the establishment and operation of energy cooperatives. Unfortunately, this problem is not noticed by the municipalities themselves, which consequently results in their level involvement in the investment planning and coordination process being inadequate for their needs.

Building local security through the development of energy cooperatives requires the involvement of residents, but due to the low level of social capital in Poland, this involvement is too small. Local communities do not see the connection between their activity and the increase in energy and economic security. The above observations are also confirmed by previous research conducted by Łabędzki and Strus [41] and Błażejewska and Gostomczyk [42].

7. Conclusions

The analyses conducted in this article confirm the adopted hypotheses. Although the number of energy cooperatives in Poland is growing in quantitative terms, it is difficult to assume that this increases the energy and economic security of local socio-economic systems. There are also no grounds to consider energy cooperatives as an alternative to coal-fired power plants. It can be said that their role will be of an auxiliary nature. However, the role of energy cooperatives can be increased if local authorities get involved in the projects. In this case, communes should support cooperatives already at the investment location stage. It is also important that municipalities can play the role of a key investor, which may be difficult due to the financial problems of Polish local governments. Nevertheless, energy cooperatives may in the future strengthen local socio-economic security and may become a tool in the fight against energy poverty.

To sum up, the development of energy cooperatives undoubtedly strengthens the security of local socio-economic systems, but to a limited extent. Security can be achieved by switching to more abundant and accessible energy sources, investing in infrastructure and reducing the energy consumption of buildings and electronic devices. In total, energy cooperatives generated less than 5.1 MW, which constitutes 0.008% of the total electricity produced. The limited importance of energy cooperatives for local security is proven by the fact that they operate in every fiftieth commune in Poland. The conducted research therefore leads to the conclusion that the energy policy to date has not brought about

satisfactory results. The emerging cooperatives primarily produce electricity to a limited extent and do not provide security for municipalities. The current proposals of the EU energy policy in the field of energy transformation are fragmentary and not comprehensive. Therefore, their effectiveness is limited.

Supplementary Materials: The following supporting information can be downloaded at: <https://www.mdpi.com/article/10.3390/en17133082/s1>, Table S1: List of energy cooperatives in Poland

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